

Airway dimension change after open bite treatment – 3D CBCT study



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Introduction

- Studies have shown that airway dimension can be correlated to skeletal/dental malocclusion, including anterior open bites.¹
- Counter-clockwise rotation of mandible or extrusion of incisors can be used to correct anterior open bites; however, their subsequent effect on airway dimension has not been well studied.
- Studies have shown that both the inferior oropharyngeal airway volume and cross-sectional area increased as the mandibular position is advanced forward (decreased mandibular plane angle).²
- Previous 3D MRI studies have shown that total airway volume, retroalatal and retroglottal airway volume increased following open bite closure.³

Objectives

- To investigate how skeletal and dental changes, including mandibular plane angle and incisor position changes, affect airway dimension in non-surgical orthodontic open bite treatment.

Material and Methods

- Retrospective study of open bite adult patients treated at UOP from 2006 (n=196)
- All subjects had T1 (before orthodontic treatment) and T2 (end of orthodontic treatment) CBCT
- Exclusions: orthognathic surgery and craniofacial patients
- Fifty-three cases were collected.
- The sample was divided into growing (Female younger than 15 yrs, Male younger than 18 yrs) and non-growing (Female older than 15 yrs, Male older than 18 yrs) groups for further analysis.
- Used 3D tracings and airway measurements (using Invivo 6) to evaluate changes in airway dimensions in various skeletal patterns - tracings were done by 2 judges
- 19 skeletal and 12 dental landmarks were evaluated
- Areas measured:
 - Airway measurements include:
 - Upper oropharynx
 - From palatal plane (ANS-PNS) to base of soft palate parallel to FH
 - Lower oropharynx
 - From base of soft palate to epiglottic vallecula parallel to FH
 - Airway measurements include:
 - Minimum cross-sectional area (MCA, mm²)
 - Volume (cc)



Results

Impact of skeletal and dental changes during open bite treatment on airway: (n=52, 1 outlier excluded from analysis)

	U.VOL		U.MCA		L.VOL		L.MCA	
	r	p	r	p	r	p	r	p
Mn length	0.29*	0.04	0.28*	0.04	0.48*	<0.01	0.36*	0.01
Mn ramus length	0.24	NS	0.19	NS	0.40*	0.003	0.28*	0.04
Mn body length	0.11	NS	0.19	NS	0.23	NS	0.26	NS
Mandibular plane angle	-0.09	NS	-0.10	NS	0.25	NS	-0.05	NS
SNB	0.16	NS	0.20	NS	0.03	NS	0.25	NS
ANB	-0.33*	0.02	-0.35*	0.01	-0.26	NS	-0.25	NS
SNA	0.04	NS	0.02	NS	-0.10	NS	0.17	NS
S perp A	0.13	NS	0.04	NS	0.17	NS	0.12	NS
S perp B	0.22	NS	0.23	NS	0.11	NS	0.25	NS
S perp Pog	0.22	NS	0.22	NS	0.09	NS	0.23	NS
S perp U1	0.21	NS	0.20	NS	0.03	NS	0.21	NS
S perp L1	0.30*	0.03	0.30*	0.03	0.21	NS	0.25	NS

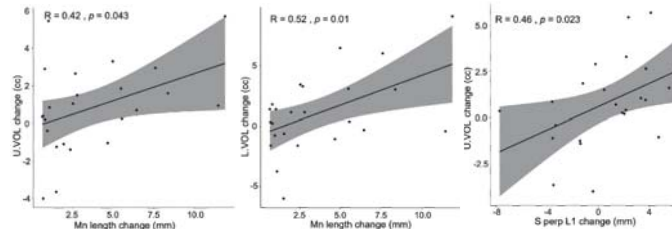
- Correlations between airway dimension and mandibular size, ANB, L1 position changes were statistically significant

Growing group (n=24, F<15, M<18)

	T1		T2		T2-T1	
	mean	sd	mean	sd	mean	sd
SNA	80.88	4.32	80.57	4.42	-0.31	1.10
SNB	76.27	5.21	76.29	5.42	0.02	1.53
ANB	4.66	2.35	4.48	2.53	-0.18	1.24
Mandibular Plane Angle (FH-MP)	29.39	5.48	28.93	5.44	-0.46	1.40

- The patients presented with hyperdivergent Class II skeletal pattern before treatment (T1).

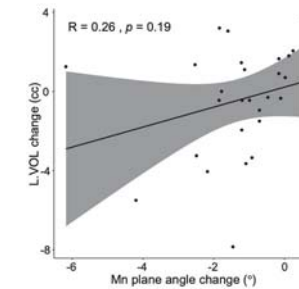
	U.VOL		U.MCA		L.VOL		L.MCA	
	r	p	r	p	r	p	r	p
Mn length	0.42*	0.04	0.33	NS	0.52	0.01	0.51*	0.01
Mn ramus length	0.3	NS	0.25	NS	0.47	0.02	0.48*	0.02
Mn body length	0.45*	0.03	0.37	NS	0.36	0.09	0.37	NS
Mandibular plane angle	-0.33	NS	-0.33	NS	-0.06	NS	-0.24	NS
SNB	0.34	NS	0.27	NS	0.29	NS	0.35	NS
ANB	-0.42*	0.04	-0.43*	0.03	-0.29	NS	-0.34	NS
SNA	0.11	NS	0	NS	0.14	NS	0.26	NS
S perp A	0.25	NS	0.09	NS	0.32	NS	0.27	NS
S perp B	0.48*	0.02	0.38	NS	0.38	NS	0.44*	0.03
S perp Pog	0.45*	0.03	0.36	NS	0.34	NS	0.42*	0.04
S perp U1	0.41	0.05	0.37	NS	0.29	NS	0.42*	0.04
S perp L1	0.46*	0.02	0.42*	0.04	0.51*	0.01	0.37	NS



- Mandibular length change had positive correlations with upper airway volume (U.VOL), lower airway volume (L.VOL), and lower airway minimal cross-sectional area (L.MCA).
- Mandibular ramus length change showed positive correlations with L.VOL and L.MCA.
- ANB angle showed a negative correlation with upper airway size.
- B point and pogonion (Pog) position change in the anterior-posterior (AP) dimension showed positive correlation with airway size.
- Upper and lower incisor positions in the AP dimension showed positive correlations with airway size.

Adult (non-growing) group (n=28, F≥15, M≥18)

	U.VOL		U.MCA		L.VOL		L.MCA	
	r	p	r	p	r	p	r	p
Mn length	0.03	NS	0.22	NS	0.42	0.03	0.12	NS
Mn ramus length	0.07	NS	0.04	NS	0.21	NS	-0.05	NS
Mn body length	-0.15	NS	0.03	NS	0.07	NS	0.17	NS
Mandibular plane angle	0.02	NS	0.06	NS	0.43	0.02	0.05	NS
SNB	0.01	NS	0.13	NS	-0.24	NS	0.16	NS
ANB	-0.24	NS	-0.22	NS	-0.22	NS	-0.15	NS
SNA	0.04	NS	0.09	NS	-0.32	NS	0.11	NS
S perp A	-0.10	NS	-0.08	NS	-0.17	NS	-0.19	NS
S perp B	-0.08	NS	0.00	NS	-0.27	NS	-0.01	NS
S perp Pog	-0.06	NS	-0.01	NS	-0.29	NS	-0.06	NS
S perp U1	0.03	NS	-0.01	NS	-0.25	NS	-0.03	NS
S perp L1	0.11	NS	0.13	NS	-0.21	NS	0.08	NS



- When one outlier was excluded, mandibular plane angle had no significant correlation with airway size.
- Dental or skeletal changes during open bite treatment did not present any statistically significant correlation with airway change in adults.

Conclusion

- Change in airway dimension showed statistically significant, moderate, positive correlations with amount of mandibular growth and anterior movement of B point and Pog in the growing group.
- Airway size change after open bite treatment did not show any significant correlation with skeletal/dental changes in the adult group.

Clinical Implications

- Increase in airway size can be expected when treating growing patients.

References

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