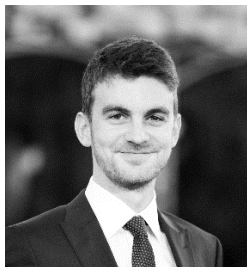


## Experimental protocol to map the forces applied by a Non-Invasive Ventilation device on the midface of children with OSAS

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**Abstract :**

**BACKGROUND:** Children with craniofacial malformations, such as syndromic craniosynostosis due to *FGFR* mutations, are at high risk of obstructive sleep apnea syndrome (OSAS). Midface hypoplasia is a well-recognized risk factor, but the etiology is often multifactorial and many children have multilevel airway obstruction. Repeated ENT surgeries may be necessary to treat OSAS. However, in some children noninvasive ventilation (NIV), delivered through a nasal mask, will be required while waiting for the frontofacial advancement (FFA) surgery, either because of severe residual OSAS despite ENT surgery or if ENT surgery is not indicated. The objective of the present study was to evaluate the impact of prolonged use of a nasal mask for NIV in infants with different syndromic craniosynostosis, in order to assess whether this treatment may worsen midface hypoplasia.

**METHODS:** To do so, the magnitude of the typical forces exerted by the masks were needed. The head and face of babies presenting midfacial retrusion were 3D printed using our state-of-the-art multimaterial polyjet printer (Stratasys J735). These realistic 3D models were modified with Computer Assisted Design tools to allow the insertion of pressure sensors in the maxillary and nasal region. Pressure sensors were mounted and used to record and to map the forces applied by the mask.

**RESULTS AND CONCLUSION:** Our experimental protocol is currently in a validation stage, to make sure monitored forces are realistic. Once the protocol is validated, it will be used to correlate the patient-specific evolution of midface retrusion with the duration of use of the NIV device and the associated forces. Therefore, our experimental findings should determine whether and to what extent the nasal mask may worsen midface hypoplasia. Additionally, they may help designing patient-specific masks to prevent or minimize these potential side effects.