



EUROPEAN CLEFT PALATE CRANIOFACIAL ASSOCIATION

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ABSTRACT BOOK

Upper airway dimensions and respiratory flow simulation in individuals with cleft palate and sleep apnea.

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Background: Individuals with cleft lip and palate (CLP) have an increased risk of developing obstructive sleep apnea (OSA) and one of the potential contributing factors is the reduction of the pharyngeal dimensions, commonly observed in this population.

Aims: This study aimed at investigating the occurrence of OSA in individuals with CLP by means of polysomnography and to correlate these findings with the upper airway dimensions and respiratory flow simulation data, using cone-beam computed tomography (CBCT) and computational fluid dynamics (CFD).

Methods: Twenty seven young adults with non-syndromic unilateral CLP (20-29y) were prospectively evaluated by means of nocturnal polysomnography (OSA = apnea-hypopnea index ≥ 5 events/h). Upper airway dimensions (volume [V] and minimum pharyngeal cross-sectional area [mCSA]) were assessed on CBCT-generated 3D models (Mimics Research 17.0, Materialise Medical, Leuven, Belgium). Inspiratory airflow simulations were done by the CFD technique (ICEM-CFD 14.5.7, Fluent 14.5, FieldView, ANSYS, Canonsburg, PA and Intelligent Light, Lyndhurst, NJ) and the mean and maximum inspiratory pressures and the resistance to respiratory flow were determined.

Results: Polysomnographic data showed that 26% of the subjects had OSA (AHI: 12 ± 8 , min:6/max:27). Subjects with OSA had significantly smaller upper airway volume ($36 \pm 5 \text{ cm}^3$) than subjects without OSA ($43 \pm 9 \text{ cm}^3$). Although not statistically significant, mCSA of OSA individuals were numerically reduced ($94 \pm 19 \text{ mm}^2$) when compared to non-OSA subjects ($145 \pm 84 \text{ mm}^2$). Even though variables evaluated by the CFD technique did not differ between subjects with and without OSA, a tendency for more negative inspiratory pressures (OSA: $24 \pm 8 \text{ Pa}(\text{ml/s})$, Non-OSA: $19 \pm 11 \text{ Pa}(\text{ml/s})$) and higher resistance (OSA: $0,133 \pm 0,043 \text{ Pa}(\text{ml/s})$, Non-OSA: $0,111 \pm 0,052 \text{ Pa}(\text{ml/s})$) was observed in subjects with OSA.

Summary/Conclusion: The results have shown that young adults with repaired cleft lip and palate are at risk for sleep apnea. The reduced airway volumes observed may lead to more negative inspiratory pressures and higher upper airway resistance to air flow, increasing the chance for pharyngeal collapse and predisposing these individuals to obstructive sleep apnea.