# Feasibility of Assessing the abnormal Paediatric Airway using Rotational Optical Coherence Tomography – The OCT Air Study

**Anne Katrine Bak Poulsen1,2,3, Signe Thim2, Thomas Kjærgaard2,3, Emil Nielsen Holck2,4,5, Aage Kristian Olsen2, Joachim Lindhardt6, Anders Mølgaard6, Nagarajan Muthialu7, Sune Rubak1,2**

1Danish Paediatric Centre of Pulmonology and Allergology, Aarhus University Hospital, Denmark, 2Department of Clinical Medicine, Aarhus University, Denmark, 3Department of Otolaryngology, Aarhus University Hospital, Denmark, 4Department of Cardiology, Aarhus University Hospital, Denmark, 5Department of Cardiology, Hospitalsenheden Midt, Viborg, Denmark, 63D Print Centre, Aarhus University Hospital, Denmark, 7Great Ormond Street Hospital for Children, Cardiothoracic Team, London, UK

## Introduction:

Abnormalities in the paediatric airway are usually diagnosed by a computerized tomography (CT)-scan and diagnostic dynamic bronchoscopies (DDB). However, these methods have several limitations in the airway; CT-scans use a high dose of ionizing radiation, which generally should be avoided in children. Additionally, the CT-output is not dynamic, thus compromising the output due to the impact of the respiratory motion on the airway’s format and volume. Even though the DDB output is dynamic, it is visually quantifiable by bronchoscopist, creating a risk of interobserver variability when grading stenoses.

This creates a demand for an alternative measuring method that is objectively quantifiable and able to obtain dynamic cross-sectional images of the airway.  
The catheter-based methods Optical Coherence Tomography (OCT) and Optical Frequency Domain Imaging (OFDI) obtains dynamic cross-sectional images by using light close to the infrared range. The methods are already implemented within other medical fields. We aim to investigate whether OCT/OFDI are feasible methods for assessing the diseased paediatric airway.

## Methods:

The study is a prospective case series where OCT/OFDI of the airway was performed on nine paediatric subjects in relation to DDB due to severe respiratory symptoms. The obtained OCT/OFDI data was subsequently and compared to the DDB-output.

## Results:

In general, qualitative data from OCT and bronchoscopy corresponded well. OCT was able to detect structural abnormalities such as tracheomalacia, scarring tissue and complete tracheal rings. Furthermore, OCT/OFDI demonstrated ability to provide a quantitative assessment of airway stenoses with higher accuracy than DDB. Statical calculations revealed that visual inspection of the stenotic area during bronchoscopy significantly varies in comparison to lumen area stenosis measured by OCT with a mean difference of 18.416%, (95% CI: 8.93-27.91, p=0.0018).

## Conclusions:

OCT show promising results as a diagnostic tool in the paediatric airway.

This study is one of the first to assess the feasibility and utility of OCT in the paediatric airway with regards to providing quantitative data of the airway. The results of our study align with prior research in other medical fields, showing that OCT can enhance procedural outcomes by improving accuracy of measurements.