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# INPLASY PROTOCOL

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sponsors: Department of  
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**Conflicts of interest:**  
None declared.

## Upper Airway Volumetric Changes on CBCT after Orthodontic Interventions: protocol for a systematic review

Steegman, RM<sup>1</sup>; Renkema, AM<sup>2</sup>; Verbeek, HPJ<sup>3</sup>; Schoeman, A<sup>4</sup>; Kuijpers-Jagtman, AM<sup>5</sup>; Ren, Y<sup>6</sup>.

**Review question / Objective:** Does the volume of the upper airway change after an orthodontic intervention? **P:** growing subjects, adults; **I:** orthodontic treatment, dentofacial orthopedics, extractions; **C:** untreated subjects and/or non-extractions; **O:** volumetric changes of the upper airway measured on CBCT scans.

**Condition being studied:** The primary objective of orthodontic treatment is to establish optimal dental and/or skeletal relationship in harmony with the soft tissue morphology and functioning. In addition, un-impeding or facilitating airway growth and development is an important objective, especially in patients susceptible for airway obstruction or sleep apnea. It is therefore important to look into the effect of various orthodontic treatments on the 3D volumetric changes of the upper airway. Compared with the use of traditional 2D lateral cephalograms, CBCT scans provide the opportunity to perform measurements in more dimensions on the airway with demonstrated reliability. This systematic review therefore includes studies using CBCT scans for evaluation of the airway.

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 04 April 2022 and was last updated on 04 April 2022 (registration number INPLASY202240017).

### INTRODUCTION

**Review question / Objective:** Does the volume of the upper airway change after an orthodontic intervention? **P:** growing subjects, adults; **I:** orthodontic treatment, dentofacial orthopedics, extractions; **C:**

untreated subjects and/or non-extractions; **O:** volumetric changes of the upper airway measured on CBCT scans.

**Rationale:** The effect of orthodontic treatment on volumetric changes of the

upper airway remains controversial. Previous reviews often focused on one type of orthodontic intervention and or on one component of the upper airway. Here we aim to provide a thorough analysis of the effect of different orthodontic interventions using a standardized nomenclature of the airway with reliable anatomical landmarks to determine the borders of the airway.

**Condition being studied:** The primary objective of orthodontic treatment is to establish optimal dental and/or skeletal relationship in harmony with the soft tissue morphology and functioning. In addition, un-impeding or facilitating airway growth and development is an important objective, especially in patients susceptible for airway obstruction or sleep apnea. It is therefore important to look into the effect of various orthodontic treatments on the 3D volumetric changes of the upper airway. Compared with the use of traditional 2D lateral cephalograms, CBCT scans provide the opportunity to perform measurements in more dimensions on the airway with demonstrated reliability. This systematic review therefore includes studies using CBCT scans for evaluation of the airway.

## METHODS

**Search strategy:** Electronic databases for searches: PubMed, EMBASE, Web of Science, the Cochrane Library.

Search strategy of each database:

**PUBMED:**

("Orthodontics"[Mesh] OR orthodont\*[tiab] OR dentofacial\*[tiab])

AND

("Respiratory System"[Mesh] OR respirat\*[tiab] OR airway\*[tiab] OR pharynx\*[tiab] OR nasopharynx\*[tiab] OR oropharynx\*[tiab] OR hypopharynx\*[tiab])

Embase:

('orthodontics'/exp OR (orthodont\* OR dentofacial\*):ab,ti,kw)

AND

('respiratory system'/exp OR (respirat\* OR airway\* OR pharynx\* OR nasopharynx\* OR oropharynx\* OR hypopharynx\*):ab,ti,kw)

**WOS:**

TS= (orthodont\* OR dentofacial\*)

AND

TS= (respirat\* OR airway\* OR pharynx\* OR nasopharynx\* OR oropharynx\* OR hypopharynx\*)

Cochrane

(orthodont\* OR dentofacial\*)

AND

(respirat\* OR airway\* OR pharynx\* OR nasopharynx\* OR oropharynx\* OR hypopharynx\*)

There will be no restrictions on publication dates or languages.

**Participant or population:** The systematic review studies healthy growing and non-growing human subjects aged 7 years and older and of any age and sex and with any orthodontic malocclusion who receive different types of orthodontic and/or dentofacial orthopedic treatment. Subjects with cleft lip and/or palate, and systemic disease relating to orofacial growth are not eligible. Studies dealing with OSAS or other airway diseases, and expiratory flow studies will be excluded.

**Intervention:** Full orthodontic treatment with fixed appliances, with or without extraction of premolars, dentofacial orthopedic treatment using functional appliances or transversal expansion appliances.

**Comparator:** The comparator will be adolescents or adults who underwent no orthodontic treatment, or orthodontic patients without extraction.

**Study designs to be included:** RCT's, controlled clinical trials, prospective cohort studies, observational studies, intervention studies.

**Eligibility criteria:** Inclusion criteria were: prospective or retrospective clinical studies, orthodontics as intervention, treatment groups >10 participants, airway definition described or clearly illustrated, CBCT acquisition with the patient positioned upright, pre- and post-treatment CBCT 3D volumetric assessments available.

**Information sources:** Electronic searches on MEDLINE using PubMed, EMBASE, Web

of Science, the Cochrane Library. Manual screening of the reference lists of the selected articles.

**Main outcome(s):** Volumetric changes of the total upper airway and that of its individual components as measured on CBCT scans are selected as the main (primary) outcome.

**Additional outcome(s):** Comparison of the effect of different orthodontic/orthopedic intervention categories is selected as the additional/secondary outcome.

**Data management:** PICO search on MEDLINE using PubMed, EMBASE, Web of Science, the Cochrane Library, Article selection in Research support portal of the university [umcgresearch.org](https://umcgresearch.org) Data collection: measures of effect pre-treatment and post-treatment. Titles and/or abstracts of studies retrieved using the search strategy and those from additional sources are screened independently by two review authors (one knowledgeable in the review topic, one methodology expert) to identify studies that potentially meet the inclusion criteria outlined above. Same for full text articles. Disagreements will be resolved by a consensus discussion with a third reviewer (knowledgeable in the review topic and methodology).

**Quality assessment / Risk of bias analysis:** Quality assessment by two reviewers, independently. Any discrepancies between the two reviewers will be resolved by consensus discussion with the third reviewer. The quality of the included studies will be assessed according to the quality assessment tool of the National Heart, Lung and Blood Institute (<https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools>). The assessment of the quality of the evidence will be performed applying the GRADE system.

**Strategy of data synthesis:** Depending on the homogeneity of the included studies, a quantitative analysis will only be carried out in case of sufficient homogeneity, in all other cases a descriptive synthesis will be carried out.

**Subgroup analysis:** If the necessary data are available, subgroup analyses will be done.

**Sensitivity analysis:** Sensitivity analysis will be performed if applicable.

**Language:** There is no language restriction in the search strategy.

**Country(ies) involved:** The Netherlands.

**Keywords:** CBCT, Airway, Orthodontics, Dentofacial Orthopedics, Volumetric changes.

**Dissemination plans:** The systematic review results will be published in an international, peer-reviewed journal, and be presented in national and international conferences.

#### **Contributions of each author:**

**Author 1 - Ralph Steegman -** designing the review; data collection; data management; analysis of data; interpretation data; writing the protocol or review.

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**Author 4 - Adriaan Schoeman -** data collection; data management; analysis of data.

**Author 5 - Anne Marie Kuijpers-Jagtman -** coordinating the review; analysis of data; interpretation data; writing the protocol or review.

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**Author 6 - Yijin Ren -** conceiving the review; designing the review; coordinating the review; data management; analysis of data; interpretation data; writing the protocol or review.

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