

ASSESSMENT OF THE UPPER AIRWAY DIMENSIONS ACROSS DIFFERENT CRANIOFACIAL PATTERNS USING 3D IMAGING: SYSTEMATIC REVIEW WITH NETWORK META-ANALYSIS

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ABSTRACT

Introduction & Aim: Different sagittal and vertical craniofacial patterns are linked to differences in the upper airway dimensions. The aim was to investigate systematically and identify any potential differences, across the different sagittal and vertical skeletal craniofacial patterns in the upper airway volume and minimum cross-sectional area (minCSA) using three-dimensional (3D) imaging.

Method: Systematic review registered in PROSPERO. Medline (via PubMed), Embase, Web of Science, ScieLo, Scopus, ProQuest (Dissertations and Thesis Global), Cochrane Library and Virtual Health Library were searched without restrictions up to May 2023 for human studies on orthodontically-untreated individuals having 3D imaging of the upper airways. Following duplicate study selection, data extraction, and risk-of-bias assessment, network meta-analyses of Mean Differences (MD) with their 95% Confidence Intervals (CI) were performed.

Results: Seventy-three publications (4679 patients; mean age 22.0 years; 45% male) were included. Upper airway volumes were significantly reduced in Class II compared to Class I subjects for the nasal cavity: MD=-3478.1mm³ (95%-CI=-6017.2;-938.9), palatopharynx (PP): MD=-1996.2mm³ (95%-CI=-3126.1;-866.2), glossopharynx (GP): MD=-1101.2mm³ (95%-CI=-1777.3;-425.0), oropharynx (OP=PP+GP): MD=-3036.3mm³ (95%-CI=-4096.5;-1976.1) and total pharynx: MD=-2686.6mm³ (95%-CI=-3494.3;-1878.9) while non-significant differences were observed for the nasopharynx (NP), hypopharynx (HP) and intraoral (IO) airway volumes. Class III subjects showed greater volumes than Class I for the OP: MD=2263.7mm³ (95%-CI=1029.9;3497.4), HP: MD=1233.5mm³ (95%-CI=434.6;2032.3) and IO: MD=1351.3mm³ (95%-CI=296.1;2406.6). Inconsistent differences were noted per vertical grouping (normodivergent, hypodivergent, hyperdivergent). Regarding minCSA, Class II had smaller minCSA than Class I subjects at the level of the PP: MD=-28.6mm² (95%-CI=-49.3; -8.0), and the OP: MD=-31.9mm² (95%-CI=-53.9; -9.9). Class III had greater minCSA than Class I subjects at the level of the PP: MD=24.5mm² (95%-CI=2.6;46.4) and OP+HP: MD=46.52mm² (95%-CI=10.5;82.5) and greater than Class II in the total pharynx and its compartments. All studies had high risk of bias (RoB) due to confounding not identified and addressed, blinding, incomplete reporting of sample characteristics and outcomes, while the quality of evidence was low in most instances.

Conclusion: Significant differences in upper airway volumes and minCSAs were identified using 3D imaging, with Class II having smaller and Class III greater values compared to Class I subjects; however, the quality of the existing evidence is questionable. Distinct craniofacial patterns could be used to help recognize subjects at a higher risk for sleep apnoea and to make a choice of appropriate therapy.

Εικόνα 1

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PATTERNS USING 3D IMAGING: SYSTEMATIC REVIEW WITH NETWORK META-ANALYSISAlexandra K. Papadopoulou^{1,2,3}, Charlotte Altheer¹, Gregory S. Antonarakis¹, Georgia Trakada^{3,4}, Spyridon N. Papageorgiou⁵

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INTRODUCTION: Craniofacial skeletal patterns in the sagittal (Class I-normal, Class II and Class III) and vertical (normodivergent, hypodivergent, hyperdivergent) dimensions have been associated with upper airway dimensions.

AIM: To investigate systematically and identify any potential differences across the different sagittal and vertical craniofacial patterns in the upper airway volume and minimum cross-sectional area (minCSA) as assessed by using three-dimensional (3D) imaging.

METHODS: Medline (via PubMed), Embase, Web of Science, ScieLo, Scopus, ProQuest (Dissertations and Thesis Global), Cochrane Library and Virtual Health Library searched without restrictions up to May 2023. Human studies on orthodontically-untreated individuals having 3D imaging of the upper airways. Following duplicate study selection, data extraction, and risk-of-bias assessment, network meta-analyses of Mean Differences (MD) with their 95% Confidence Intervals (CI) were performed.

Registration number: PROSPERO (CRD42022366928).

Class I: normal ANB

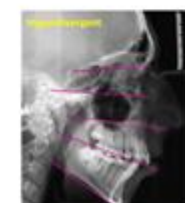
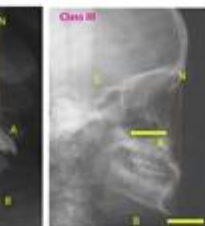
Class II: increased ANB (usually M2 retrognathia)

Class III: decreased or negative ANB (usually M2 retrognathia or combination M2 retrognathia & M2 prognathia)

Normodivergent: normal angulation of the horizontal reference planes

Hypodivergent: decreased angulation of the horizontal reference planes (horizontal growers, short-face, brachycephalic)

Hyperdivergent: increased angulation of the horizontal reference planes (vertical growers, long-face, dolichcephalic)



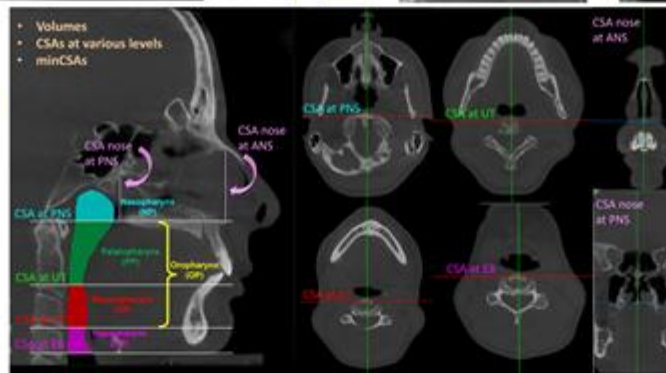
RESULTS

Studies: 66

Publications: 70

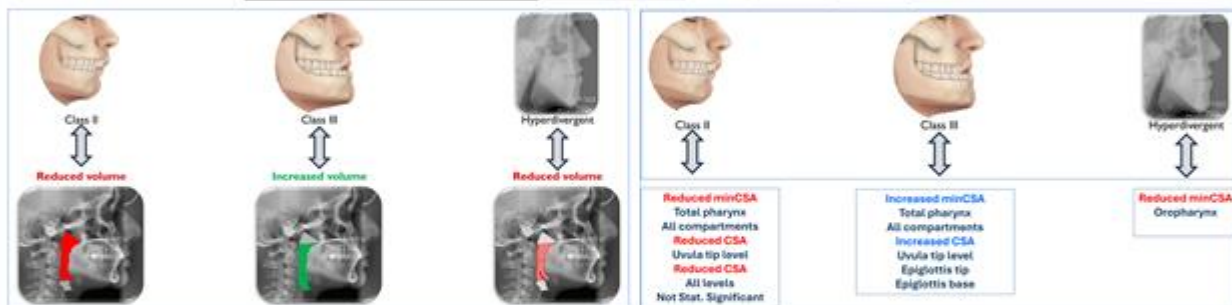
NC: nasal cavity
NP: nasopharynx
PP: palatopharynx
OP: oropharynx
HP: hypopharynx

ANS: anterior nasal spine
PNS: posterior nasal spine
UT: uvula tip
EB: epiglottis base



High risk of bias

- ✓ Retrospective design
- ✓ Samples (mixed ages)
- ✓ Incomplete reporting
- ✓ Assessors blinding
- ✓ Which jaw retrognathic?



CONCLUSIONS

- Significant differences in upper airway **volumes**, **CSAs at various anatomic levels** and **minCSAs** were identified using 3D imaging, with Class II (convex profile) and hyperdivergent (long face) patients having smaller and Class III (concave profile) patients having greater values compared to Class I (straight profile) patients.
- The quality of the existing evidence is questionable due to the high risk of bias of the included studies.
- Distinct craniofacial patterns assessed by specialist orthodontists could be used to**
 - help recognize subjects at a higher risk for sleep apnoea
 - make a choice of appropriate therapy

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