Who's Watching Our Kids?

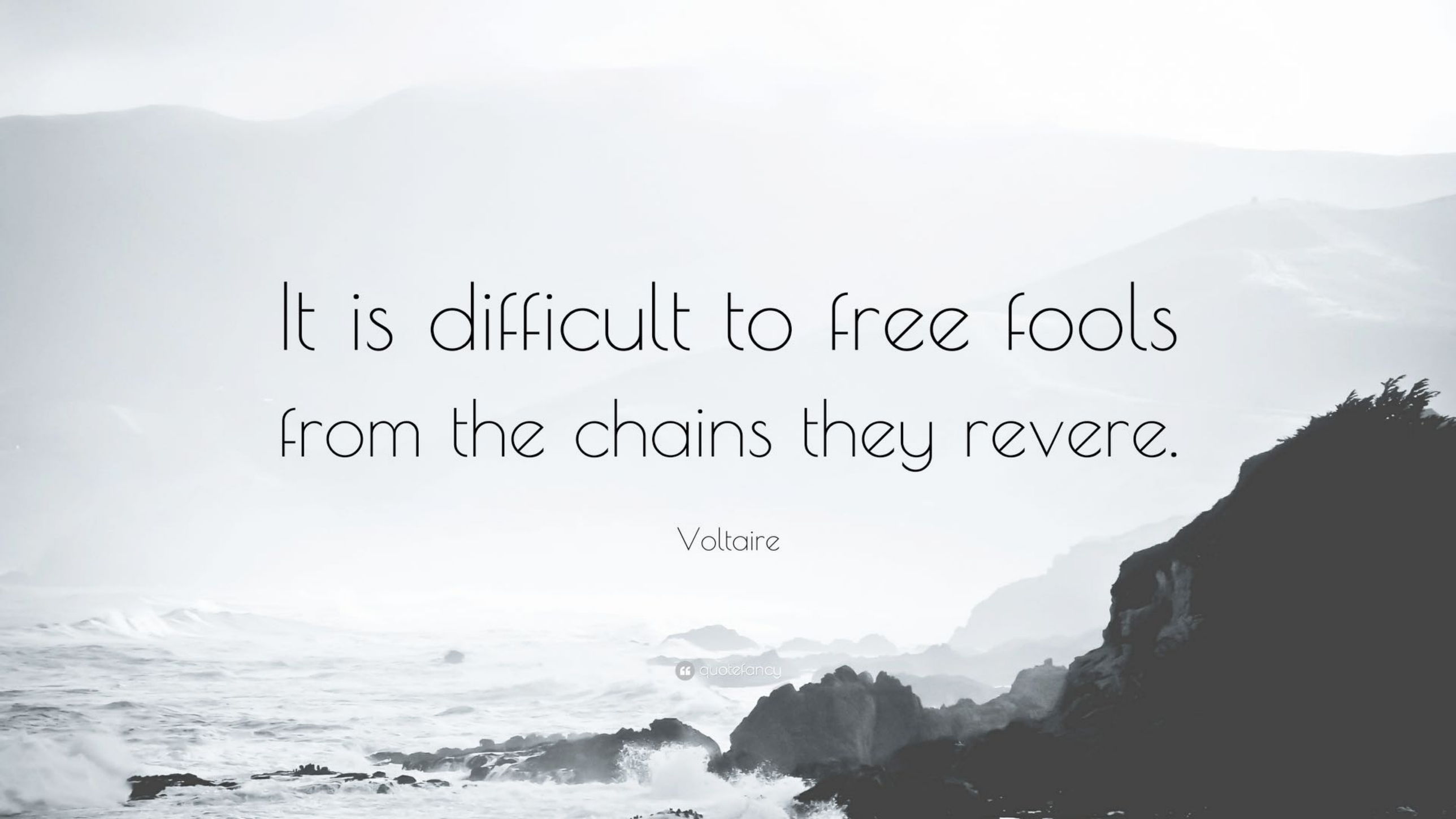
- the orthodontist as primary child airway professional -

John Graham, DDS, MD
Salt Lake City, Utah

My Journey to Airway-Centric Orthodontics

Clinical Snapshot

- Passive Self-Ligation
- Annual Extraction Rate < 0.5%
- No Rapid Palatal Expanders

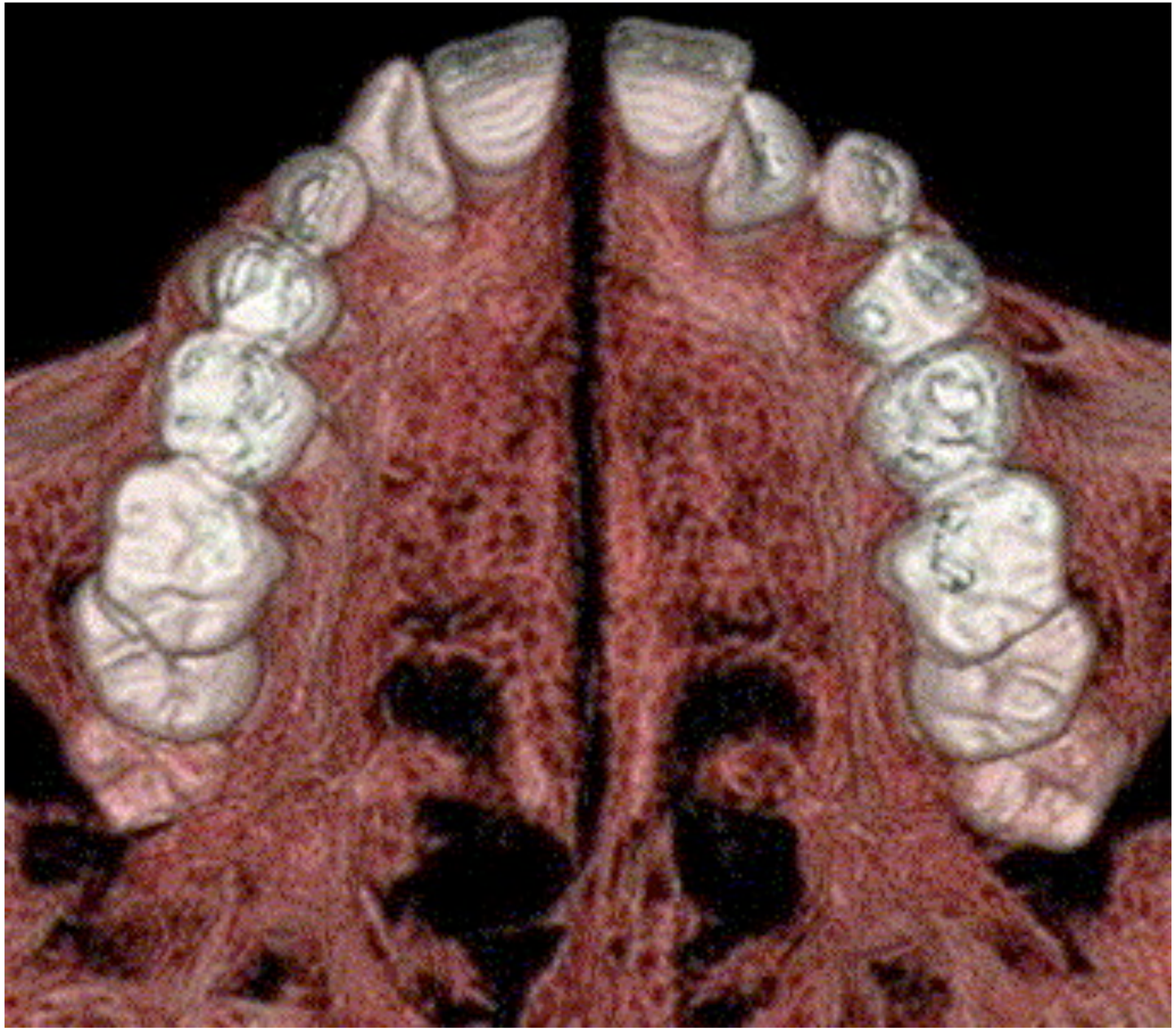

It is difficult to free fools
from the chains they revere.
Voltaire
quotefancy

In nearly 15 years of private practice I’ve never used an RPE for resolution of crossbite or crowding.

High-resolution multislice computerized tomography with multiplanar and 3-dimensional reformation imaging in rapid palatal expansion

Karin Habersack,[a] Anita Karoglan,[a] Bernhard Sommer,[b] and Klaus U. Benner[c]
Weilheim and Munich, Germany

Introduction: The purpose of this study was to evaluate whether high-resolution multislice computerized tomography (CT) with multiplanar reformation and 3-dimensional (3D) imaging is helpful in demonstrating the effects on midfacial sutures induced by rapid palatal expansion (RPE), thereby appraising and corroborating the current state of the art or possibly adding new findings. **Methods:** Two patients in different stages of skeletal maturity (aged 10 and 16 years) underwent CT examinations immediately after active opening with the RPE appliance. **Results:** The 3D CT imaging method proved to be valuable in visualizing skeletal effects on not only the midpalatal suture, but also adjacent sutures. It allowed precise 3D location of tooth positions. In the 3D CT images of 1 patient, the complete opening of the midpalatal suture was visible. The median dissection of the incisal foramen at the point of unification of the 2 nasopalatine channels could be visualized. Additionally, the positions of severely displaced maxillary canines could be located precisely. In the other patient, apart from the completely open midpalatal suture, the opening or widening of the internasal suture, the nasomaxillary sutures, and the frontomaxillary sutures were visible. **Conclusions:** The 3D imaging of high-resolution multislice CT opens up a new dimension in orofacial diagnosis. Improvements of the quantity and the exactness of diagnostic parameters were attained. The imaging method is helpful and indicated in RPE patients with additional diagnostic objectives related to the development of occlusion. This imaging method is recommended in borderline cases (juvenile or adult patients with questionable sutural response) to determine whether the suture is completely open or whether surgical support is needed. (Am J Orthod Dentofacial Orthop 2007;131:776-81)



COMP: Class I, Invisalign

12	to 12	Status	Consultation
		Recall	
02/21/18		Brackets	
		Bal $	0.00
		Ttl Chr	0 hrs - 41 min
		Ttl Dr	0:18:08
		Birth Date	9/5/81
		City	Holladay

of 12-12 Target to

Chart Note | P. Prob. | Ch. Compl. | Dispos.

Future Appointments

Last Entry

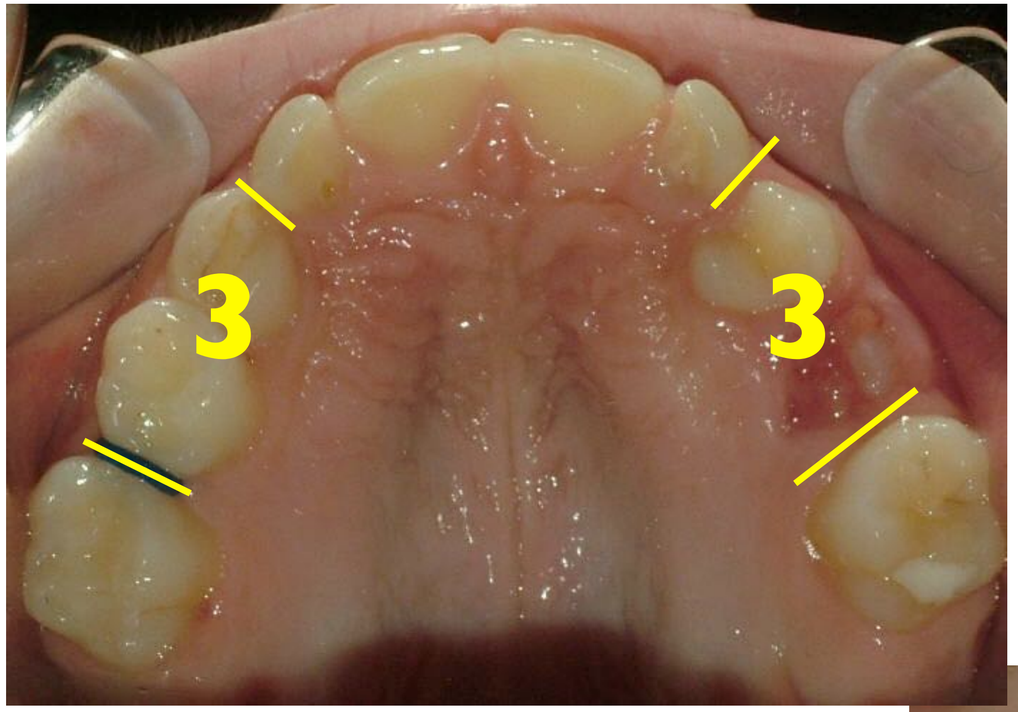
U AW

02/ 18

Phase: Unassigned Show All Sort by: Treatment Pt Notes

Date	As.	Dr.	Type	Today's Proced	Proc Code	XRay	OJ/OB	AW's	Elastics/Hrs	Lo	OH	A/E	AP	PR	Nex
02/21/18	CG	JW G	V	Consult: CT Scan, Photos, Exam.Had braces and an expander in Jr High/HS. No retainers given. Teeth are shifting and leaning in towards tongue. Dr G recommends comp full tx w/Invisalign. D1, 8-12 months to open up bite and fix crowding. Went over attachments, IPR, refinement scans and possible elastic wear.							B				contrac invisali

Severe Crowding
Resolved Without RPEs Or Extractions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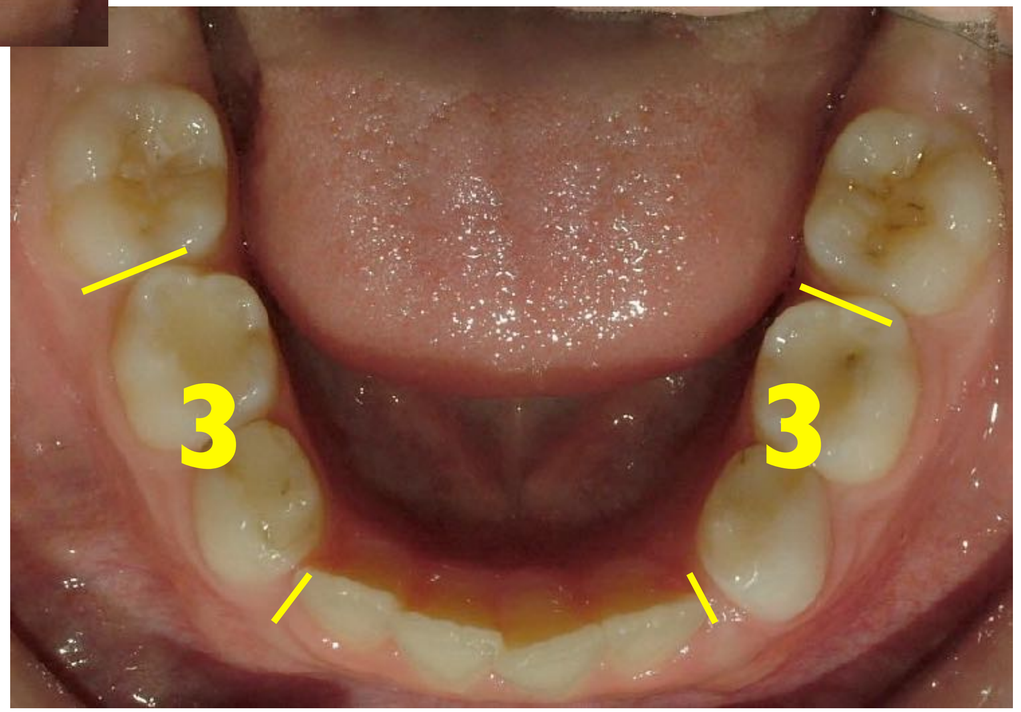
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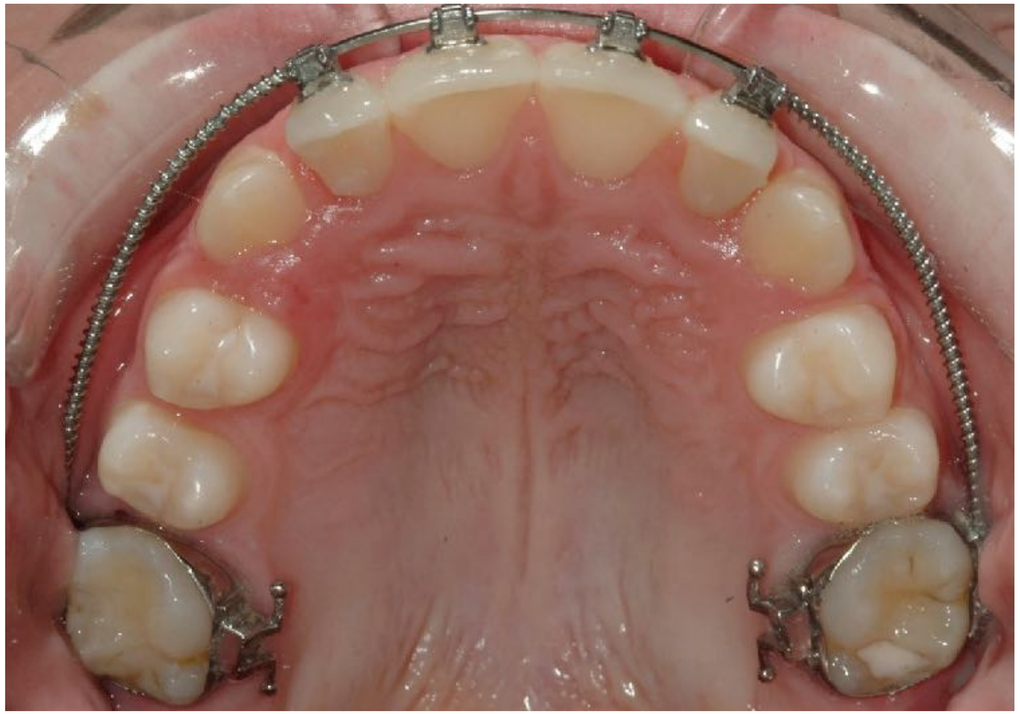

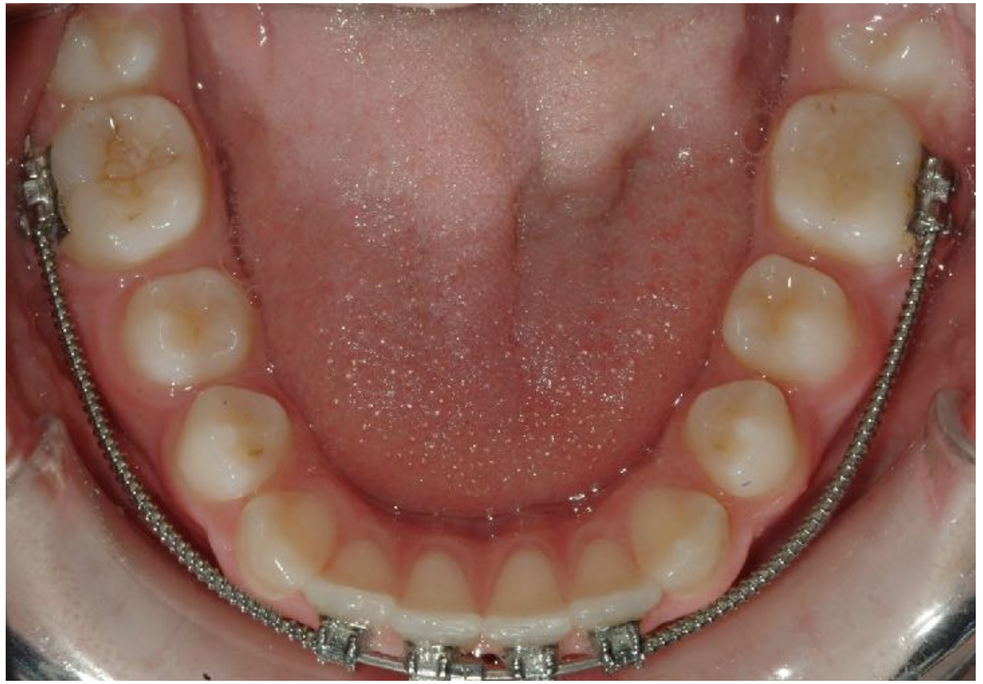

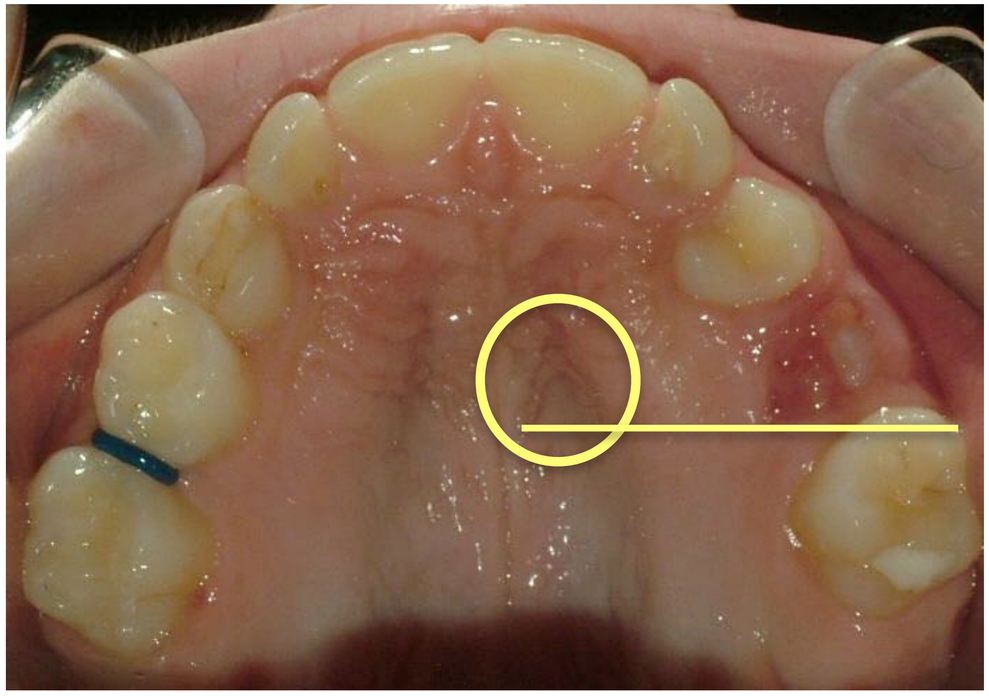

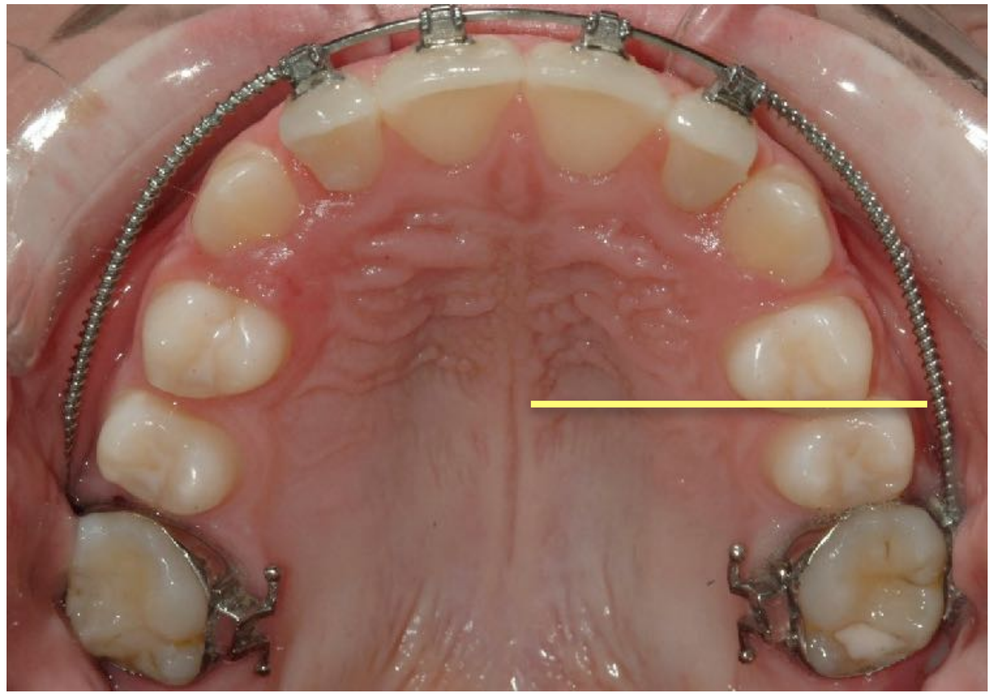

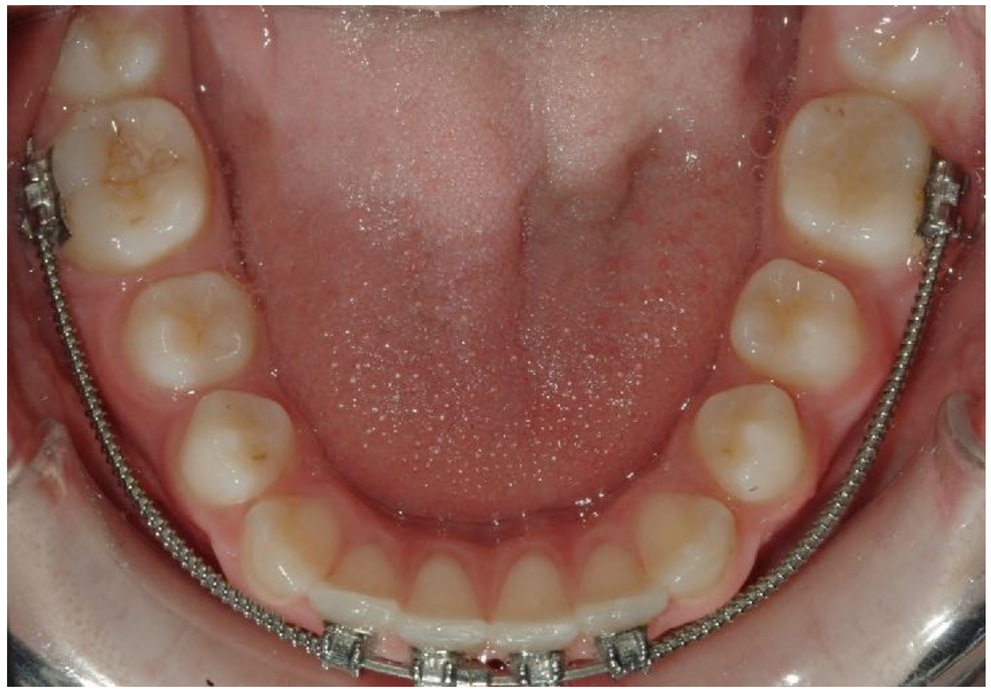



Parents told he needed Phase I *after*
four bicuspids were extracted

Is there a place in my practice for rapid palatal expanders?

Yes…

Yes…

and it loosened the chains I revered

It took a decade, an iCAT, and my daughter to figure it out

Taylor, the day of her adenotonsillectomy

Obstructive Sleep Apnea (OSA)

Nocturnal enuresis decreased significantly in all patients after the RME period, and all patients showed full dryness after 3 years†

Nocturnal enuresis ceased within a few months in the 10 cases studied by using rapid maxillary expansion to reduce nasal constriction††

Surgical removal of upper airway obstruction led to a significant decrease in or complete cure of nocturnal enuresis in 76% of children studied*

†Timms D, Rapid maxillary expansion in the treatment of nocturnal enuresis, Angle Orthodontist 1990, 60(3):229-33

††Namer Al-Taal, et al, Effect of rapid maxillary expansion on monosymptomatic primary NE , Angle Orthodontist 2015, 85(1):102-108

*Weider, DJ, Nocturnal enuresis in children with upper airway obstruction, Otolaryngol Head Neck Surg 1991;105:417-32

Obstructive Sleep Apnea (OSA)

OSA is one of the most common causes of sleep-disordered breathing in the general pediatric population*

Reported prevalence ranging from 1-5% *†

* Bixler EO, Vgontzas AN, Lin HM, Liao D, Calhoun S, Vela-Bueno A, et al. Sleep disordered breathing in children in a general population sample: prevalence and risk factors. Sleep. 2009;32(6):731–6

† Rosen CL, Larkin EK, Kirchner HL, Emancipator JL, Bivins SF, Surovec SA, et al. Prevalence and risk factors for sleep-disordered breathing in 8 to 11-year-old children: association with race and prematurity. J Pediatr.2003;142(4):383–9.

Obstructive Sleep Apnea (OSA)

- Peak prevalence occurs at 2-8 years
- Symptoms are very nonspecific and require a high level of suspicion
- Daytime symptoms may include some or all:
    - Difficulty concentrating
    - Morning headaches
    - Daytime sleepiness
    - ADHD

Obstructive Sleep Apnea (OSA)

25% of children with ADHD snore.

Of those 81% could have their ADHD eliminated if their habitual snoring were effectively treated*

*Chervin, RD et al. Symptoms of Sleep Disorders, Inattention, and Hyperactivity in Children,1997, Sleep, 20(12):1185-1192.

Treatment Outcomes of Adenotonsillec Apnea: A Prospective Longitudinal Stu

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[1]Department of Child Psychiatry and Sleep Center, Chang Gung Memoria Sleep Medicine Division, Stanford, CA; [3]Department of Otolaryngology, a Taoyuan, Taiwan; [4]Department of Cranio Facial Center and Sleep Center; [5]Department of Education, National Chia-Yi University, Chiayi, Taiwan; [6] University, Taipei, Taiwan

Objective: To evaluate the efficacy of adenotonsillectomy (AT) in the tr longitudinal study with analysis of risk factors of recurrence of OSA.
Study Design: An investigation of children (6 to 12 y old) with OSA dc examination, questionnaires, and polysomnography.
Multivariate generalized linear modeling and hierarchical linear mod resolution of OSA, and Generalized Linear Models were used for analy
Results: Of the 135 children, 88 terminated the study at 36 month boys 8.9 ± 2.04 y, girls: 8.8 ± 2.07 y; body mass index [BMI] = 19.5 13.54 ± 7.23 and a mean postoperative AHI at 6 mo (AHI_6) of 3.47 ± 8 in AHI was noted with a mean AHI_{36} = 6.48 ± 5.57 events/h and AHI_{36} > in the OSA-18 questionnaire.
The residual pediatric OSA after AT was significantly associated with B AT, recurrence of pediatric OSA was significantly associated with enur rate of change in BMI and body weight.
Conclusions: Adenotonsillectomy leads to significant improvement in worsening over time was observed in 68% of our cases.
Keywords: adenotonsillectomy, comorbidity, obstructive sleep apnea,
Citation: Huang YS; Guilleminault C; Lee LA; Lin CH; Hwang FM. Tre apnea: a prospective longitudinal study. *SLEEP* 2014;37(1):71-76.

INTRODUCTION

Obstructive sleep apnea (OSA) syndrome is a highly prevalent condition in children and characterized by snoring, witnessed apnea, unrefreshing sleep, and excessive daytime sleepiness.[1,2] Children with OSA experience recurrent periods of elevated upper airway resistance during sleep due to partial or complete upper airway obstruction, which results in snoring, episodic oxyhemoglobin desaturation, hypercapnia, and repeated arousals.[3,4] The respiratory disturbance of recurrent hypoxia-reoxygenation episodes during the night is associated with an increased risk of suboptimal growth, poor sleep quality, neurocognitive dysfunction, behavioral problems, overweight status, and cardiovascular disease in childhood.[5-8] The prevalence of OSA is approximately 2-3% in children,[9,10] and current studies have evaluated the influence of OSA on various associated morbidities[1-8,11] and tried to identify the factors predicting poor treatment outcome.[12]

Submitted for publication February, 2013
Submitted in final revised form October, 2013
Accepted for publication October, 2013
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Orthodontic Expansion Treatment and Adenotonsillectomy in the Treatmen Obstructive Sleep Apnea in Prepubertal Children

Christian Guilleminault, MD, BiolD[1], Stacey Quo, DDS[2], Nelly T. Huynh, PhD[1], Kasey Li, MD, DDS[1]

[1]Stanford University Sleep Medicine Program, Stanford, CA; [2]University of California San Francisco School of Dentistry, San Francisco,

Study objective: Rapid maxillary expansion and adenotonsillectomy are proven treatments of obstructive sleep apnea (OSA) in children. Our goal was to investigate whether rapid maxillary expansion should be offered as an alternative to surgery in select patients. In addition, if both therapies are required, the order in which to perform these interventions needs to be determined.
Design: Prepubertal children with moderate OSA clinically judged to require both adenotonsillectomy and orthodontic treatment were randomized into 2 treatment groups. Group 1 underwent adenotonsillectomy followed by orthodontic expansion. Group 2 underwent therapies in the reverse sequence.
Subjects: Thirty-two children (16 girls) in an academic sleep clinic.
Method: Clinical evaluation and polysomnography were performed after each stage to assess efficacy of each treatment modality.
Results: The 2 groups were similar in age, symptoms, apnea-hypopnea index, and lowest oxygen saturation. Two children with orthodontic treatment first did not require subsequent adenotonsillectomy. Thirty children underwent both treatments. Two of them were still sy atic and presented with abnormal polysomnogram results followi therapies. In the remaining 28 children, all results were sign different from those at entry (P = 0.001) and from single thera 0.01), regardless of the order of treatment. Both therapies were sary to obtain complete resolution of OSA.
Conclusion: In our study, 87.5% of the children with sleep-dis breathing had both treatments. In terms of treatment order, children underwent orthodontic treatment alone, whereas no underwent surgery alone to resolve OSA. Two children who unc both treatments continued to have OSA.
Keywords: Prepubertal children, pediatric obstructive sleep orthodontics, adenotonsillectomy, treatment
Citation: Guilleminault C; Quo S; Huynh NT; Li K. Orthodontic sion treatment and adenotonsillectomy in the treatment of obs sleep apnea in prepubertal children. *SLEEP* 2008;31(7):953-95

THE IMPACT OF RAPID MAXILLARY EXPANSION (RME) ON NASAL RESISTANCE AND NOCTURNAL SLEEP SYMPTOMS IN CHILDREN WAS DESCRIBED even before the syndrome of obstructive sleep apnea syndrome (OSAS) in children.[1-6] RME has been used to treat children presenting with OSAS.[7-9] In these studies, children either had adenotonsillectomy prior to orthodontic treatment or had an isolated problem involving the maxilla. However, most children seen in sleep clinics present with moderate to large tonsils, scored between 2+ and 4+ on the Friedman et al scale,[10] and a narrow upper airway with maxillary constriction and/or some degree of mandibular retrusion, which presents as a narrow and long face.[11-14] There are unresolved questions in this commonly seen child. Should orthodontic treatment be considered first or should adenotonsillectomy be performed as first-line treatment? Can orthodontic expansion be an isolated treatment option for a child with OSAS who still has adenoids and tonsils? Also, while it is known that the persistence of tonsillar enlargement may interfere with orthodontic treatment, no data is available on the impact of combined ther OSAS.

In our clinical practice, we educate families that enotonsillectomy and orthodontic expansion may be The order of these treatments has largely been a de convenience or parental preference, influenced, for by appointment availability or timing of school vaca this study, prepubertal children with moderate OSAS as a lowest oxygen saturation of 90% and an apnea-h index [AHI] of 20 events per hour) needing both ade lectomy and orthodontic treatment were prospectiv domized into 2 treatment groups. Each treatment gro baseline polysomnography recording. Group 1 was s to undergo adenotonsillectomy followed by orthodonti sion (maxillary or bimaxillary expansion). Group 2 w uled to undergo the reverse sequence, starting with ort expansion, followed by adenotonsillectomy. Polysomn was performed after each stage to assess the efficacy treatment modality.

METHODS

All the children studied were referred to the Stanfo Disorders Clinic for symptoms known to be associa sleep-disordered breathing. They were seen in a team se evaluated by an otolaryngologist, an orthodontist, and certified sleep physician. Each child underwent a cor sive assessment, including the Pediatric Sleep Questic a general pediatric physical examination, and a sleep physical examination. Oral examination was performed tonsil and tongue position with respect to the position

Disclosure Statement
This was not an industry supported study. Dr. Huynh has participated in research funded by Sepracor. The other authors have indicated no financial conflicts of interest.

Submitted for publication November, 2007
Accepted for publication March, 2008
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Tongue posture improvement and pharyngeal airway enlargement as secondary effects of rapid maxillary expansion: A cone-beam computed tomography study

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Kagoshima, Niigata, and Himeji, Japan

Introduction: Rapid maxillary expansion (RME) is known to improve nasal airway ventilation. Recent evidence suggests that RME is an effective treatment for obstructive sleep apnea in children with maxillary constriction. However, the effect of RME on tongue posture and pharyngeal airway volume in children with nasal airway obstruction is not clear. In this study, we evaluated these effects using cone-beam computed tomography. **Methods:** Twenty-eight treatment subjects (mean age 9.96 ± 1.21 years) who required RME treatment had cone-beam computed tomography images taken before and after RME. Twenty control subjects (mean age 9.68 ± 1.02 years) received regular orthodontic treatment. Nasal airway ventilation was analyzed by using computational fluid dynamics, and intraoral airway (the low tongue space between tongue and palate) and pharyngeal airway volumes were measured. **Results:** Intraoral airway volume decreased significantly in the RME group from 1212.9 ± 1370.9 mm^3 before RME to 279.7 ± 472.0 mm^3 after RME. Nasal airway ventilation was significantly correlated with intraoral airway volume. The increase of pharyngeal airway volume in the control group (1226.3 ± 1782.5 mm^3) was only 41% that of the RME group (3015.4 ± 1297.6 mm^3). **Conclusions:** In children with nasal obstruction, RME not only reduces nasal obstruction but also raises tongue posture and enlarges the pharyngeal airway. (Am J Orthod Dentofacial Orthop 2013;143:235-45)

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The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.
Supported by KAKENHI from Japan Society for the Promotion of Science (22390392, 22592292, and 22792061).
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Submitted, April 2012; revised and accepted, September 2012.
0889-5406/$36.00

http://dx.doi.org/10.1016/j.ajodo.2012.09.014

Nasal breathing allows proper growth and development of the craniofacial complex. In contrast, nasal obstruction that leads to mouth breathing results in lower tongue posture (with greater intraoral airway volume) and a constricted and V-shaped maxillary dental arch.[1]

Rapid maxillary expansion (RME) has been widely used by orthodontists to increase the maxillary transverse dimensions of young patients. Recent studies have suggested that RME also increases nasal width and volume.[2-5] Therefore, RME is generally thought to diminish the resistance to nasal airflow.[6,7] Gray[8] investigated the medical results of RME in 310 patients and found that over 80% of them changed their breathing pattern from mouth breathing to nasal breathing. Furthermore, the efficacy of RME to treat obstructive sleep apnea syndrome (OSAS) in children has been reported.[9-11] However, the mechanism behind the RME effect is not clear. OSAS in children has various causes.[12] Our purpose was to clarify a mechanism by which RME improves the symptoms.

Upper airway obstruction has also been associated with low tongue posture; among its other effects, RME

Journal section: Oral Medicine and Pathology
Publication Types: Review

Rapid maxillary expansion and obstructive sleep apnea: A review and meta-analysis

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Received: 27/09/2015
Accepted: 27/01/2016

Please cite this article in press as: Machado-Júnior AJ, Zancanella E, Crespo AN. Rapid maxillary expansion and obstructive sleep apnea: A review and meta-analysis. Med Oral Patol Oral Cir Bucal. (2016), doi:10.4317/medoral.21073

Rapid maxillary expansion and obstructive sleep apnea: A review and meta-analysis

Table 1. Selected studies to conduct the meta-analysis.

Author	Year	N	Male	Female	Age	AHI 0	AHI 1	Follow-up	*p*-value	Evidence level
Guilleminault *et al.* (19)	2011	15			6.5+-0.2SEM	11.1+-0.7	5.4+-0.6	3	0.15	2B
Villa *et al.* (20)	2011	10			6.6+-2.1 SD	6.3+-4.7	2.4+-2.0	12	0.05	3B
Miano *et al.* (21)	2009	9	6	3	6,4+-1.97 SD	17.4+-21	5.4+-6.25	12	0.02	3B
Villa *et al.* (22)	2007	16	9	7	6.6+-2.0 SD	5.8+-6.8	1.5+-1.6	12	0.005	3B
Pirelli *et al.* (23)	2004	31	19	12	8.7	12.18+-2.6	0.4+-1.1	4	0.0001	3B
Pirelli *et al.* (24)	2005	42	26	16	7.3	12.17+-2.5	0.5+-1.2	4	0.000	3B
Pirelli *et al.* (25)	2012	40				12.8	6.5+-3.1	4	0.05	3B
Villa *et al.* (26)	2013	22			8.20+-2.62 SD	5.81±6.05	2.64±3.11	12	0.005	3B
Caprioglio et al. (27)	2013	14			7.1+-0.6 SD	5.7+-1.2	1.4+-0.6	12	<0.001	3B
Guilleminault *et al.* (28)	2008	16		16	6.45+-0.8SD	12.2+-4.0	5.1+-3.8	6		3B

Rapid maxillary expansion and obstructive sleep apnea: A review and meta-analysis

- 10 studies met inclusion criteria (215 children)
- Non-syndromic children between 0 and 12 years
- Diagnosis of OSAS from polysomnography who underwent RME with polysomnography after
- AHI available before and after RME

Rapid maxillary expansion and obstructive sleep apnea: A review and meta-analysis

Meta-analysis conclusions

- There is a decrease in AHI after RME in children with OSAS
- AHI decline is maintained as indicated by follow-up tests ranging from 3 months to 14 years
- RME in children with OSAS appears to be another effective treatment

Minimum Cross-sectional Area (MCA) As A Screening tool for OSA Risk

High risk OSA = 0-52 mm^2

Mod risk OSA = 52-110 mm^2

Low risk OSA > 110 mm^2

Consentini T, Le Donne R, Mancini D, et al: Magnetic resonance imaging of the upper airway in obstructive sleep apnea. Radiol Med 108:404, 2004

Strelzow VV, Banks RHI, Basile A, et al: Cephalometric airway analysis in obstructive sleep apnea syndrome. Laryngoscope 98:1149, 1988

Lowe AA, Gionhaku N, Takeuchi K, et al. Three dimensional CT reconstructions of tongue and airway in adult subjects with obstructive sleep apnea. Am J Orthod Dentofacial Orthop 1986; 90(5):364–74.

Avrahami E, Englender M. Relation between CT axial cross-sectional area of the oropharynx and obstructive sleep apnea syndrome in adults. AJNR Am J Neuroradiol 1995;16(1):135–40.

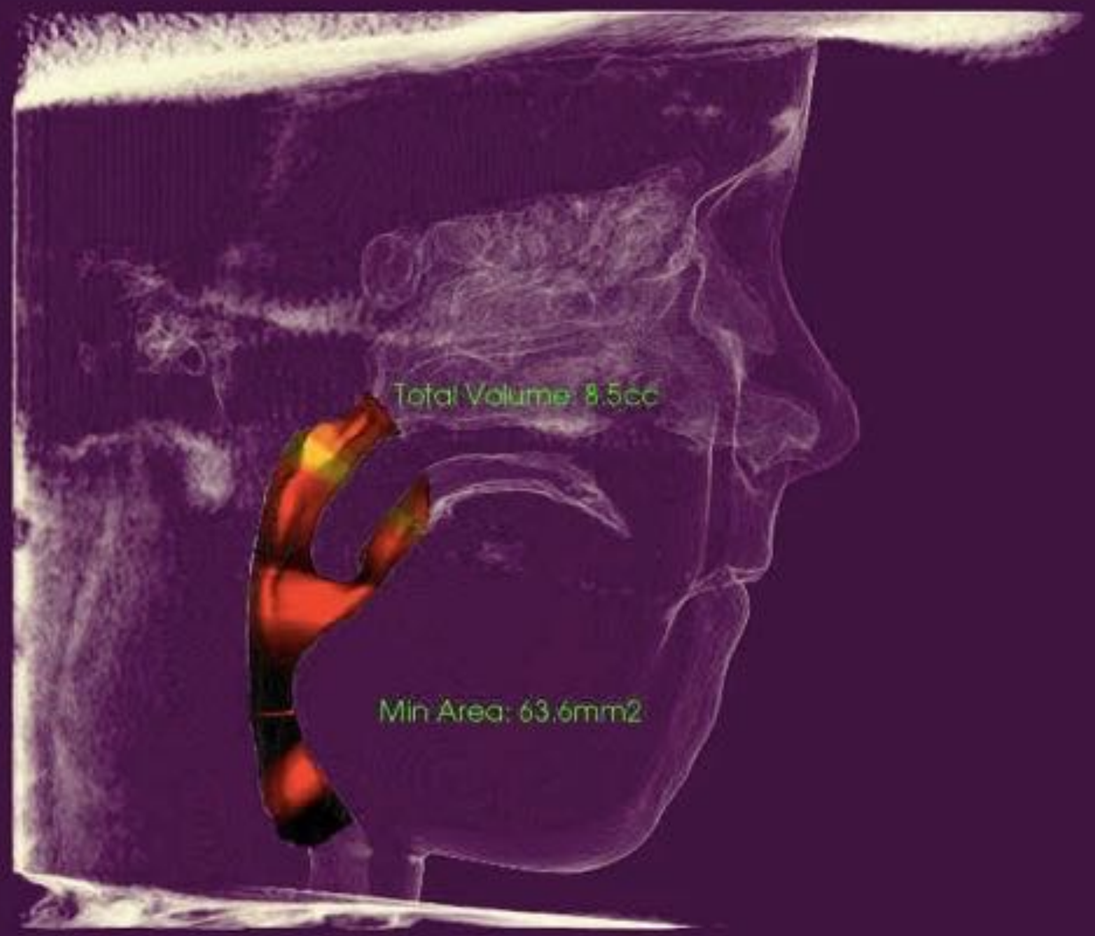
Ogawa T, Enciso R, Shintaku WH, et al. Evaluation of cross-section airway configuration of obstructive sleep apnea. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007;103(1):102–8.

Poiseulle's Law

Vessel resistance (R) is directly proportional to the length (L) of the vessel and the viscosity (ɳ) of the blood, and inversely proportional to the radius to the fourth power (r4).

$$R \propto \frac{\eta L}{r^4}$$

Caroline



OSA Risk
High Risk = 0-52 mm^2
Moderate Risk = 52-110 mm^2
Low Risk > 110 mm^2

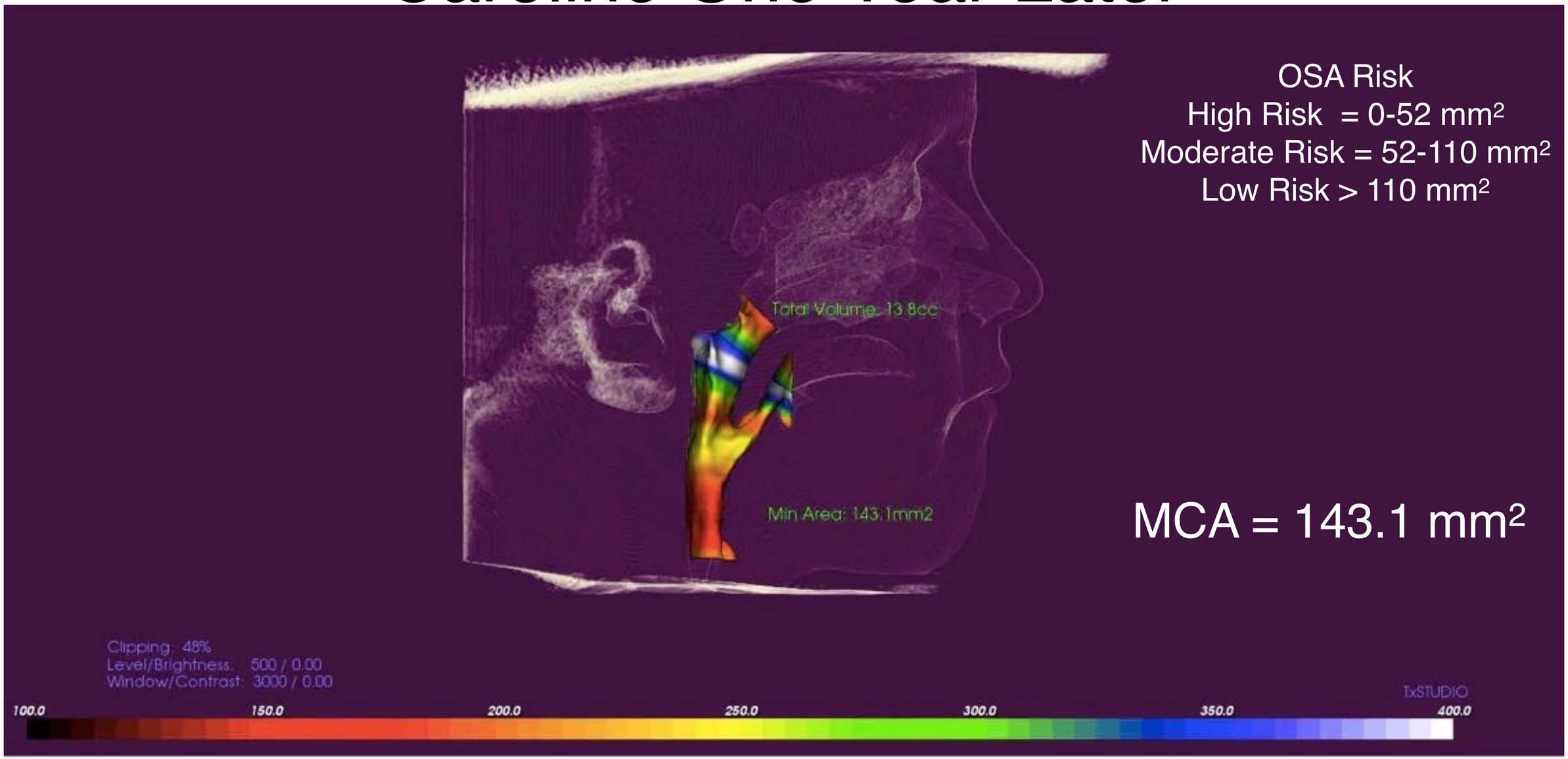
MCA = 63.6 mm^2

Clipping: 41%
Level/Brightness: 500 / 0.00
Window/Contrast: 3000 / 0.00

TxSTUDIO

100.0 150.0 200.0 250.0 300.0 350.0 400.0

Caroline One Year Later

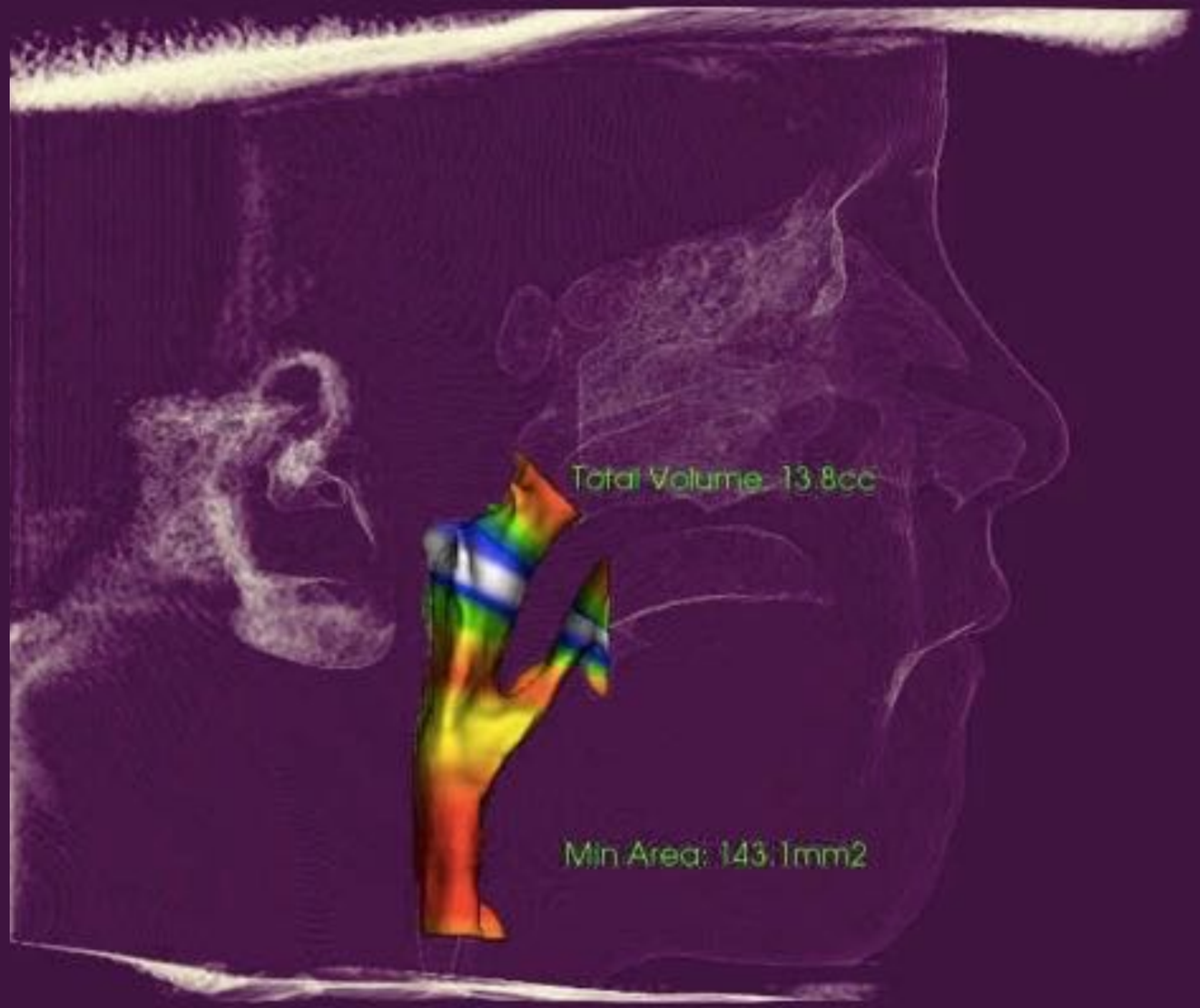


OSA Risk
High Risk = 0-52 mm^2
Moderate Risk = 52-110 mm^2
Low Risk > 110 mm^2

MCA = 143.1 mm^2

No Treatment

MCA = 63.6 mm^2



MCA = 143.1 mm^2

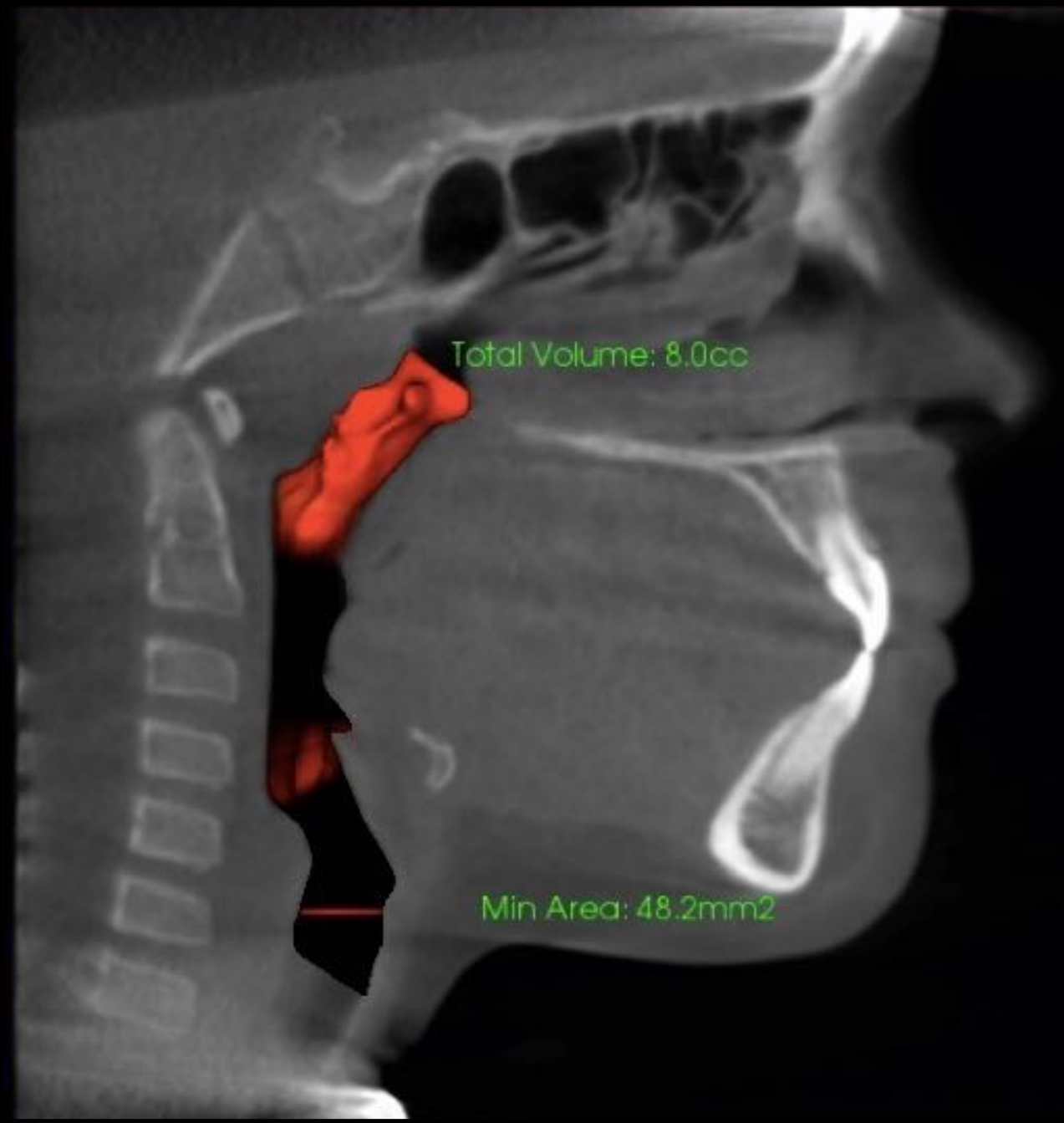
MCA = 63.6 mm^2

MCA = 143.1 mm^2

OSA As A Family Trait

OSA in Families

Olivia 9.6



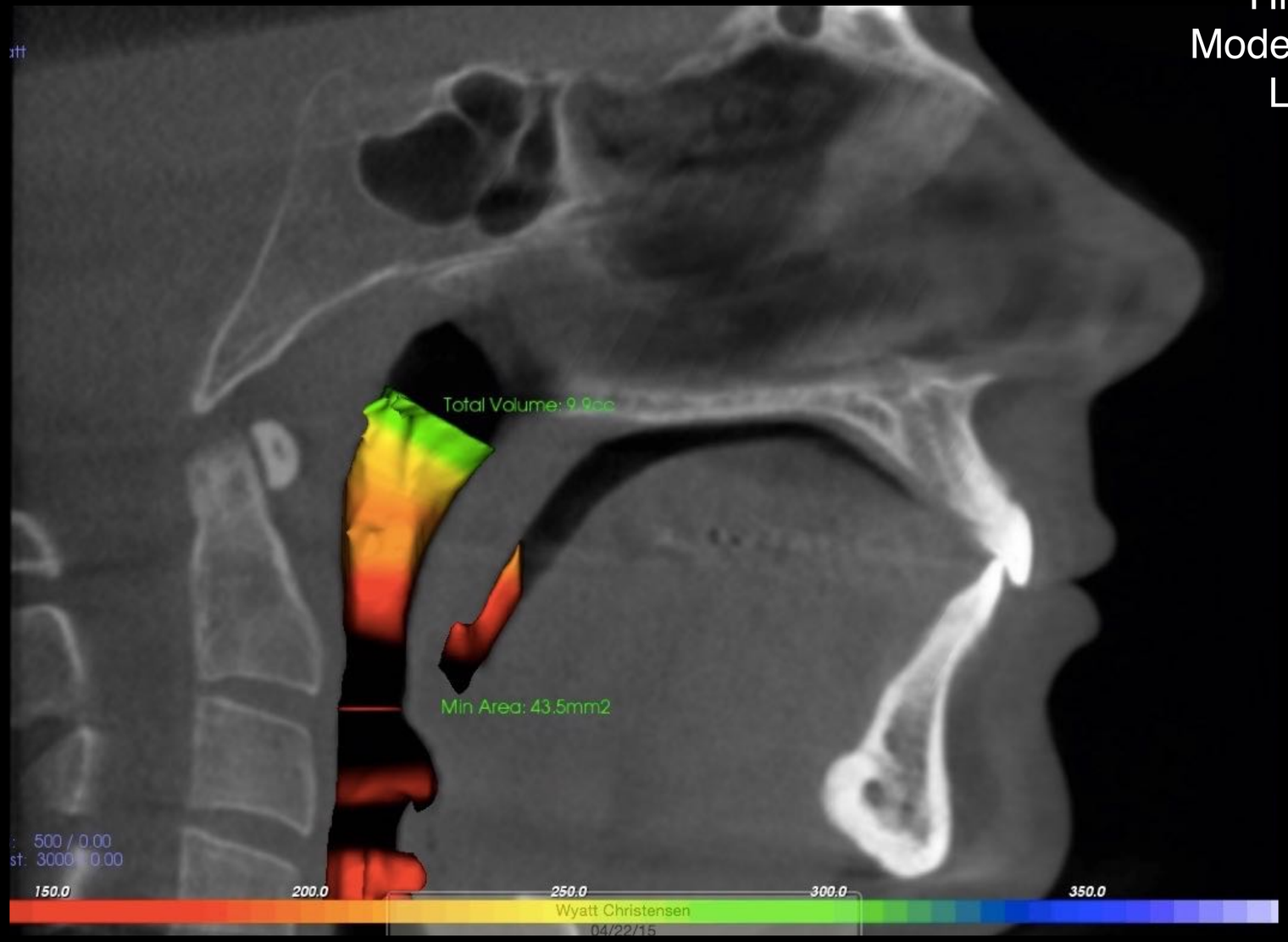
OSA Risk
High Risk = 0-52 mm^2
Moderate Risk = 52-110 mm^2
Low Risk > 110 mm^2

MCA = 48.2 mm^2

OSA in Families

Wyatt 37.12

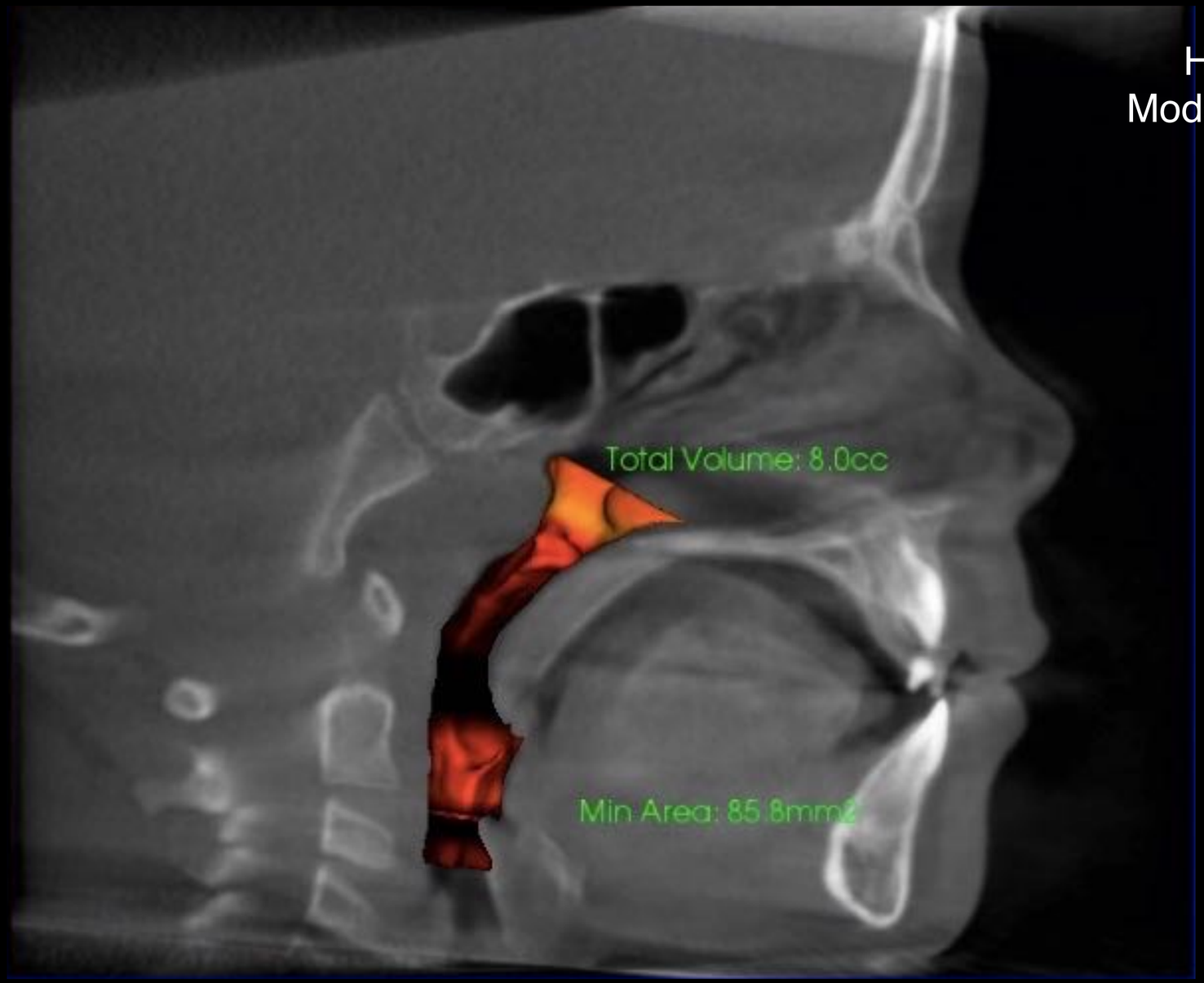
OSA Risk
High Risk = 0-52 mm^2
Moderate Risk = 52-110 mm^2
Low Risk > 110 mm^2



MCA = 43.5 mm^2

OSA in Families

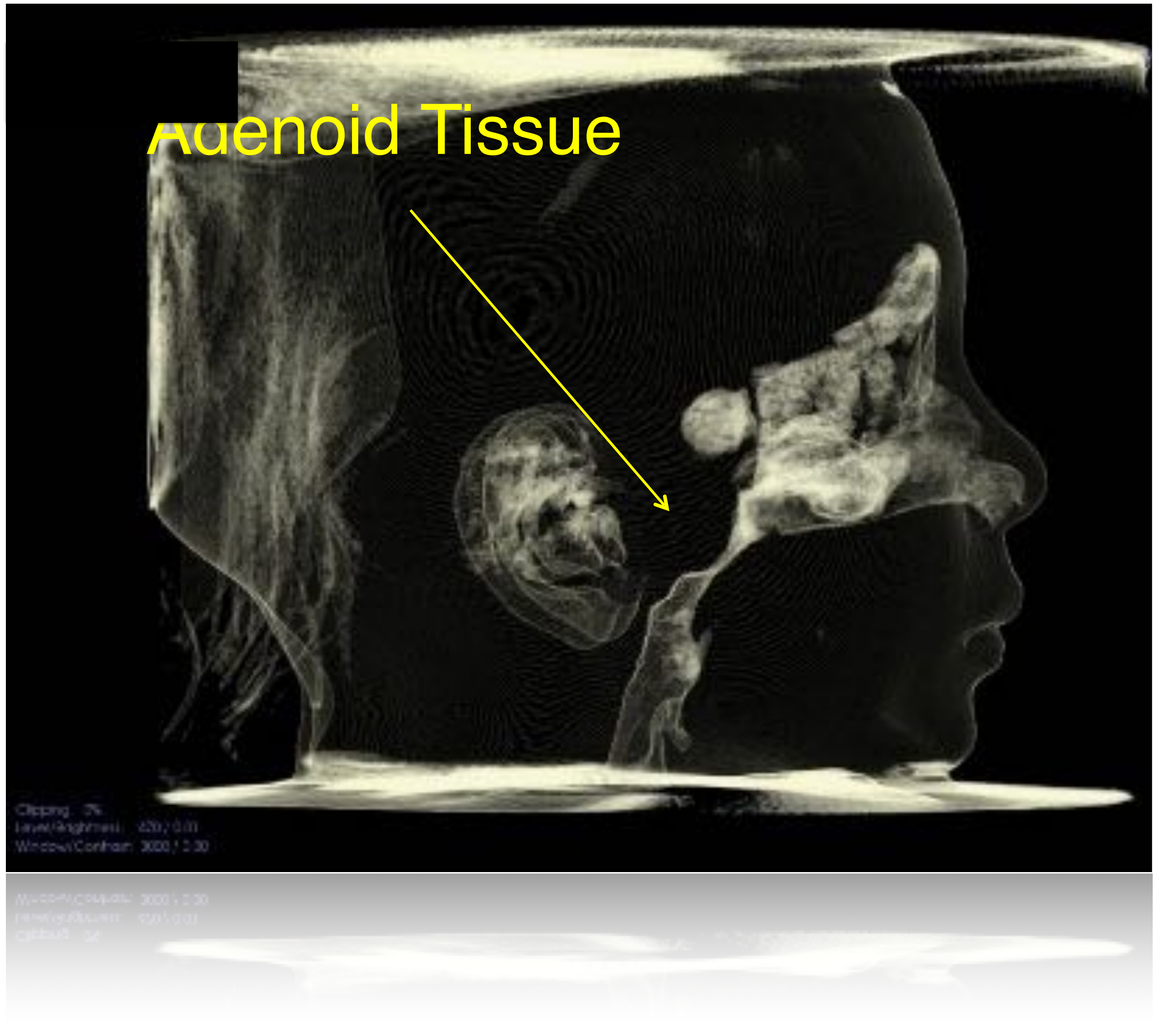
Calvin - 7.9



OSA Risk
High Risk = 0-52 mm^2
Moderate Risk = 52-110 mm^2
Low Risk > 110 mm^2

MCA = 85.8 mm^2

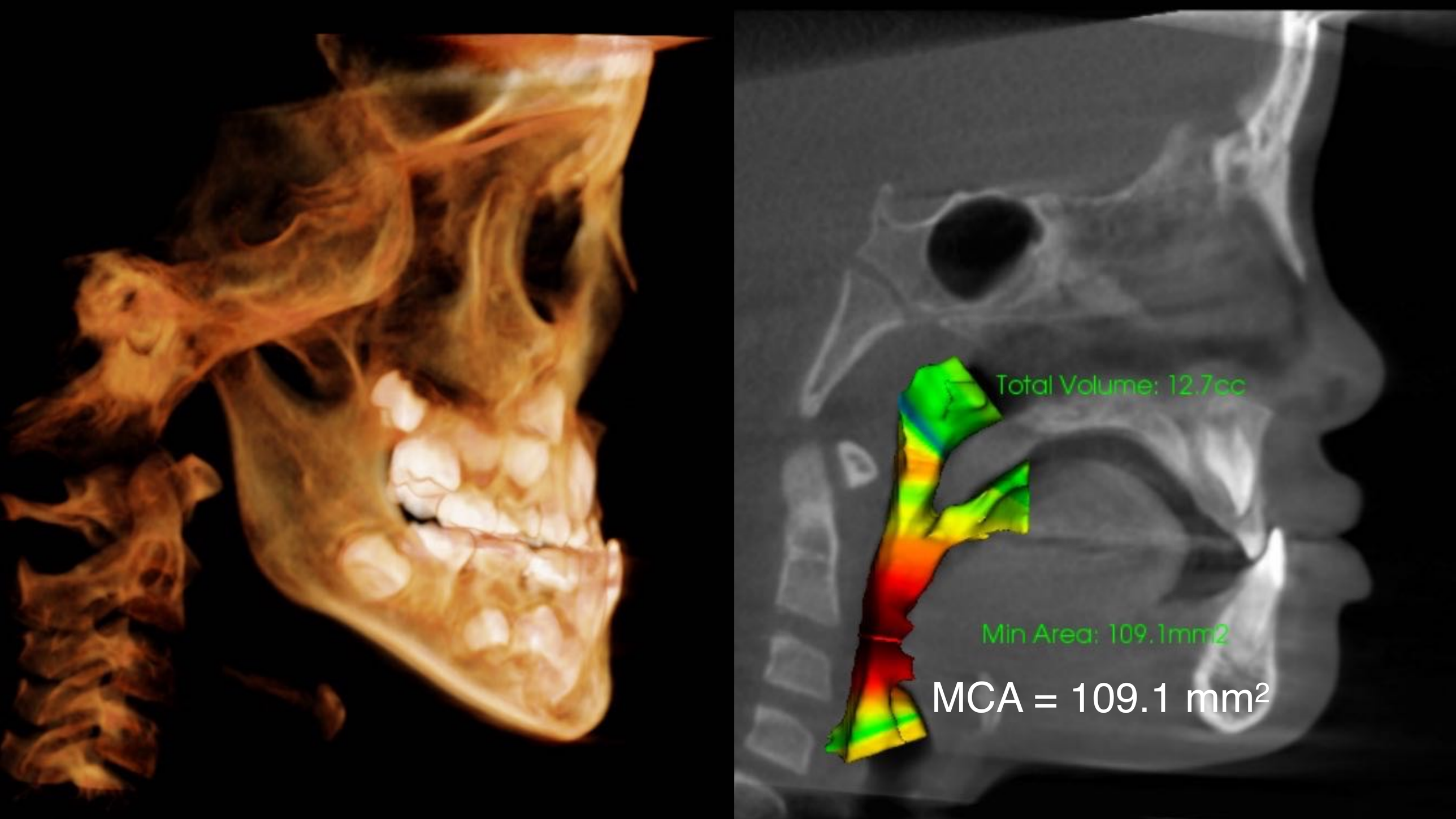
2 Year Airway Difference

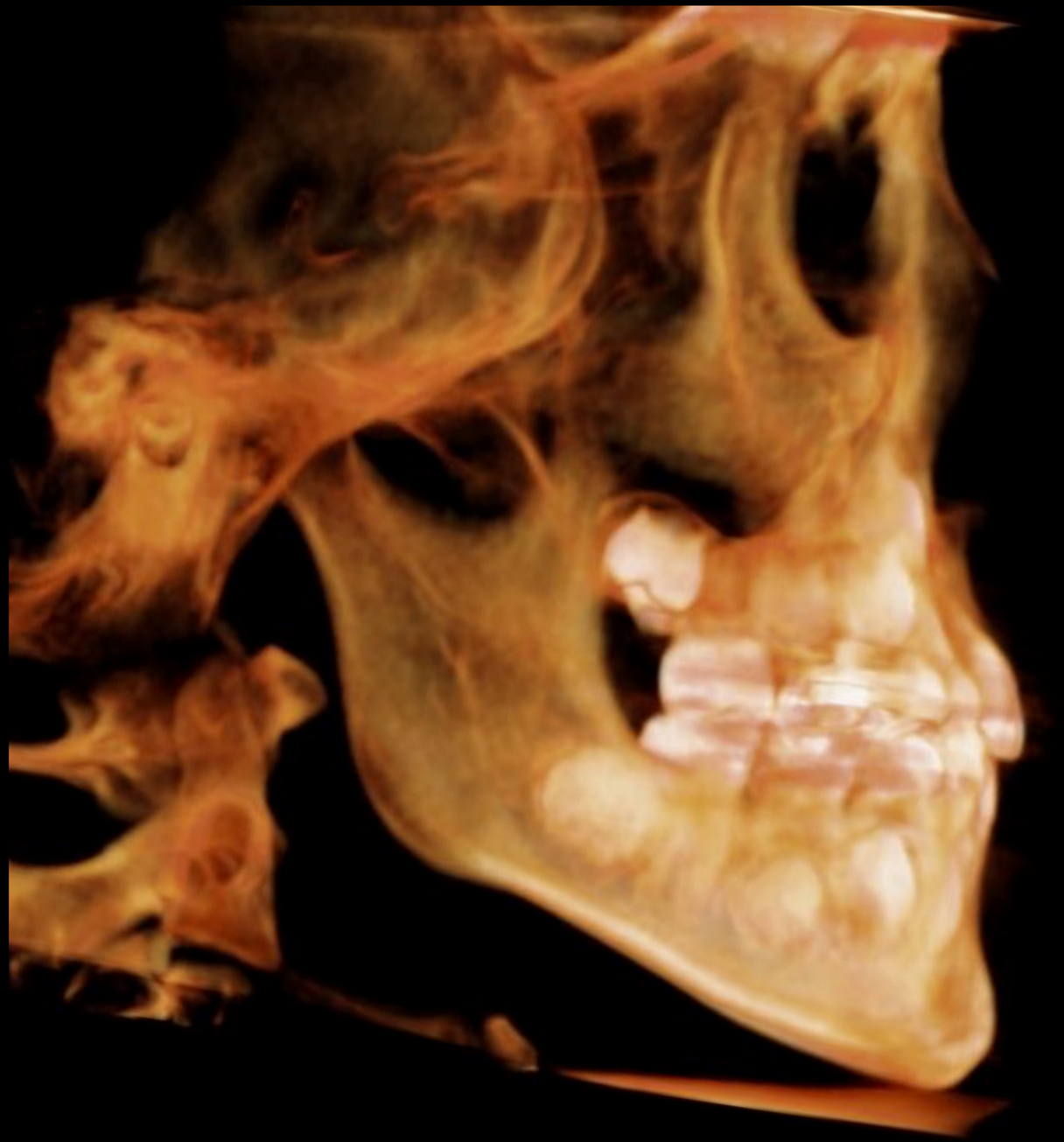


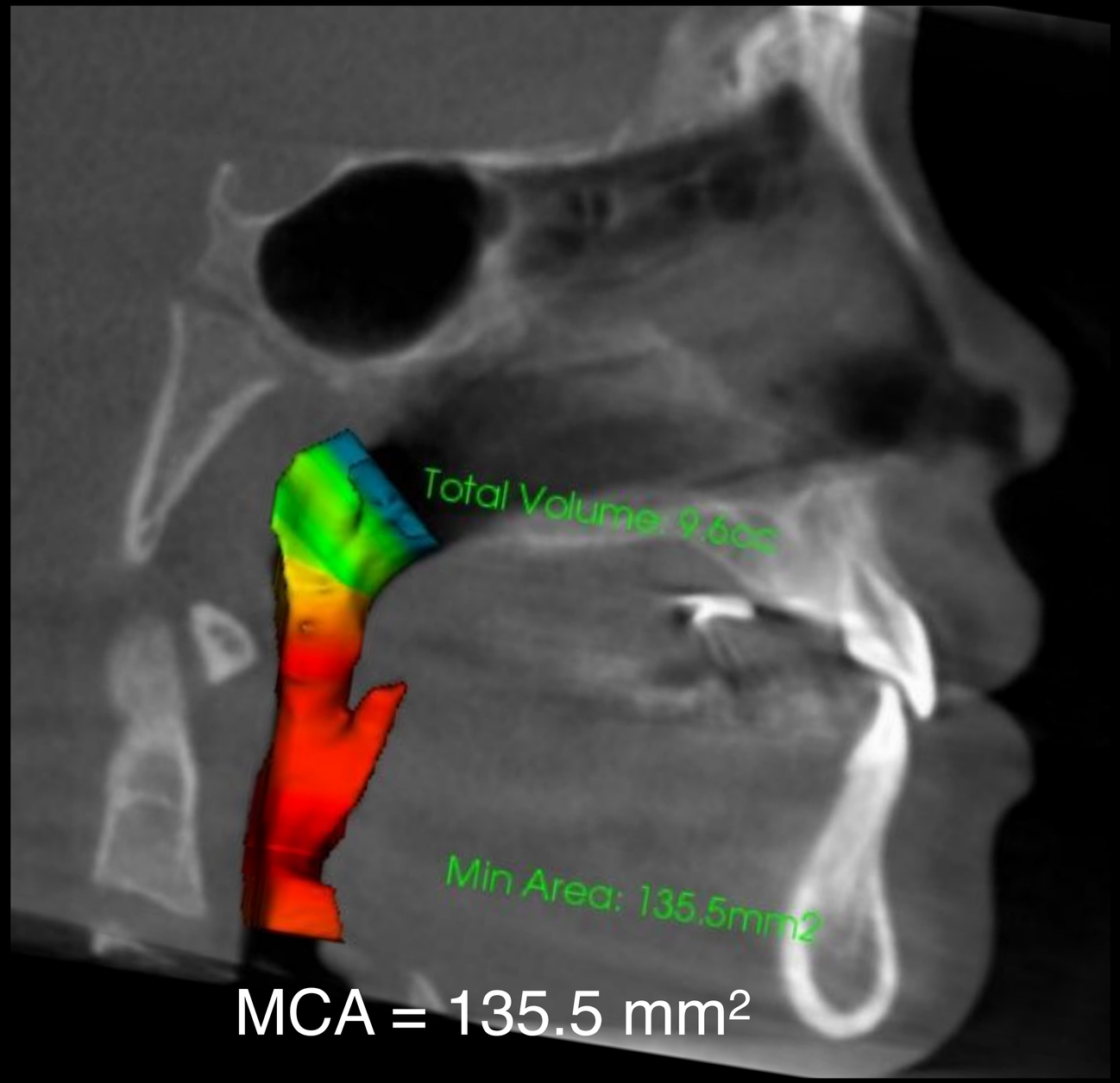
Pre-treatment MCA = 23.8 mm^2

Post-treatment MCA = 304 mm^2

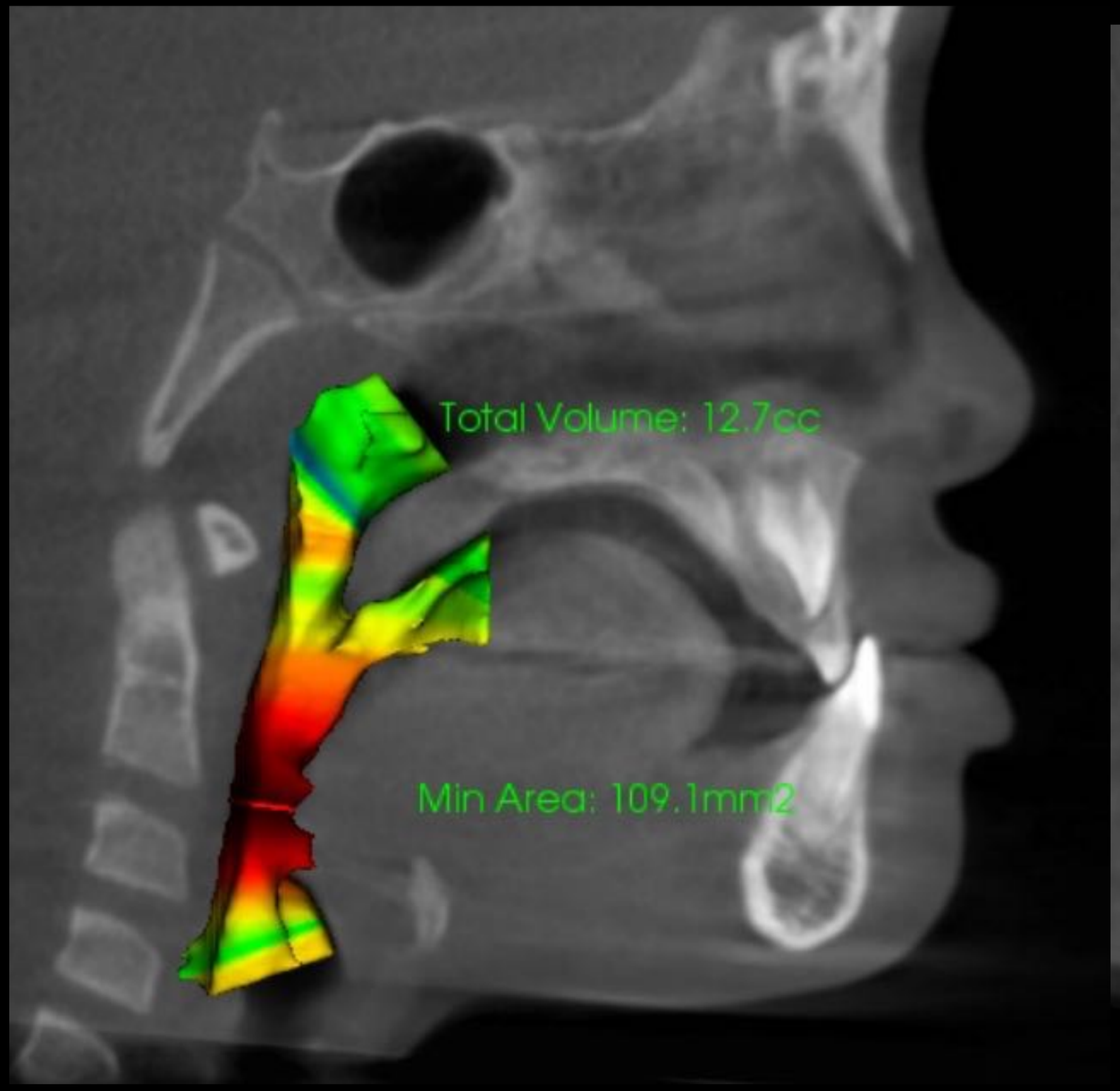
Slide courtesy of Dr. J.C. Quintero


Total Volume: 12.7cc
Min Area: 109.1mm2
MCA = 109.1 mm²

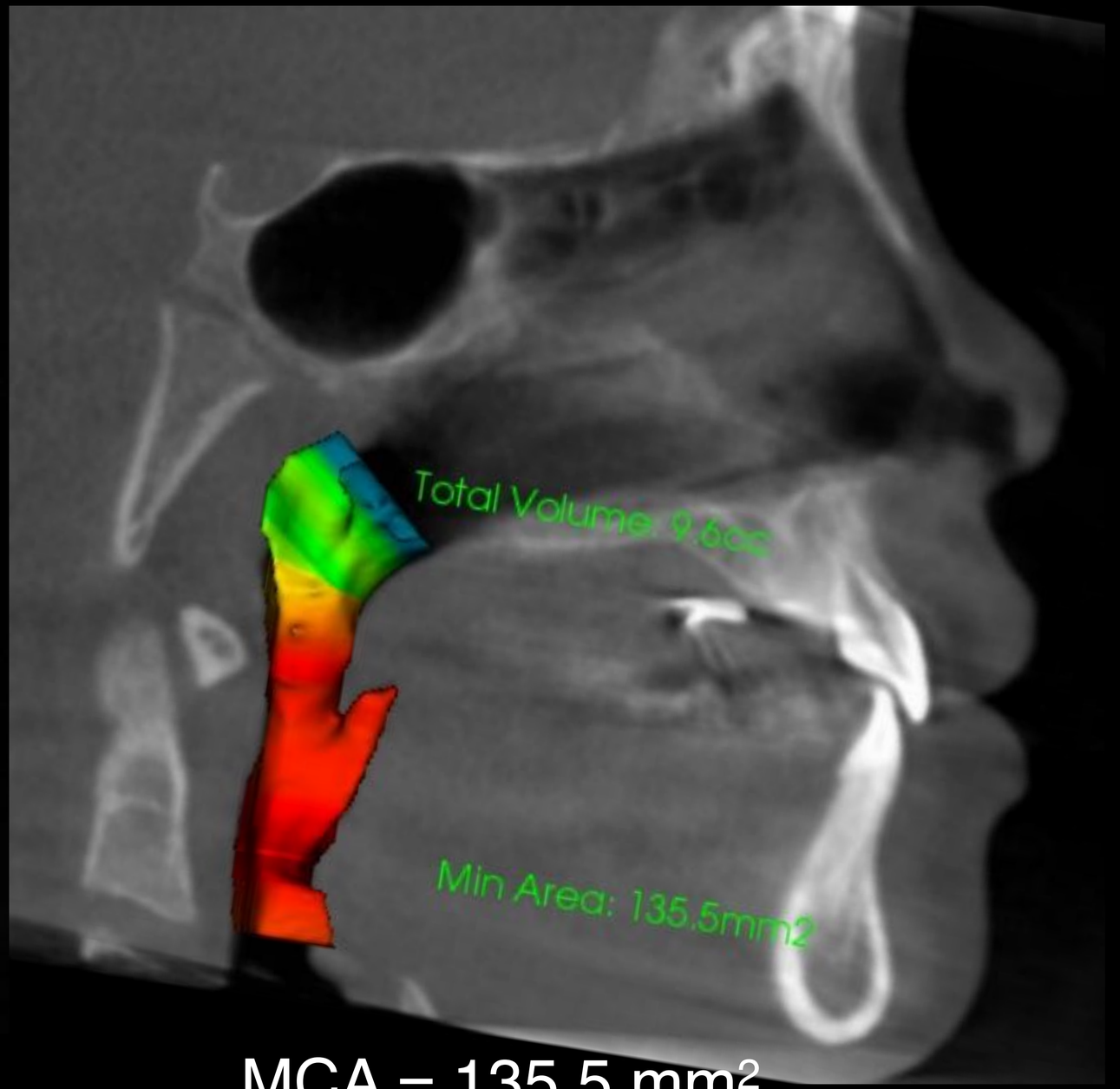




MCA = 135.5 mm^2



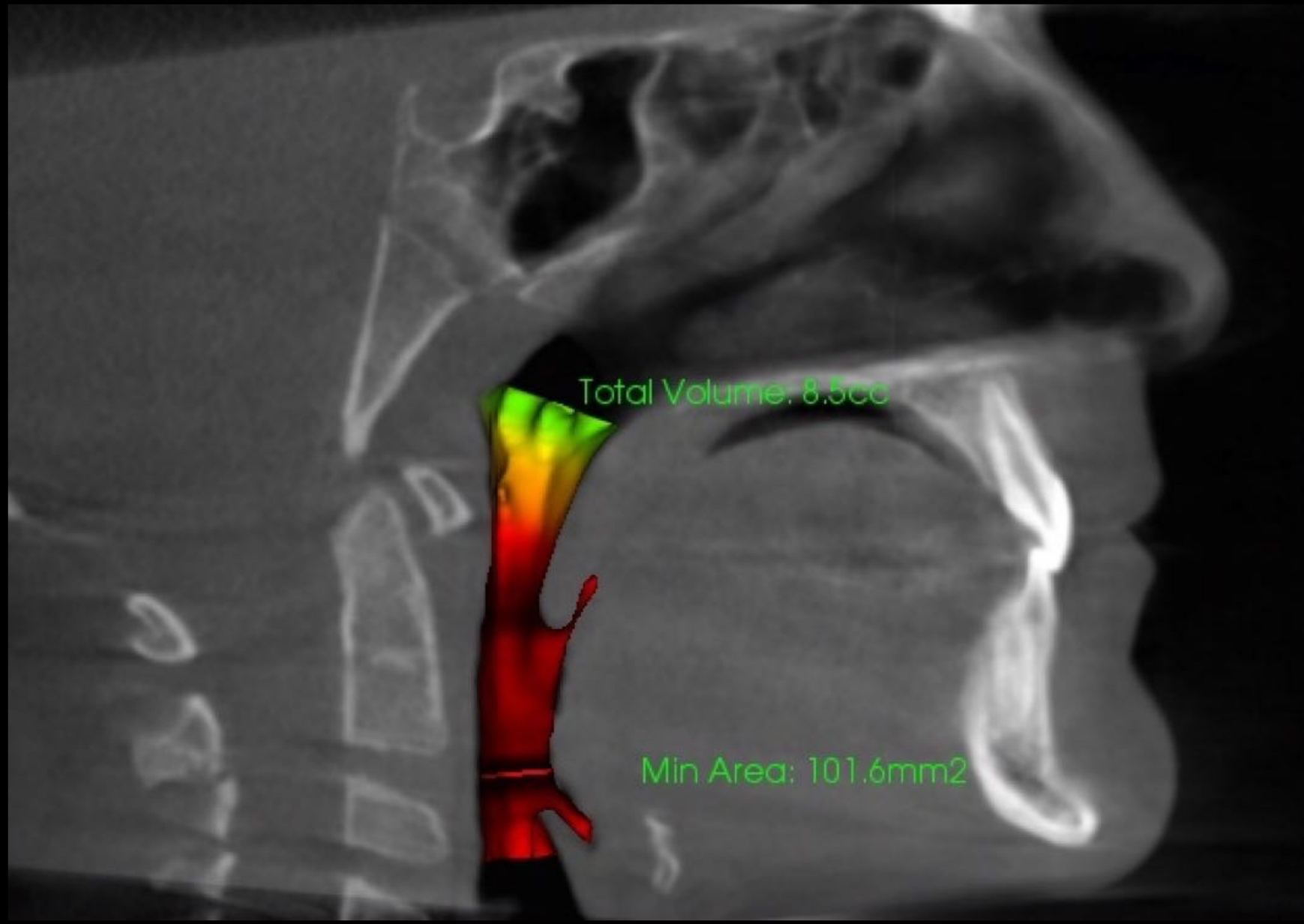
MCA = 109.1 mm^2

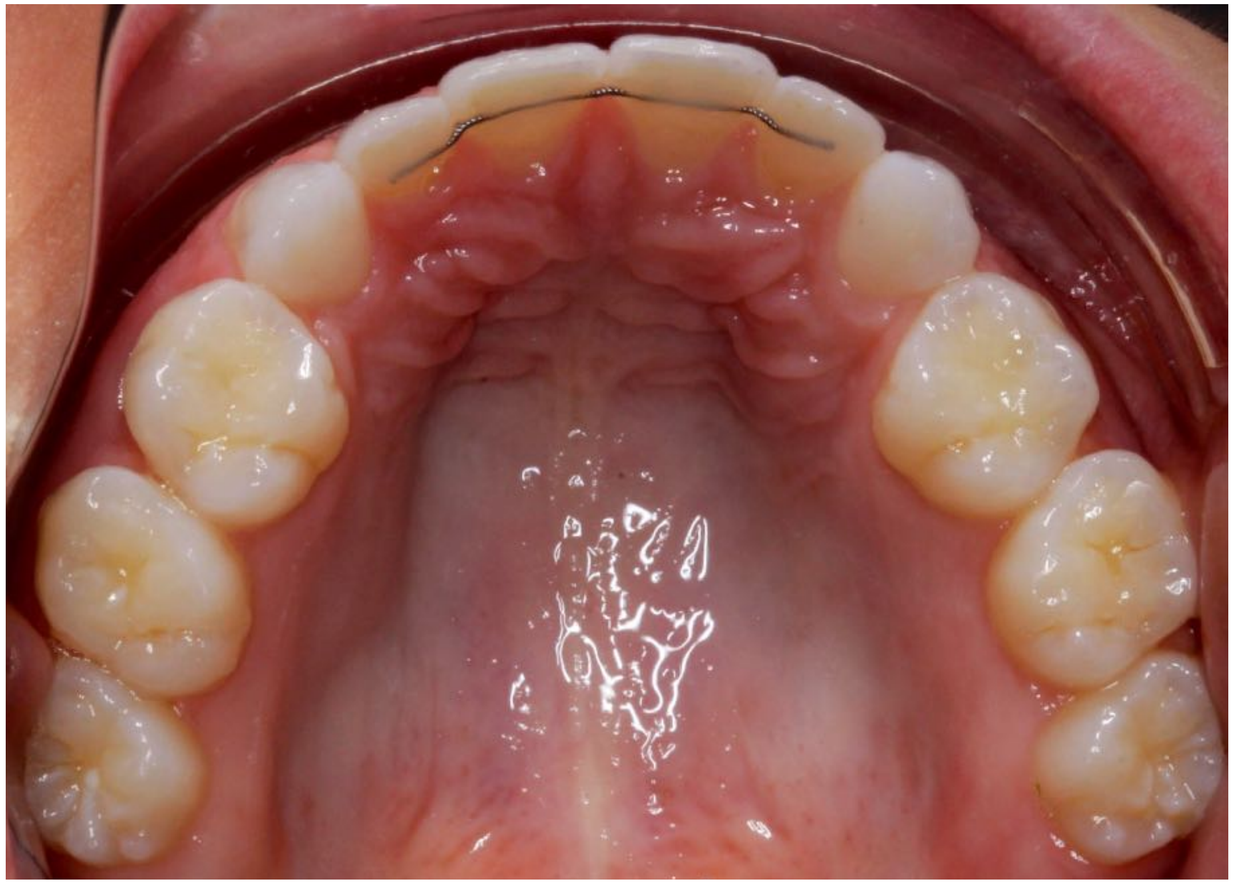


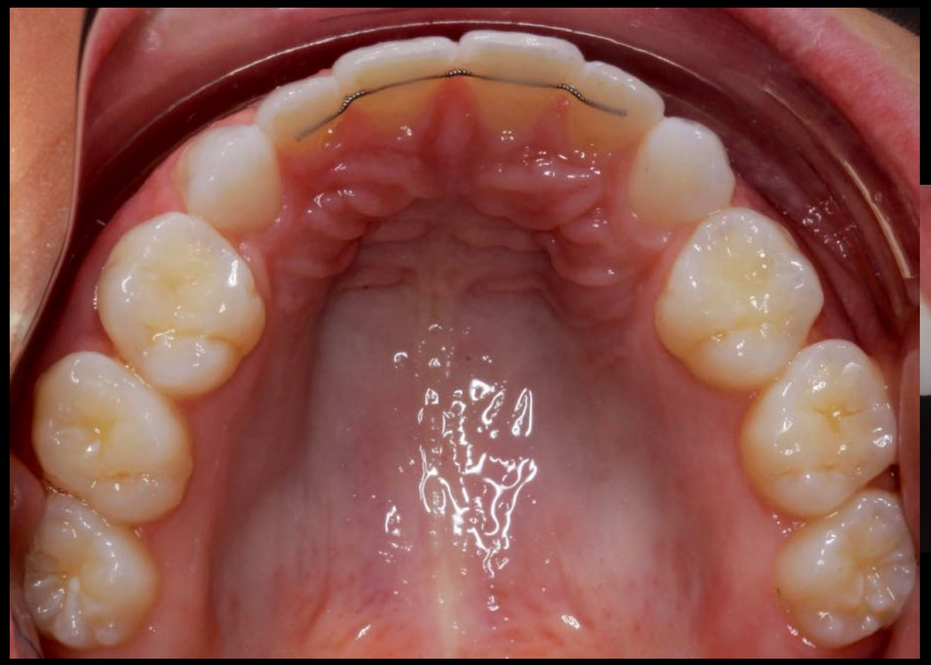
MCA = 135.5 mm^2

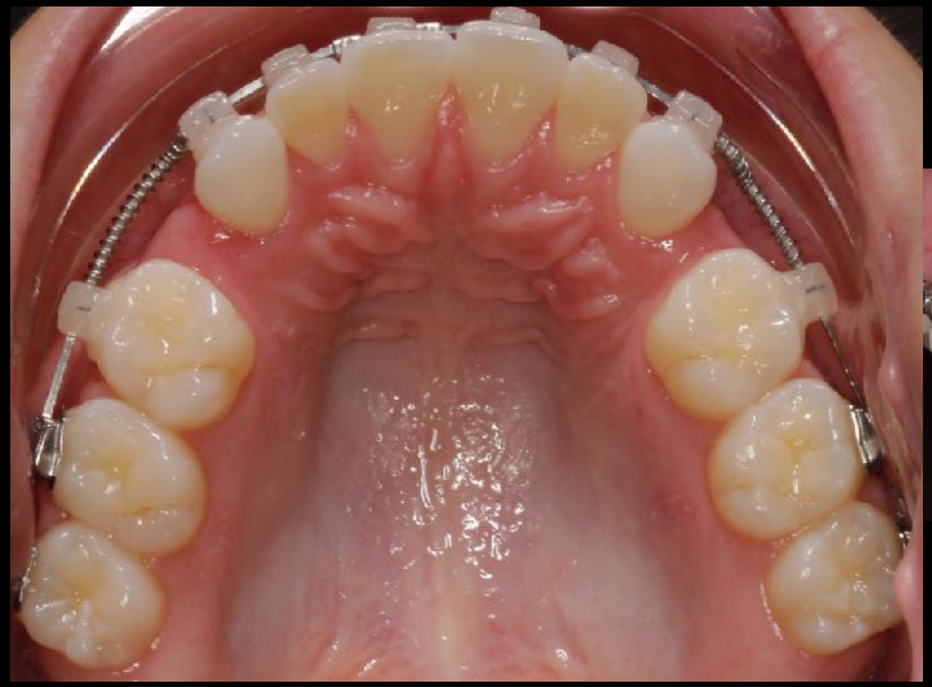
OSA Risk
High Risk = 0-52 mm^2
Moderate Risk = 52-110 mm^2
Low Risk > 110 mm^2

MCA = 101.6 mm^2

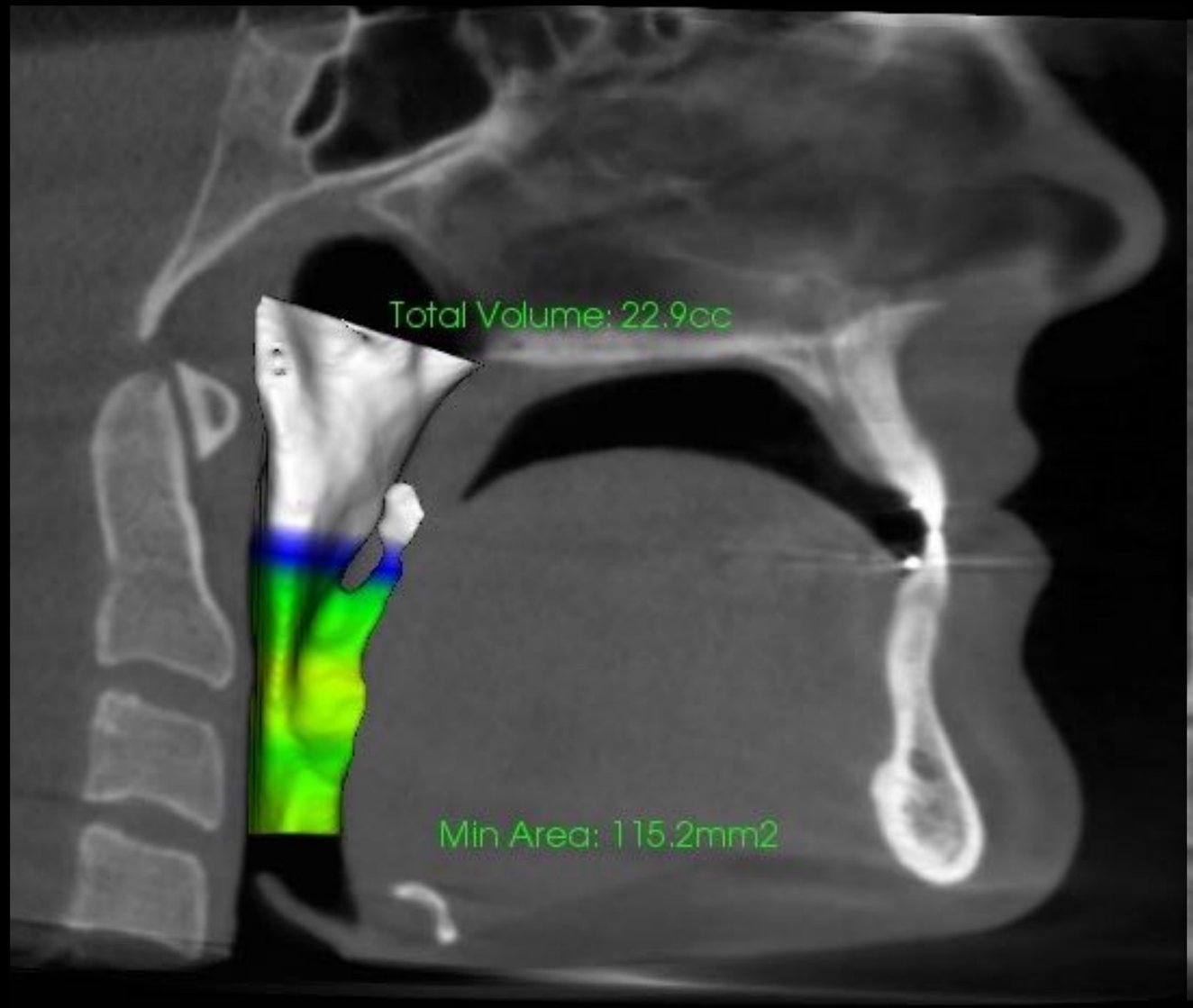






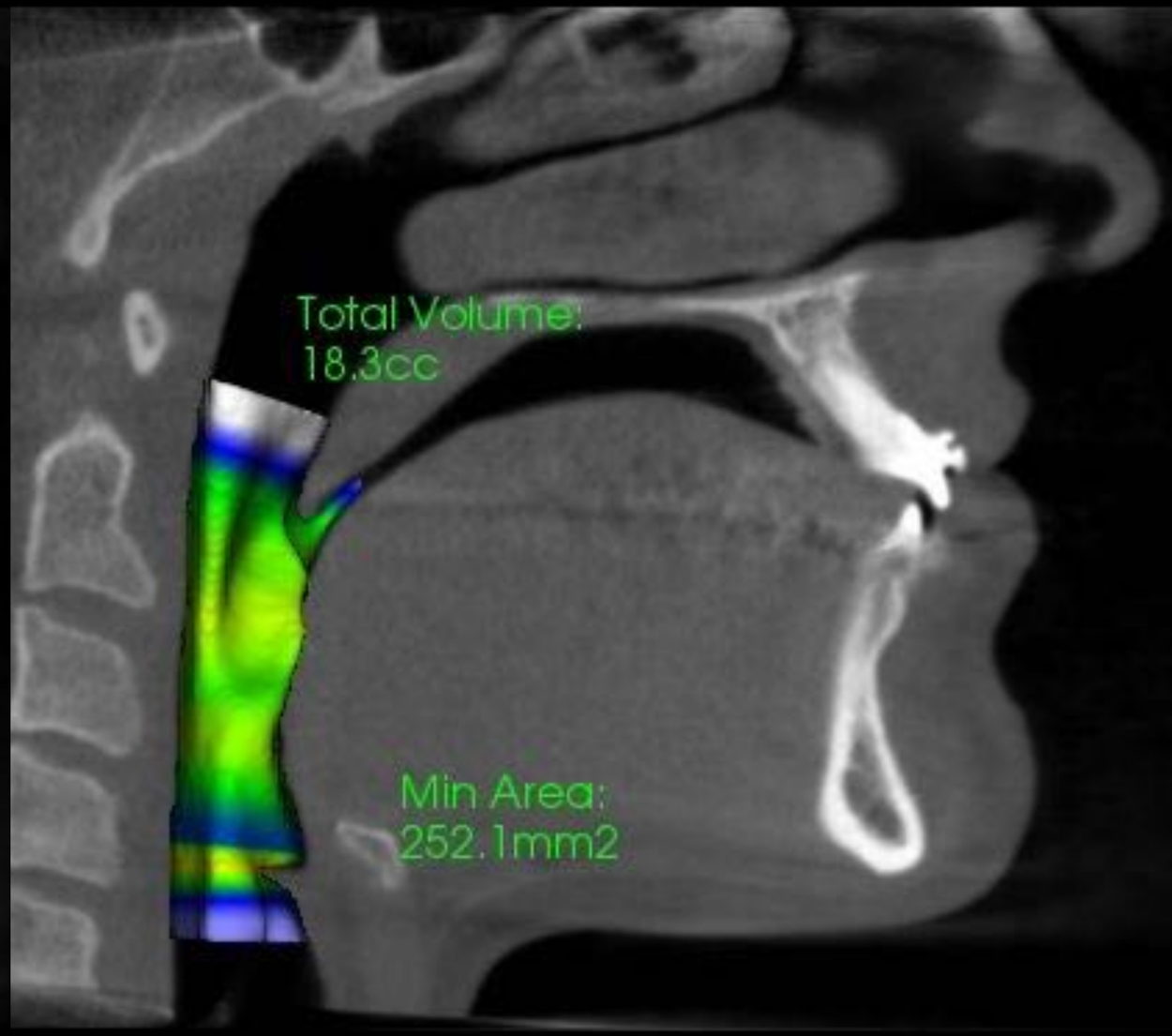


Initial



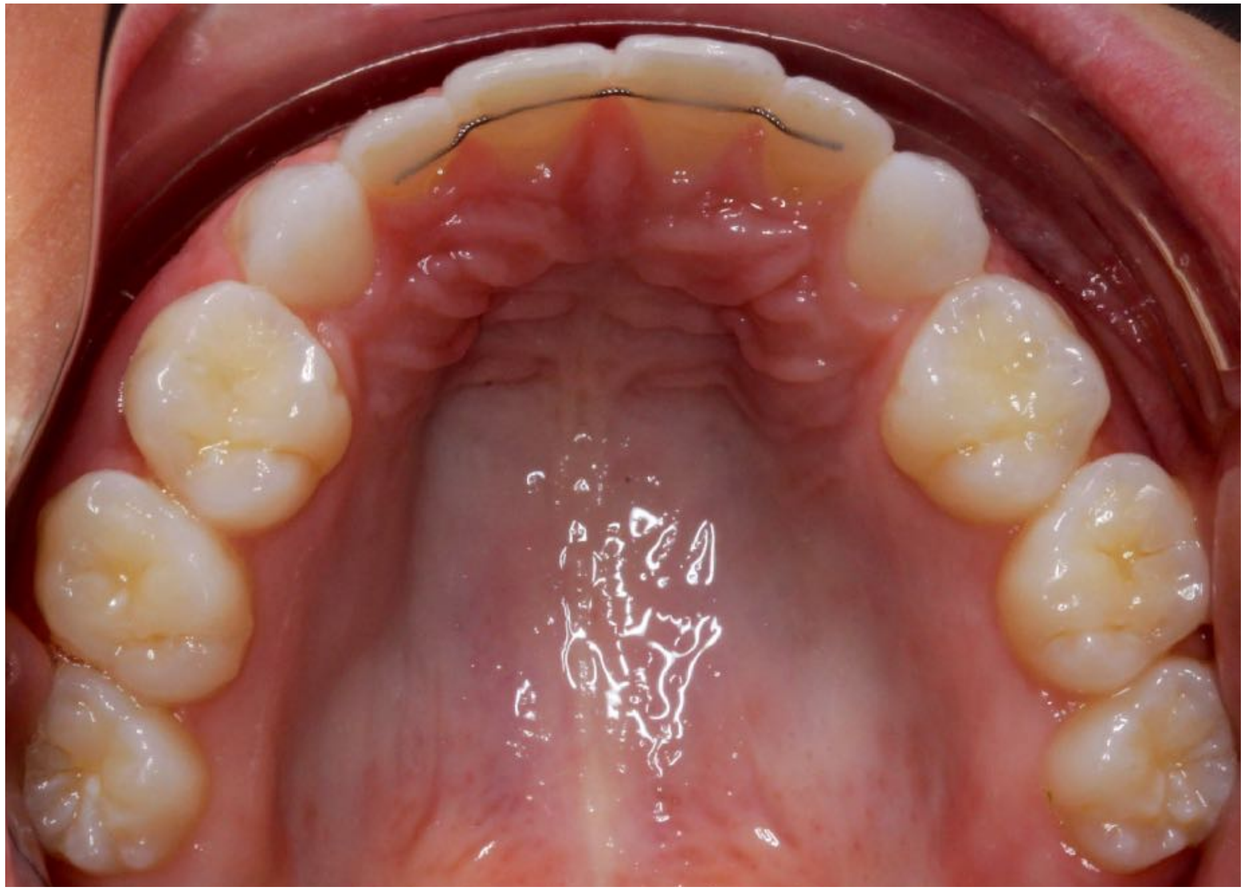
MCA = 115.2 mm^2

Progress



MCA = 252.1 mm^2





John B. Ludlow, DDS, MS

Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology

ORAL AND MAXILLOFACIAL RADIOLOGY

Comparative dosimetry of dental CBCT devices for oral and maxillofacial radiology

ORIGINAL ARTICLE

AJO-DO

Assessment of phantom dosimetry and image quality of i-CAT FLX cone-beam computed tomography

John B. Ludlow and Cameron Walker

Chapel Hill, NC, and Kansas City, Mo

Introduction: The increasing use of cone-beam computed tomography in orthodontics has been coupled with heightened concern about the long-term risks of x-ray exposure in orthodontic populations. An industry response to this has been to offer low-exposure alternative scanning options in newer cone-beam computed tomography models. **Methods:** Effective doses resulting from various combinations of field of view size and field location comparing child and adult anthropomorphic phantoms with the recently introduced i-CAT FLX cone-beam computed tomography unit (Imaging Sciences, Hatfield, Pa) were measured with optical stimulated dosimetry using previously validated protocols. Scan protocols included high resolution (360°, 300 frames, 120 kV[p], 5 mA, 3.7 seconds), QuickScan (180°, 160 frames, 120 kV[p], 5 mA, 2 seconds), standard (360°, 300 frames, 120 kV[p], 5 mA, 3.7 seconds), QuickScan+ (180°, 160 frames, 90 kV[p], 3 mA, 2 seconds). Contrast-to-noise ratio was calculated as a quantitative measure of image quality for the various exposure options using the QUART DVT phantom. **Results:** Child phantom doses were on average 36% greater than adult phantom doses. QuickScan+ protocols resulted in significantly lower doses than standard protocols for the child ($P = 0.0167$) and adult ($P = 0.0055$) phantoms. The 13 × 16-cm cephalometric fields of view ranged from 11 to 86 μSv in the adult phantom and 18 to 120 μSv in the child phantom for the QuickScan+ and standard protocols, respectively. The contrast-to-noise ratio was reduced by approximately two thirds when comparing QuickScan+ with standard exposure parameters. **Conclusions:** QuickScan+ effective doses are comparable with conventional panoramic examinations. Significant dose reductions are accompanied by significant reductions in image quality. However, this trade-off might be acceptable for certain diagnostic tasks such as interim assessment of treatment results. (Am J Orthod Dentofacial Orthop 2013;144:802-17)

The use of cone-beam computed tomography (CBCT) in orthodontics has increased dramatically over the last few years.[1] Because cancer is the principal long-term biologic effect of exposure to x-rays, one of the greatest issues facing use of CBCT in orthodontics is justification of the increased doses of ionizing radiation administered to patients compared with standard 2-dimensional imaging techniques.

A routine medical computed tomography head scan can have an effective dose of approximately 2 mSv.[2] Whereas most CBCT examinations have been reported to impart a much lower dose, CBCT units from different manufacturers vary in their doses by as much as 10-fold for an equivalent field of view (FOV), with some units roughly equivalent in dose to optimized computed tomography scans.[3] Although the risk to a patient from 1 computed tomography or CBCT examination might not by itself be large, millions of examinations are performed each year, making radiation exposure from dental and medical imaging an important public health issue. It has been estimated that 1.5% to 2% of all cancers in the United States can be attributed to computed tomography studies alone.[4] This is especially important for the adolescent and pediatric populations that routinely receive orthodontic treatment and whose

ed to common dental ninations

ernational Commission on recommendations on

Ludlow, BS; Stuart C. White, DDS, PhD

STRACT

ARTICLE

Slide courtesy of Dr. Sean Carls

ATOM (Child) Phantom

OSL ID No.	Child Phantom Location (level of OSLD location)
1	Calvarium anterior (2)
2	Calvarium left (2)
3	Calvarium posterior (2)
4	Mid brain (2)
5	Mid brain (3)
6	Pituitary (4)
7	Right orbit (4)
8	Right lens of eye (4-5)
9	Left lens of eye (4-5)
10	Right maxillary sinus (5)
11	Left nasal airway (5)
12	Right parotid (6)
13	Left parotid (6)
14	Left back of neck (6)
15	Right ramus (7)
16	Left ramus (7)
17	Right submandibular gland (7)
18	Left submandibular gland (7)
19	Center sublingual gland (7)
20	Center C spine (8)
21	Thyroid superior–left (8)
22	Thyroid – left (9)
23	Thyroid - right (9)
24	Esophagus (9)

Phantom Levels

Slide courtesy of Dr. Sean Carlson

How many microseiverts does a child receive with an 4.8 second scan?

17.5
μSv

The American Association of Physicists in Medicine (AAPM) issued the following position statement in December, 2011: “risks of medical imaging at effective doses below 50,000 uSv for single procedures or 100,000 μSv for multiple procedures over short time periods are too low to be detectable and may be nonexistent.”[1]

The ICRP recommends we keep non-occupational exposure levels less than 1,000 μSv/pt./year.[2]

The **The United Nations Scientific Committee on the Effects of Atomic Radiation** (UNSCEAR) report of 2012 states that no discernible effects of exposures below 0.1 Sv (100,000 μSv) appear to exist, which is compatible with known cellular-repair mechanisms.[3]

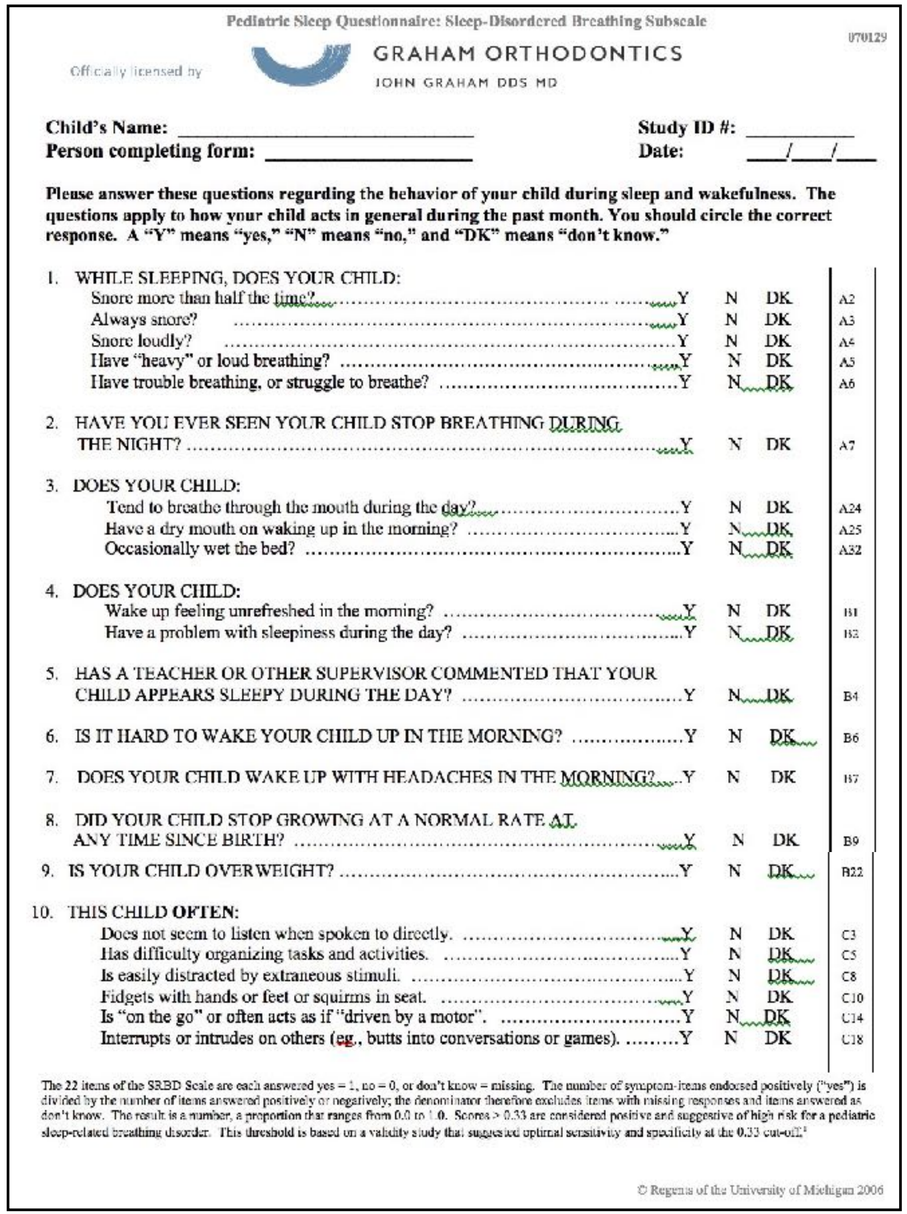
1. Dezarn, W. A. *et al.* Recommendations of the American Association of Physicists in Medicine on dosimetry, imaging, and quality assurance procedures. *Medical physics* **38,** 4824–4845 (2011).

2. ICRP, 2007. 2007 Recommendations of the International Commission on Radiological Protection (Users Edition). ICRP Publication 103 (Users Edition). Ann. ICRP 37 (2-4).

3. Bertin, D. M. [2012 report of UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation)]. 1–21 (2012).

All Patients In My Practice Have A CBCT Scan

If CBCT Scan Reveals Risk



Pediatric Sleep Questionnaire: Sleep-Disordered Breathing Subscale

070129

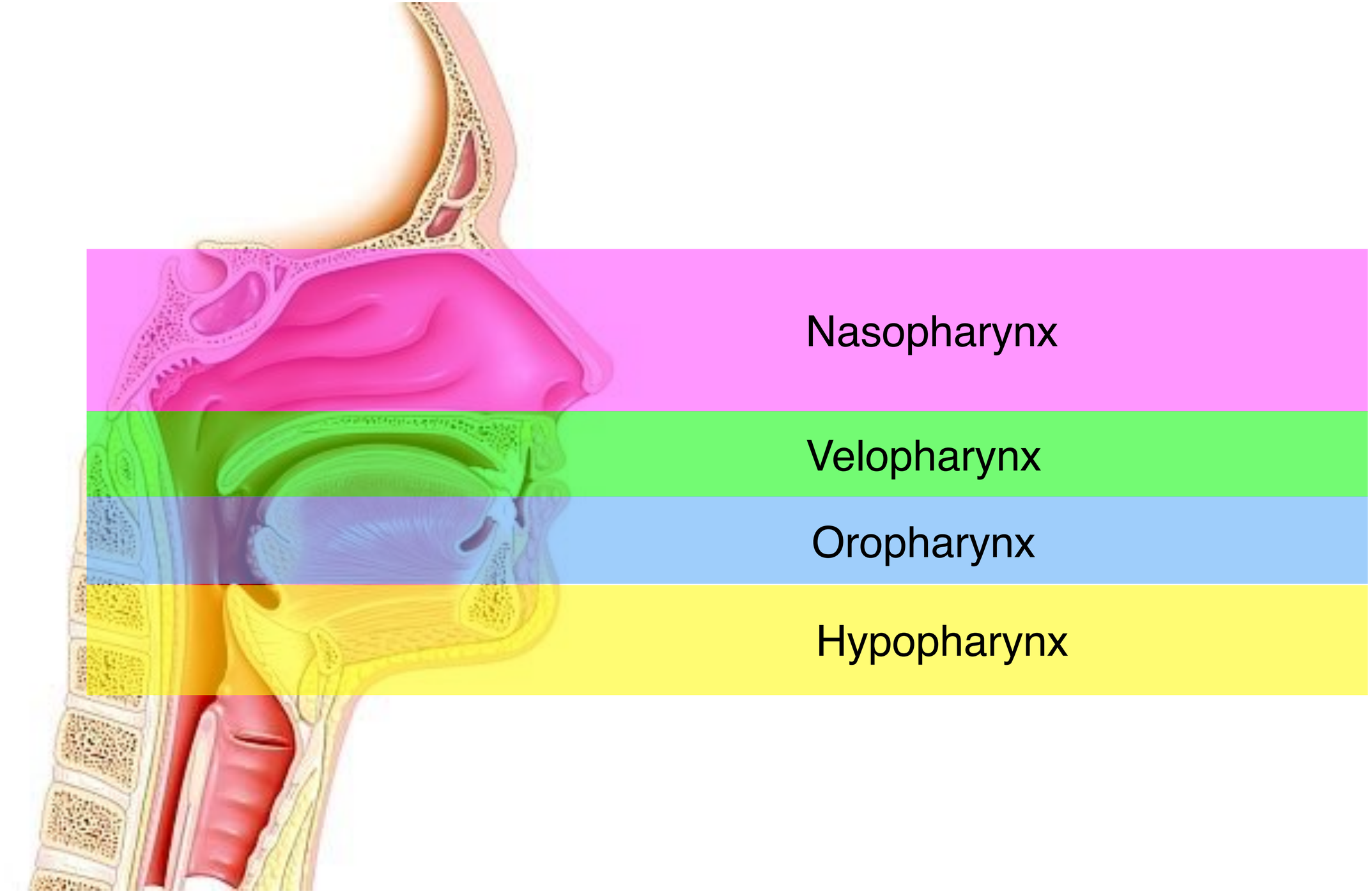
Officially licensed by GRAHAM ORTHODONTICS
JOHN GRAHAM DDS MD

Child's Name: _____ **Study ID #:** _____
Person completing form: _____ **Date:** ___/___/___

Please answer these questions regarding the behavior of your child during sleep and wakefulness. The questions apply to how your child acts in general during the past month. You should circle the correct response. A "Y" means "yes," "N" means "no," and "DK" means "don't know."

1.	WHILE SLEEPING, DOES YOUR CHILD:			
	Snore more than half the time?	Y	N DK	A2
	Always snore?	Y	N DK	A3
	Snore loudly?	Y	N DK	A4
	Have "heavy" or loud breathing?	Y	N DK	A5
	Have trouble breathing, or struggle to breathe?	Y	N DK	A6
2.	HAVE YOU EVER SEEN YOUR CHILD STOP BREATHING DURING THE NIGHT?	Y	N DK	A7
3.	DOES YOUR CHILD:			
	Tend to breathe through the mouth during the day?	Y	N DK	A24
	Have a dry mouth on waking up in the morning?	Y	N DK	A25
	Occasionally wet the bed?	Y	N DK	A32
4.	DOES YOUR CHILD:			
	Wake up feeling unrefreshed in the morning?	Y	N DK	B1
	Have a problem with sleepiness during the day?	Y	N DK	B2
5.	HAS A TEACHER OR OTHER SUPERVISOR COMMENTED THAT YOUR CHILD APPEARS SLEEPY DURING THE DAY?	Y	N DK	B4
6.	IS IT HARD TO WAKE YOUR CHILD UP IN THE MORNING?	Y	N DK	B6
7.	DOES YOUR CHILD WAKE UP WITH HEADACHES IN THE MORNING?	Y	N DK	B7
8.	DID YOUR CHILD STOP GROWING AT A NORMAL RATE AT ANY TIME SINCE BIRTH?	Y	N DK	B9
9.	IS YOUR CHILD OVERWEIGHT?	Y	N DK	B22
10.	THIS CHILD **OFTEN**:			
	Does not seem to listen when spoken to directly.	Y	N DK	C3
	Has difficulty organizing tasks and activities.	Y	N DK	C5
	Is easily distracted by extraneous stimuli.	Y	N DK	C8
	Fidgets with hands or feet or squirms in seat.	Y	N DK	C10
	Is "on the go" or often acts as if "driven by a motor".	Y	N DK	C14
	Interrupts or intrudes on others (eg., butts into conversations or games).	Y	N DK	C18

The 22 items of the SRBD Scale are each answered yes = 1, no = 0, or don't know = missing. The number of symptom-items endorsed positively ("yes") is divided by the number of items answered positively or negatively; the denominator therefore excludes items with missing responses and items answered as don't know. The result is a number, a proportion that ranges from 0.0 to 1.0. Scores > 0.33 are considered positive and suggestive of high risk for a pediatric sleep-related breathing disorder. This threshold is based on a validity study that suggested optimal sensitivity and specificity at the 0.33 cut-off.[2]


Nasopharynx
Velopharynx
Oropharynx
Hypopharynx

Admin | Clinical

Chloe

Tx Phase Info | Dx/Tx Plan | Images | Tx Notes | Tx Notes+

Comprehensive Treatment

Initial (16, 8/11/15) | Most Recent Set | 08/11/15

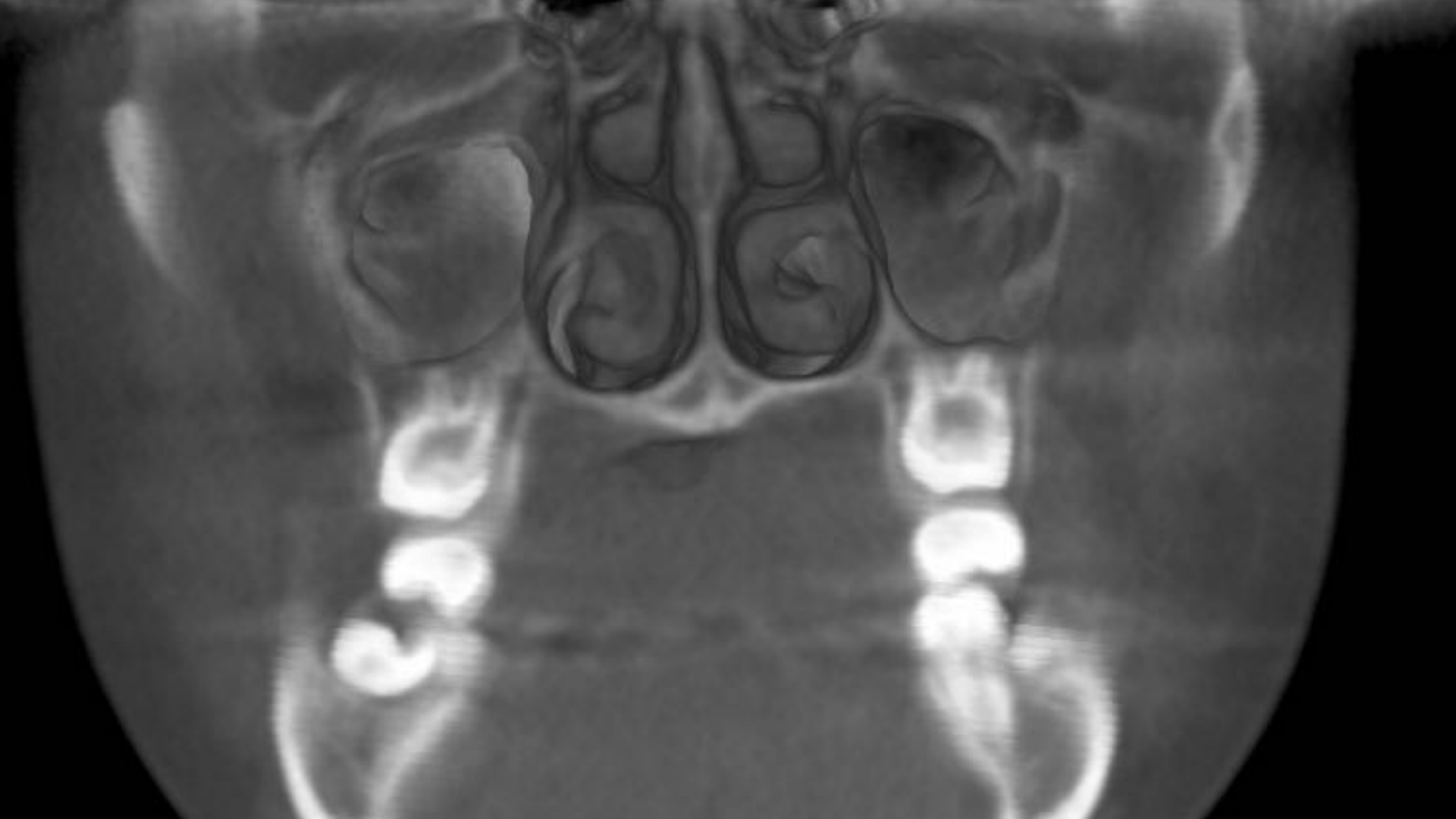
Browser... | Most Recent

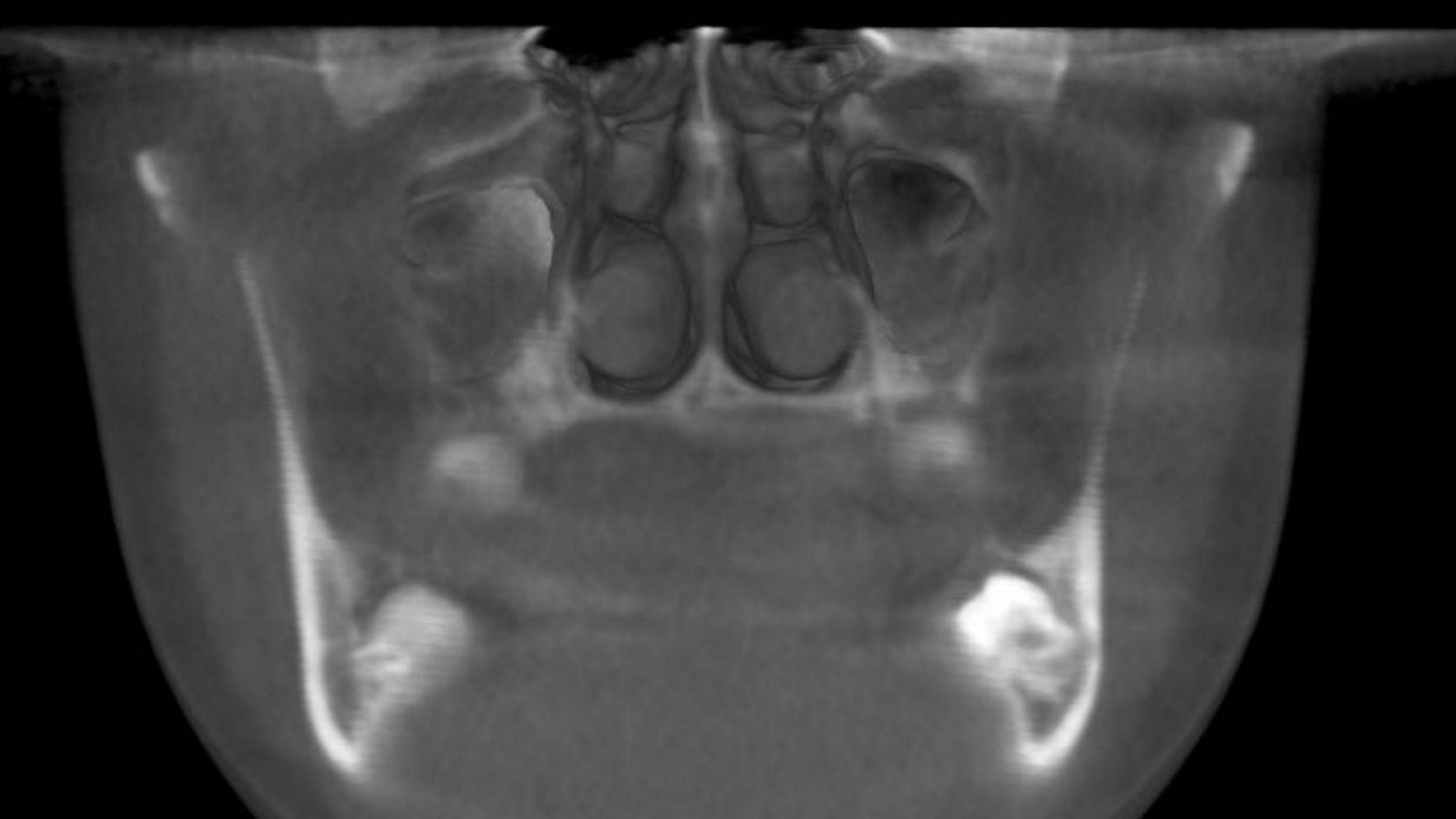
Tx Phase Info | Dx/Tx Plan | Images | Tx Notes

No Tx Note for Today

Approve Treatment Note

Approval	Date	Compliance	Appliances	Elastics	AWs	Status	Notes	Next Appt	Next Appt Notes
	08/11/15 JG/CG					Active Tr... Started	CT SCAN, PHOTOS, EXAM. HAD BRACES FOR 3 YRS WITH DR [redacted] AT [redacted] BITE IS STILL OFF, TEETH ARE FLARED. SHE WAS NEVER GIVEN ANY RETAINERS, ONLY PUT FIXED RETAINERS ON CHLOE.		



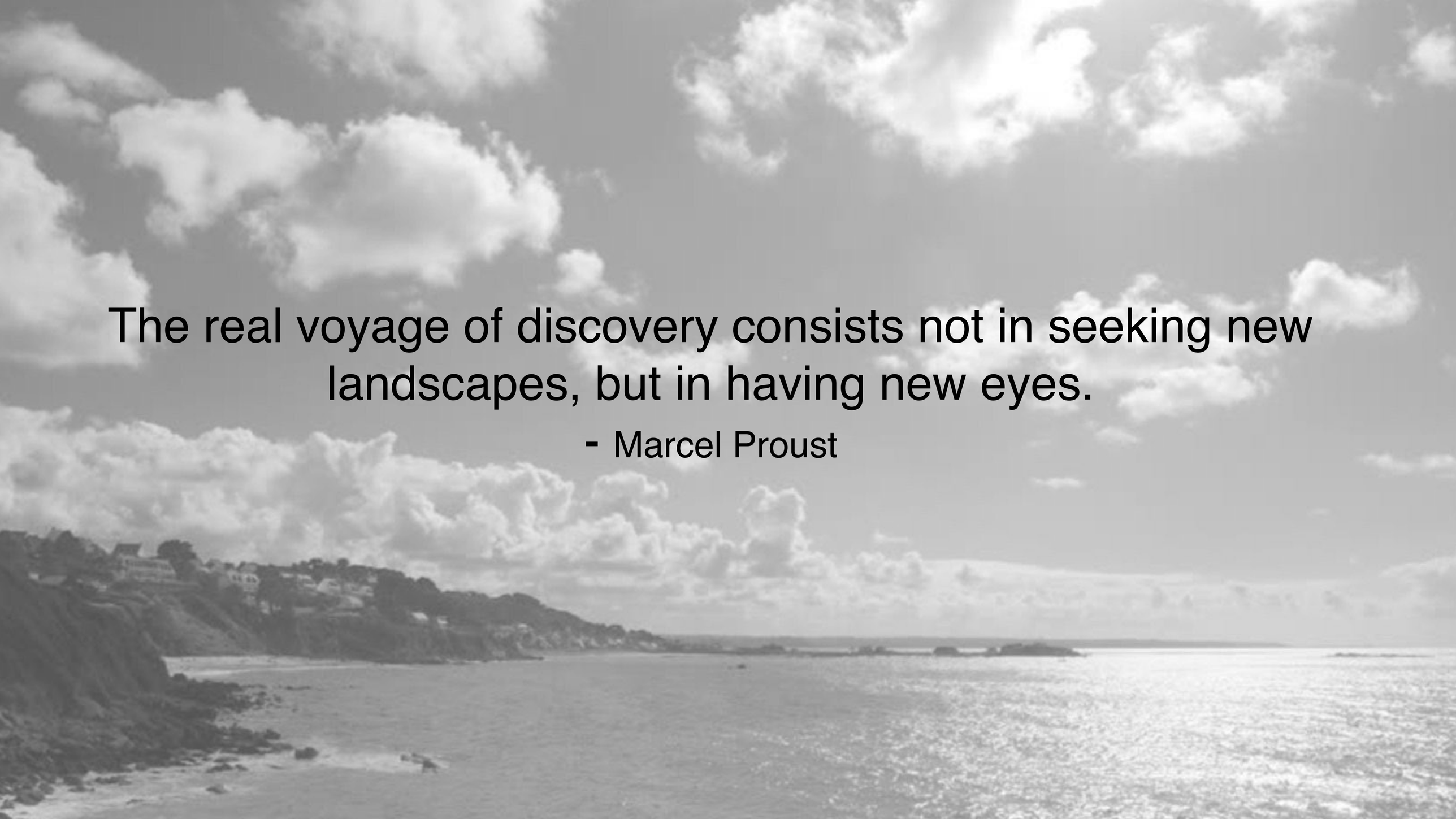


My daughter Chloe has TRULY never been able to breathe through her nose since birth. At an early age we noticed how she would breathe through her mouth while awake, as well as while she slept. She never learned to blow her nose, and when eating she would have to stop chewing sometimes to take a breath. She was also susceptible to strep because of her mouth breathing. If she was sick with a cold, she had absolutely no chance. As a small child she would look up at me with tears and say “All I want is a new nose.”

All of this lead to many doctor visits: ENT’s, Allergists, cameras place up her nose, which lead to different diagnoses and a plethora of medications. She learned to adjust her lifestyle based on a Severe Allergy diagnosis. Her daily regimen was saline nasal cleanse x 2/day, Nasacort, Claritin, Sudafed, an occasional Benadryl, not to mention the Afrin as needed. She also slept sitting up.

We are grateful to you Dr. Graham for taking time to care and take interest in Chloe. A week after surgery and the removal of splints, Chloe had the results she always dreamed of. She sleeps on one pillow, breathes with her mouth closed, blew her nose for the first time, no dry lips or dry mouth, and she is 100% medication-free. We think of putting all that medication in her body and all the money spent and it’s very unsettling.

This has been life changing for her. Thanks Dr. Graham, for giving Chloe her “new nose”!


The real voyage of discovery consists not in seeking new landscapes, but in having new eyes.
- Marcel Proust

The effect of mandibular advancement on upper airway structure in obstructive sleep apnoea

Andrew S L Chan,[1,2,3] Kate Sutherland,[1,2] Richard J Schwab,[4] Biao Zeng,[1,2,3] Peter Petocz,[5] Richard W W Lee,[1,2,3] M Ali Darendeliler,[6] Peter A Cistulli[1,2,3]

ABSTRACT

Background The mechanisms by which mandibular advancement splints (MAS) improve obstructive sleep apnoea (OSA) are not well understood. This study aimed to evaluate the mechanism of action of MAS by assessing their effect on upper airway structure in patients with OSA.

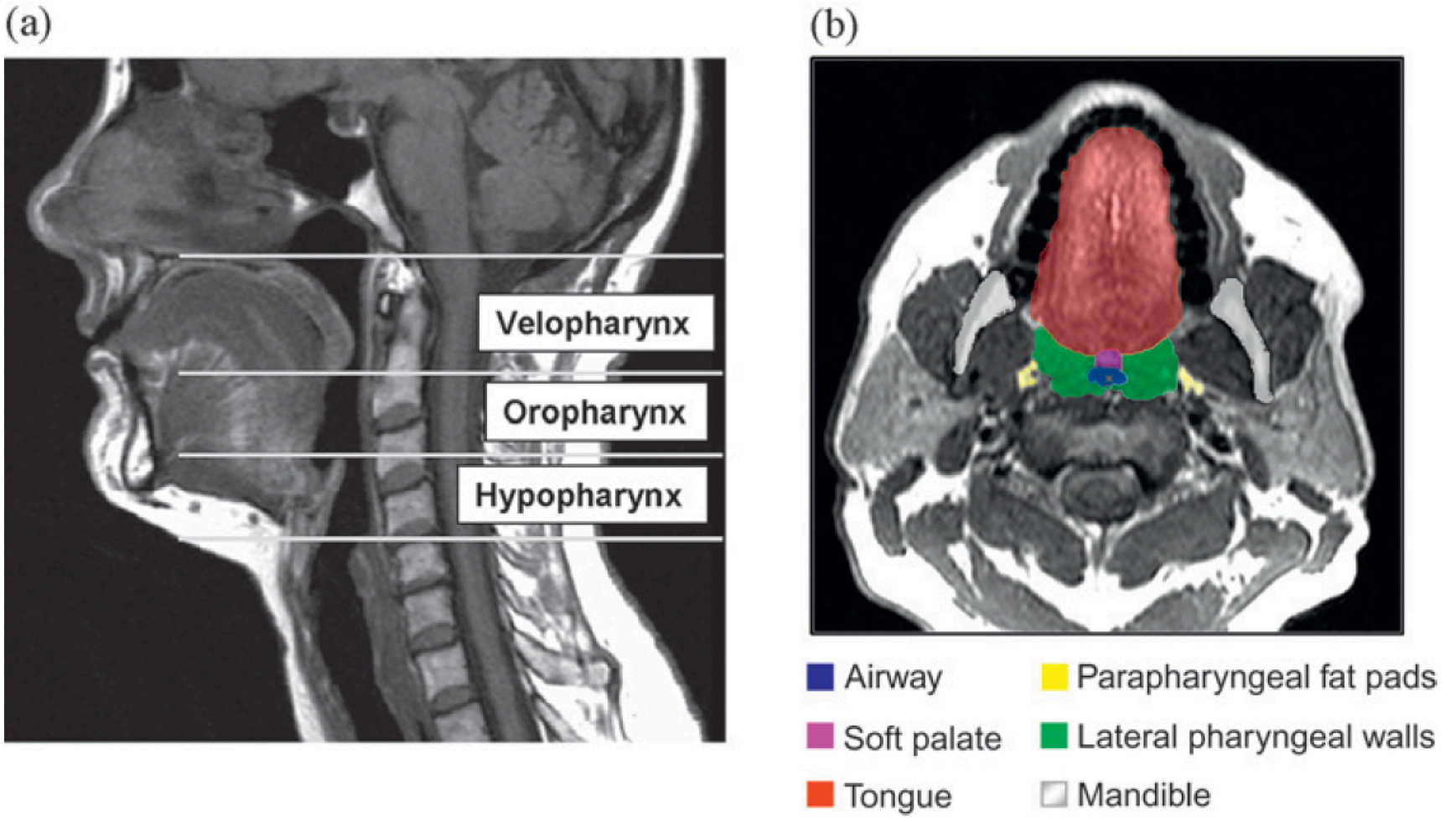
Methods Patients were recruited from a sleep disorders clinic for treatment with a custom-made MAS. MRI of the upper airway was performed during wakefulness in the supine position, with and without the MAS.

Results Sixty-nine patients with OSA were recruited. Treatment with the MAS reduced the apnoea—hypopnoea index (AHI) from 27.0±14.7 events/h to 12.2±12.5 events/h ($p<0.001$). There was an increase in the total airway volume with mandibular advancement (16.5±0.7 cm^3 vs 18.1±0.8 cm^3; $p<0.01$) that occurred predominantly because of an increase in the volume of the velopharynx (5.7±0.3 cm^3 vs 6.5±0.3 cm^3; $p<0.001$). This increase in airway calibre was associated with an increase in the lower anterior facial height (6.8±0.1 cm vs 7.5±0.1 cm; $p<0.001$), reduction in the distance between the hyoid and posterior nasal spine (7.4±0.1 cm vs 7.2±0.1 cm; $p<0.001$), lateral displacement of the parapharyngeal fat

preventing collapse of the upper airway during sleep.[4] However, the mechanisms by which MAS improve OSA are not well understood. Limited studies have identified an effect of mandibular advancement on aspects of the structure and function of the upper airway.[9–16] Importantly, these predominantly used cephalometric x-rays which are limited by their two-dimensional nature. However, soft tissue volumes and movements, and the interaction between upper airway structural parameters and treatment response have never been systematically studied in patients using an oral appliance. A better understanding of the biomechanical mechanisms that mediate the efficacy of MAS may have important clinical implications, including the development of more efficacious appliances, and may improve the selection of patients for this treatment modality.

MRI is a powerful, non-invasive research tool and is probably one of the best methods for assessing the three-dimensional structure of the upper airway lumen and the surrounding soft tissue structures.[17] Therefore, this study aimed to evaluate the mechanism of action of MAS in patients with OSA by assessing their effect on

Figure 2 (A) Segments of the upper airway on mid-sagittal MRI: velopharynx (from the hard palate to the tip of the uvula), oropharynx (from the tip of the uvula to the tip of the epiglottis) and hypopharynx (from the tip of the epiglottis to the level of the vocal cords). (B) Segmentation of upper airway structures on axial MRI: airway lumen, parapharyngeal fat pads, soft palate, tongue (genioglossus) and lateral pharyngeal walls.



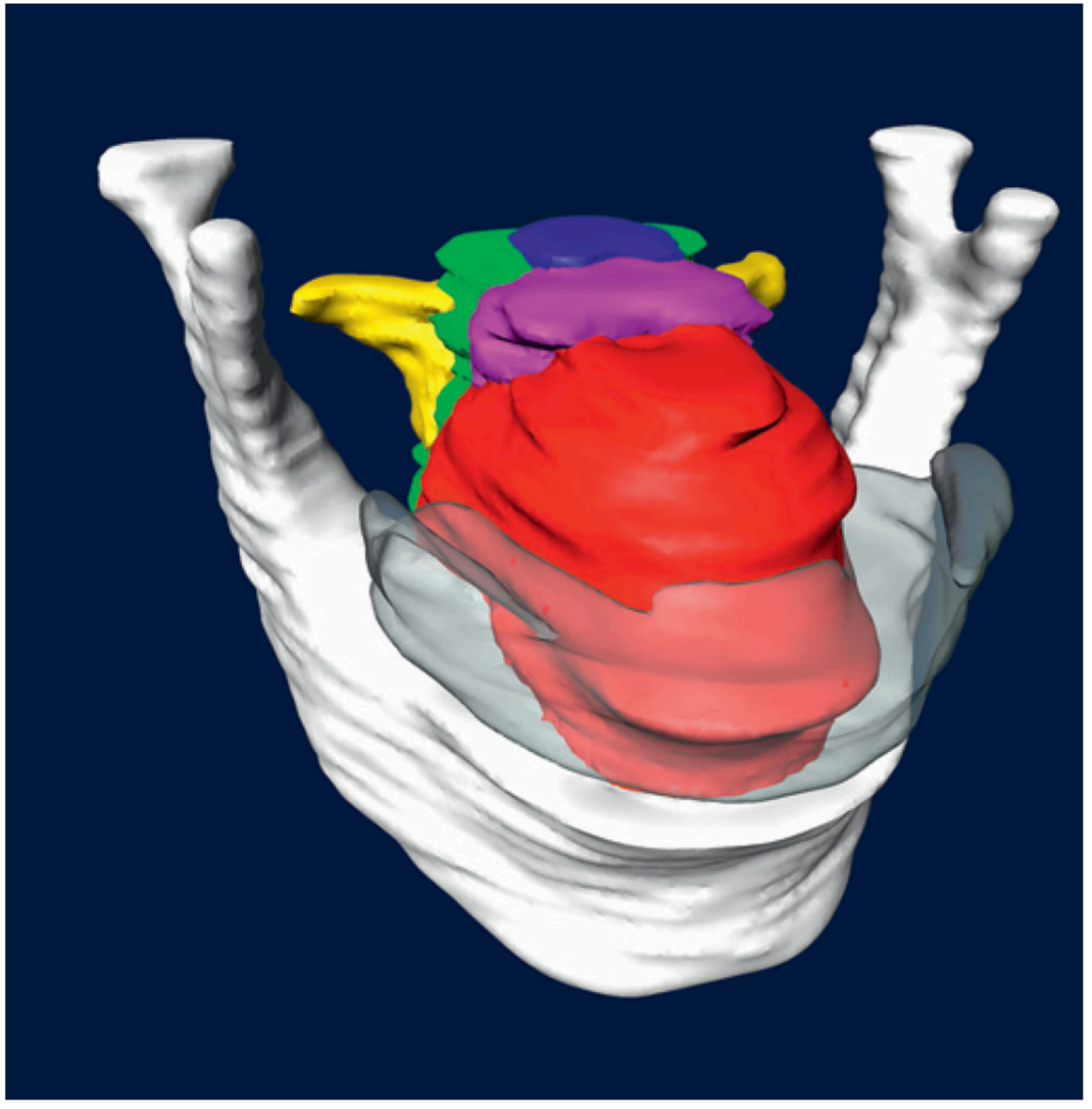
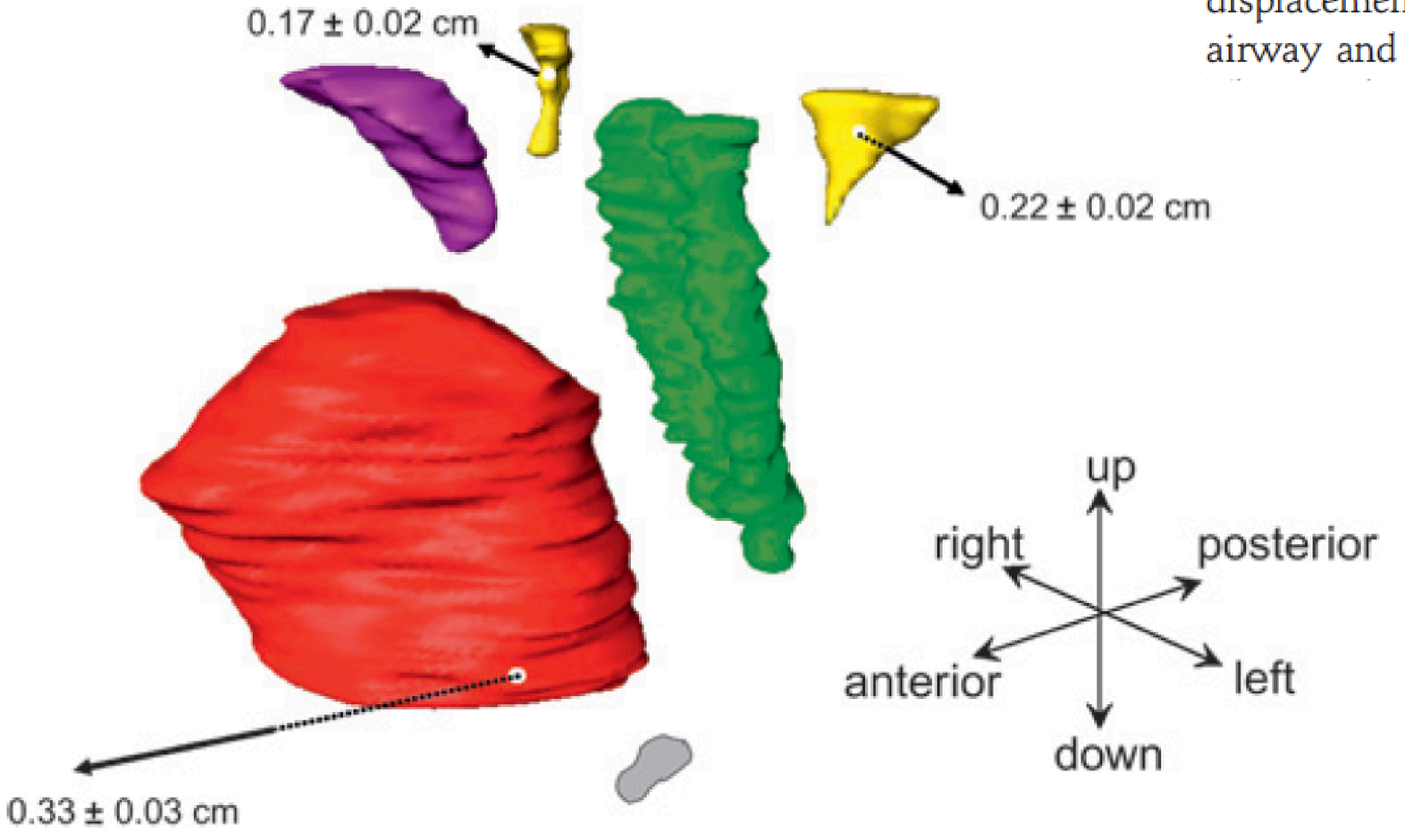
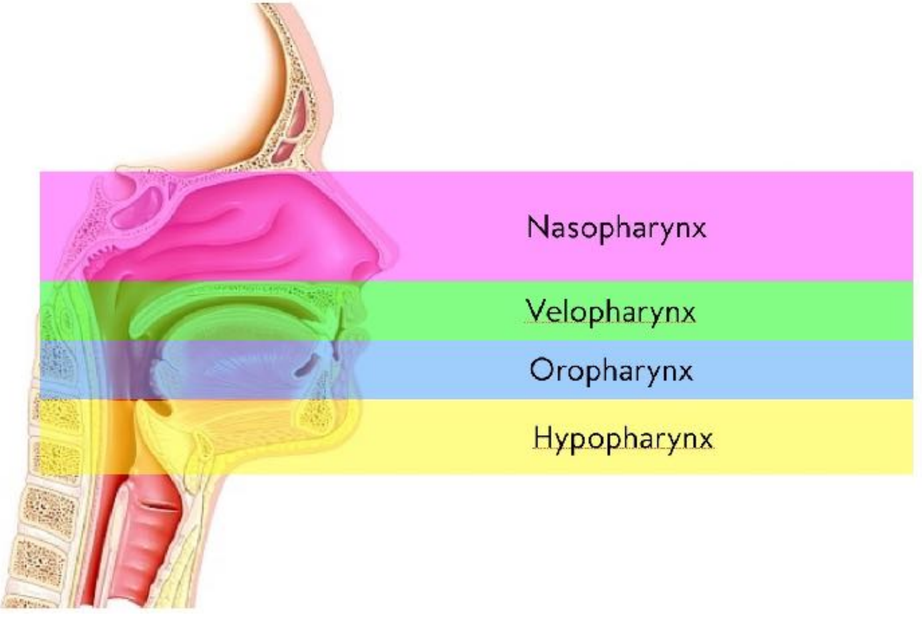


Figure 4 Volumetric reconstruction of the upper airway. The structures shown are: airway lumen (blue), soft palate (purple), tongue (red), parapharyngeal fat pads (yellow), lateral pharyngeal walls (green) and mandible (white). The MAS is shown in grey.

during sleep.[4] A key finding of this study is that mandibular advancement improves the calibre of the upper airway, but this occurs predominantly due to an increase in the volume of the velopharynx and is mediated by an increase in its lateral dimensions. These airway effects are associated with a number of bony and soft tissue changes, including an increase in lower anterior facial height, raised position of the hyoid, lateral displacement of the parapharyngeal fat pads away from the airway and anterior positioning of the base of tongue muscles.





Does the orthodontic specialty get it?

SYSTEMATIC REVIEW CE AJO-DO

Early orthodontic treatment for Class II malocclusion reduces the chance of incisal trauma: Results of a Cochrane systematic review

Badri Thiruvenkatachari,[a] Jayne Harrison,[b] Helen Worthington,[c] and Kevin O'Brien[d]
Manchester and Liverpool, United Kingdom

In this article, we summarize the most clinically relevant findings of our recently updated Cochrane systematic review into the treatment of Class II Division 1 malocclusion. **Methods:** A systematic review of the databases was performed to identify all randomized controlled trials evaluating early treatment with functional appliances to correct Class II Division 1 malocclusion. **Results:** Three early treatment studies with data from 353 participants were included in this review. The results showed no significant difference for any outcomes, except new incidence of incisor trauma, which was significantly less for the early treatment group. The risk ratio analysis for new incisor trauma showed that providing early treatment reduced the risk of trauma by 33% and 41% in the functional and headgear groups, respectively. However, when the numbers needed to treat were calculated, early treatment with functional appliances prevents 1 incidence of incisal trauma for every 10 patients (95% CI, 5-174), and headgear treatment prevents 1 incidence of incisal trauma for every 6 patients (95% CI, 3-23). **Conclusions:** Orthodontic treatment for young children, followed by a later phase of treatment when the child is in early adolescence, appears to reduce the incidence of new incisal trauma significantly compared with treatment that is provided in 1 phase when the child is in early adolescence. However, these data should be interpreted with caution because of the high degree of uncertainty. There are no other advantages in providing 2-phase treatment compared with 1 phase in early adolescence. (Am J Orthod Dentofacial Orthop 2015;148:47-59)

ndri Thiruvenkatachari,[a] Jayne Harrison,[b] Helen Worthington,[c] and Kevin O'Brien[d]
anchester and Liverpool, United Kingdom

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Which specialty is best poised to *discover*, *treat* and *follow-up* with sleep disordered breathing in children?

Sleep Physician

Sleep Testing/Screening when referred by pediatrician

Cannot prescribe, insert or adjust oral appliances

Referral for adenotonsillectomy

Nasal corticosteroids

Sleep Dentist

Referral to sleep specialist

Referral to orthodontist

Orthodontist

CBCT airway evaluation on every patient
Sleep testing/screening
Referral for adenotonsillectomy
Mandibular repositioning
Rapid Maxillary Expansion
Protraction facemask
Orthodontic arch development
iCAT airway re-evaluation
Continued guided airway development into adulthood
Covered by either medical insurance or financed as a phase I

Will

Utah Sleep & Pulmonary Specialists

Utah Sleep & Pulmonary Specialists

Pediatric & Adult Pulmonary & Sleep Medicine

Gregory Dupont, MD
Adult Sleep Specialist
Board Certification:
Pulmonary Medicine
Internal Medicine
Diplomate,
American Board of Sleep Medicine

Kathleen D. Pfeffer, MD
Pediatric Sleep Specialist
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Diplomate,
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Address
9103 S. 1300 W.
Suite 103
West Jordan, UT 84088

801 432-8690
801 432-8681 FAX

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POLYSOMNOGRAPHIC REPORT

GRAHAM, WILL
DOB: 9-12-02
DOS: 9-20-13

REFERRING PHYSICIAN: Rachel Baar, M.D.
IHC Memorial Clin
2000 S. 900 E.
SLC, UT 84105

BRIEF HISTORY: Will is an 11 year old young
history of difficulties falling to sleep and maintainin
if he is given melatonin, but he still wakes. Pare
room and note that he wakes typically between 2
drink of water, goes to his bathroom, but occasi
He states that he can sleep better on the cou
sleeping on the floor of his room when mom
completely denies any symptoms of restle
crawlies, and numbness. Paternal grandfath
myasthenia gravis. Maternal grandmother
insomnia. A 3 year old sister is scheduled f

Will gets very frustrated that he cannot
very restless, constantly moving. He doe
is having difficulty breathing. Ton
circumscribed tonsils, uvula was slight
other findings. Sleep study is performe
disorder which might contribute
maintaining sleep.

METHOD: The patient was mo
conventional polysomnography, i
oral/nasal airflow, single channe
by plethysmography and video

RESULTS: Overall this was
10:32 p.m. He fell asleep in
until 5:06 a.m., or 375 minu
efficiency of 78.1%. He en
when he should have been
He was horribly restless
3+4 sleep, but around 2:
sleep he transitioned in
sleep again until 3:30.
stage 2, 3+4 sleep and
should be les

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37.5% stage 3+4; and 16.1% REM. REM sleep is low, not surprisingly, given
1 REM cycle. Normal is 20-25%.

He slept primarily on his back, but associated with transitions to light stage
or awakenings he moved back and forth onto his left side.

There are 68 arousals or 13.2 an hour, which is moderately elevated. Of th
11.3 an hour were respiratory event related, also moderately elevated; 7
1.4 an hour were spontaneous, which is normal.

There were 20 periodic limb movements or 3.9 an hour, which is norm
or 0.6 an hour were associated with arousals. However, associated w
into stage 1 sleep and light sleep. significant restless leg type activi
fact 236 leg movements were noted during light sleep or wakeful
restless legs.

Breathing wise, oxygen saturations asleep on room air averag
was 93%. There were no obstructive apneic events, there were
breathing events occurring primarily during transitions into
These were scattered throughout the night; 2 occurred in REM
his back, 2 on his left side. Overall obstructive apnea/hy
number of obstructive breathing events per hour, is 1.2, whic

There were 10 central pauses also scattered throughout
occur during transitions between deep sleep and night
seconds and lasted as long as 14.8 seconds. 3 events oc
left side. No central apnea per se, no periodic breathin
is 1.9. Overall apnea/hypopnea index (AHI) is 3.1, wh

There were 48 RERAs or respiratory event related
events that cannot be scored as apneas or hypop
typically suggest some degree of upper airway re
during periods of light stage 1 sleep, and transitio

Clinical information, periods of increased eff
intercostal muscles. Periods of paradoxical b
throughout the night, although no snoring was
and turning were noted throughout the night.

IMPRESSIONS/RECOMMENDATIONS:
not need to move, these results sugges
consistent with periodic limb movemer
disordered breathing.

It should be noted that his long REM
Both REM sleep and being in the
breathing, and this was not seen.

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Under these circumstances, checking Will's iron and ferritin level and making sure hypoferritinemia is not contributing to leg movements would be worthwhile. A trial of gabapentin, Clonidine, or Clonazepam before bed might also be helpful in calming his legs and allowing more sleep continuity.

I look forward to discussing these results with Will and his parents.

Kathleen D. Pfeffer, M.D.
Diplomat, American Academy of Sleep Medicine
Board Certified Pediatric Pulmonologist

cc: Home

dm:

disorder which might contribute to Will's difficulties falling to sleep and maintaining sleep.

METHOD: The patient was monitored by a technician and studied with full, conventional polysomnography, including continuous measurements of EEG, EOG, oral/nasal airflow, single channel ECG, leg EMG, chest and abdominal movements by plethysmography and video and audio recording.

RESULTS: Overall this was a really hard study for Will. Lights were turned off at 10:32 p.m. He fell asleep in 19.5 minutes. Sleep period extended from 10:51 p.m. until 5:06 a.m., or 375 minutes. During this time he slept for 308 minutes, a sleep efficiency of 78.1%. He entered into stage 3+4 sleep normally. At about 12:50 a.m., when he should have been entering into REM sleep, he entered into stage 1 sleep. He was horribly restless at this time. He then transitioned back into stage 2, stage 3+4 sleep, but around 2:15 a.m., again associated with an attempt to enter into REM sleep he transitioned into light sleep and then woke. He did not achieve sustained sleep again until 3:30. At this time he had a very long REM cycle and entered into

There were 10 central pauses also scattered throughout the night and tending to occur during transitions between deep sleep and night sleep. These averaged 11.6 seconds and lasted as long as 14.8 seconds. 3 events occurred on his back, 7 on his left side. No central apnea per se, no periodic breathing. Central apnea index (CAI) is 1.9. Overall apnea/hypopnea index (AHI) is 3.1, which is within normal limits.

There were 48 RERAs or respiratory event related arousals. These are respiratory events that cannot be scored as apneas or hypopneas, yet result in arousal, and typically suggest some degree of upper airway resistance. These were also scored during periods of light stage 1 sleep, and transitions in and out of wakefulness.

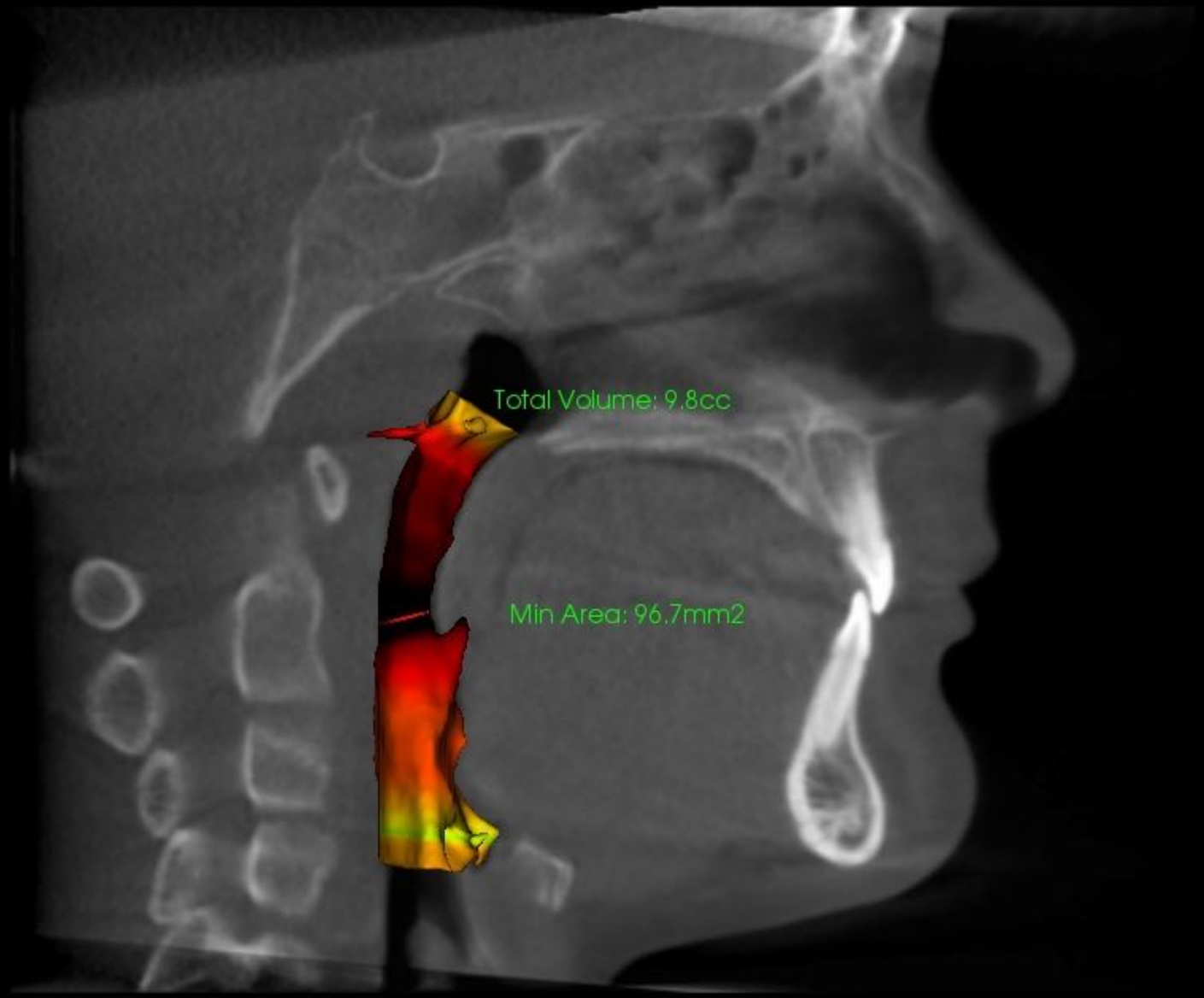
Clinical information, periods of increased effort were occasionally noted in the intercostal muscles. Periods of paradoxical breathing were also occasionally seen throughout the night, although no snoring was detected. Frequent periods of tossing and turning were noted throughout the night.

IMPRESSIONS/RECOMMENDATIONS: Despite Will's feeling that his legs do not need to move, these results suggest Restless Leg Syndrome. They are not consistent with periodic limb movements, and they are not consistent with sleep

Graham,Will
20020912
M

20150527

MCA = 96.7 mm²



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TxSTUDIO

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T
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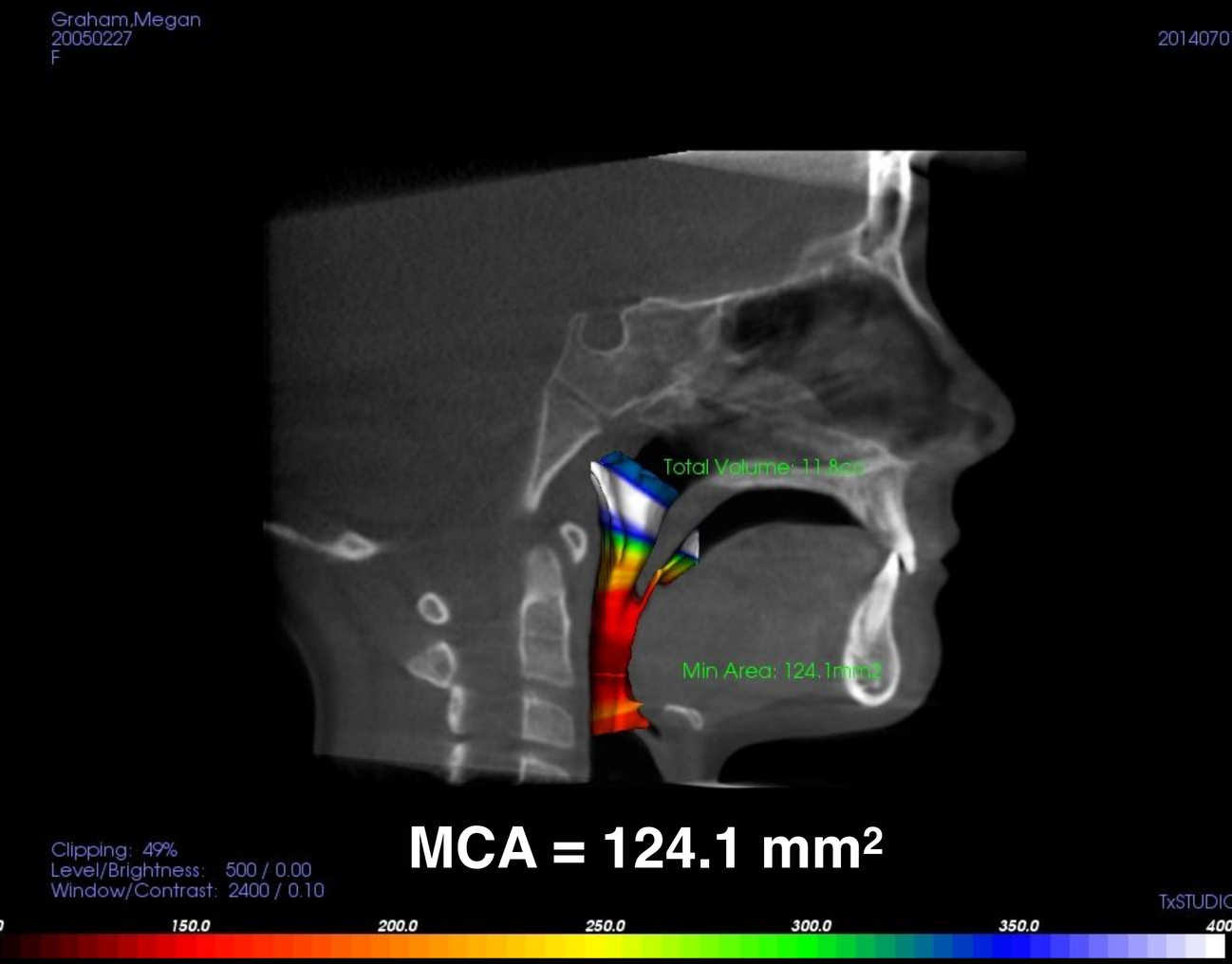
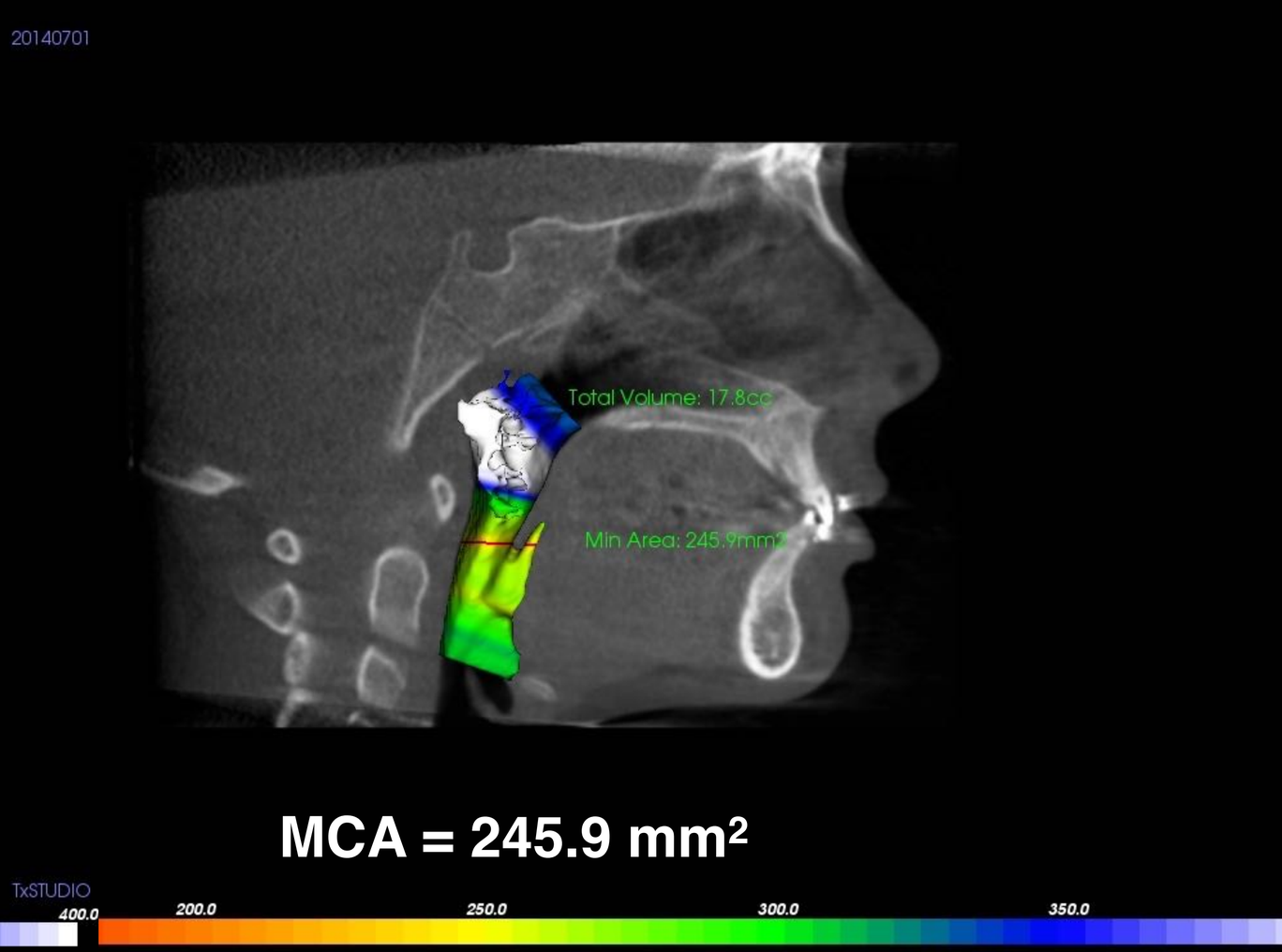
Megan

Eight months of phase 1 treatment with fixed appliances, no expander.



MCA = 124.1 mm²



MCA = 245.9 mm²

25TH

AADSM ANNIVERSARY MEETING

DENVER

JUNE 9 - 11, 2016

SHERATON DENVER

DOWNTOWN

Learning Objectives

By the end of the AADSM 25th Anniversary Meeting, participants should be able to:

1. Acquire knowledge about the management of obstructive sleep apnea in both adults and children;
2. Discuss state-of-the-art knowledge of recent advances in dental sleep medicine and sleep apnea treatment;
3. Review the relationship between obstructive sleep apnea, cardiovascular disease and other associated co-morbidities;
4. Understand the evidence regarding long-term oral appliance therapy, including potential side effects and options for managing complications in patients with snoring and/or OSA; and
5. Apply best practices for building and developing a successful dental sleep medicine practice, including an overview of proper patient management and development of care plans; creating awareness about sleep related breathing disorders and their treatments; positioning your practice as a provider of dental sleep medicine; and proper medical insurance billing.

SCHEDULE AT A GLANCE

For full schedule details, visit www.aadsm.org/AnnualMeeting.aspx.

Thursday, June 9, 2016

8:00am-12:15pm *Educational Courses* *Fee required*	**C01: Introduction to Dental Sleep Medicine**	Katherine Phillips, DDS, Chair | Don Farquhar, DDS | James Hogg, DDS | Kevin Postol, DDS
	C02: Advanced Dental Sleep Medicine	Alan Blanton, DDS, Chair | Marc Braem, DDS | Leslie Dort, DDS | Anne Bartolucci, PhD | Ryan Soose, MD
10:00am-4:00pm	**Exhibit Hall Open**	
12:15pm-1:30pm *Meet the Professors* *Fee required*	**M01: The Role of Sleep Bruxism in Obstructive Sleep Apnea** **M02: The Best Questions to Ask to Find Sleep Disorders** **M03: Titration Versus Treatment Success**	Ghizlane Aarab, DDS Timothy Morgenthaler, MD Marc Braem, DDS
1:30pm-2:15pm	**Welcome Address and Awards**	
2:15pm-3:15pm	KEYNOTE ADDRESS **I01: Insights into the Pathogenesis and Management of OSA Utilizing Upper Airway Imaging**	Richard Schwab, MD
3:15pm-3:30pm	**Refreshment Break**	
3:30pm-4:30pm	**I02: A Look Back at 25 Years of Dental Sleep Medicine**	Robert Rogers, DMD
4:30pm-5:30pm	**I03: Measuring Quality in the Treatment of OSA/Oral Appliances**	Timothy Morgenthaler, MD
6:00pm-8:00pm	**Industry Supported Events**	

Learning Objectives

By the end of the AADSM 25th Anniversary Meeting, participants should be able to:

1. Acquire knowledge about the management of obstructive sleep apnea in both adults and children;
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5. Apply best practices for building and developing a successful dental sleep medicine practice, including an overview of proper patient management and development of care plans; creating awareness about sleep related breathing disorders and their treatments; positioning your practice as a provider of dental sleep medicine; and proper medical insurance billing.

Friday, June 10, 2016

8:00am-9:00am	**D01: Turf War: Home Sleep Apnea Testing**	Gail Demko, DMD | Kelly Carden, MD
	W01: Titration: Where to Start?	Ghizlane Aarab, DDS, PhD
9:00am-10:00am	**S01: Year in Review**	Marc Braem, DDS
	I04: PSG: What Does the Dental Sleep Clinician Need to Know?	Richard Berry, MD
10:00am-4:00pm	**Exhibit Hall Open**	
10:00am-10:30am	**Refreshment Break and Poster Viewing**	
10:30am-11:30am	**I05: Sleep Apnea and Cardiovascular Disease**	Atul Malhotra, MD
	W02: Telemedicine	Steve Van Hout
11:30am-12:30pm	**R01: Challenging Cases**	Moderator: Alan Blanton, DDS
	S02: Sleep-Disordered Breathing and Cardiometabolic Interactions in Pregnancy and in the General Population	Sushmita Pamidi, MD
12:30pm-1:00pm	**ABDSM Information Session**	
12:30pm-1:45pm *Meet the Professors* *Fee required*	**M04: Frequently Asked Questions about Sleep Apnea** **M05: New Titration Protocols – How to Test Them Without Bias** **M06: The Road to Personalized Medicine for Sleep Apnea: Challenges and Opportunities**	Atul Malhotra, MD Fernanda Almeida, DDS, PhD Danny Eckert, PhD
1:45pm-3:15pm	**W03: PSG and HSAT: Diagnostics, Outcome Studies and Split Nights**	Max Hirschkowitz, PhD
	W04: Modified Oral Appliance and Combination Therapy	Katherine Phillips, DDS | James Hogg, DDS
3:15pm-3:45pm	**Refreshment Break and Poster Viewing**	
3:45pm-4:45pm	**S03: Basic Science of Sleep, Wakefulness and Upper Airway Tone**	Michael Decker, PhD
	O01: Oral Presentations	
4:45pm-5:45pm	**W05: Insurance Company Audits: How to be Prepared**	Mary Beth Rogers
	I06: Sleep Deprivation	David Dinges, PhD

Learning Objectives

By the end of the AADSM 25th Anniversary Meeting, participants should be able to:

1. Acquire knowledge about the management of obstructive sleep apnea in both adults and children;
2. Discuss state-of-the-art knowledge of recent advances in dental sleep medicine and sleep apnea treatment;
3. Review the relationship between obstructive sleep apnea, cardiovascular disease and other associated co-morbidities;
4. Understand the evidence regarding long-term oral appliance therapy, including potential side effects and options for managing complications in patients with snoring and/or OSA; and
5. Apply best practices for building and developing a successful dental sleep medicine practice, including an overview of proper patient management and development of care plans; creating awareness about sleep related breathing disorders and their treatments; positioning your practice as a provider of dental sleep medicine; and proper medical insurance billing.

Saturday, June 11, 2016

For full schedule details, visit www.aadsm.org/AnnualMeeting.aspx.

8:00am-9:00am	**S04: AADSM Accreditation: Impacting the Physician Sleep Specialist's Network**	Patricia Braga, DDS | Norman Blumenstock, DDS | Jennifer Le, DMD
	W06: Managing OSA: CPAP vs VPAP vs AutoPAP, is there a difference?	Christopher Lettieri, MD
9:00am-10:00am	**S05: Sleep and Chronic Pain**	Michael Smith, MD
	S06: Midface Hypoplasia and Pediatric OSA: Causes, Correlations and Orthodontic Interventions	Soleil de Marsche Roberts, DMD
10:00am-3:00pm	**Exhibit Hall Open**	
10:00am-10:15am	**Refreshment Break**	
10:15am-11:15am	**I07: Cognition, Behavior and OSA in Children**	Ronald Chervin, MD, MS
	S07: Insomnia and Sleep Apnea: Collaborative Approaches to this Comorbidity	Jason Ong, PhD
11:15am-12:15pm	**S08: Impact of Sleep Apnea on Neurocognition**	Stuart Quan, MD
	W07: Complementary and Alternative Therapies for Insomnia Disorder	Jennifer Martin, PhD
12:15pm-1:30pm *Meet the Professors* *Fee required*	**M07: Understanding the Rules and Regulations Regarding Oral Appliance Use in Pilots and Commercial Drivers**	Christopher Lettieri, MD
	M08: Using Combination Therapy to Help Develop the Physician Referral Network	Patricia Braga, DDS
	M09: Sleep Medicine in 2036: Promise and Opportunities	Ronald Chervin, MD, MS
1:30pm-2:30pm	**W08: Phenotyping and Oral Appliances: Towards Individualized Strategies to Optimize Treatment Success According to Underlying Mechanisms**	Danny Eckert, PhD
	S09: The PTSD and Sleep Apnea Connection	Ali El Solh, MD
2:30pm-3:30pm	**I08: Is Insomnia History? The Modernization of Sleep**	Roger Ekirch, PhD
	W09: Objective Compliance	Fernanda Almeida, DDS, PhD
3:30pm-4:00pm	**AADSM Membership Meeting**	

SLEEP 2016

DENVER • JUNE 11-15

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30TH ANNIVERSARY MEETING OF THE ASSOCIATED PROFESSIONAL SLEEP SOCIETIES, LLC

A JOINT MEETING OF THE AMERICAN ACADEMY OF SLEEP MEDICINE AND THE Sleep Research Society®

SPECIAL SECTION

JCSM
Journal of Clinical Sleep Medicine

pii: jc-00030-15
http://dx.doi.org/10.5664/jcsm.4558

Quality Measures for the Care of Pediatric Patients with Obstructive Sleep Apnea

Sanjeev V. Kothare, MD[1]; Carol L. Rosen, MD[2]; Robin M. Lloyd, MD[3]; Shalini Paruthi, MD[4]; Sherene M. Thomas, PhD[5]; Matthew M. Troester, DO[6]; Kelly A. Carden, MD[7]

[1]NYU Langone Medical Center, New York, NY; [2]University Hospitals Rainbow Babies and Children's Hospital, Cleveland, OH; [3]Mayo Clinic, Rochester, MN; [4]Saint Louis University School of Medicine, St. Louis, MO; [5]American Academy of Sleep Medicine, Darien, IL; [6]Phoenix Children's Hospital, Phoenix, AZ; [7]Saint Thomas Sleep Specialists, Nashville, TN

The Board of Directors of the American Academy of Sleep Medicine (AASM) commissioned a Task Force to develop quality measures as part of its strategic plan to promote high quality patient-centered care. Among many potential dimensions of quality, the AASM requested Workgroups to develop outcome and process measures to aid in evaluating the quality of care of five common sleep disorders: insomnia, obstructive sleep apnea in adults, obstructive sleep apnea in children, restless legs syndrome, and narcolepsy. This paper describes the rationale, background, general methods development, and considerations in implementation of these quality measures in obstructive sleep apnea (OSA) in children. This document describes measurement methods for five desirable process measures: assessment of symptoms and risk factors of OSA, initiation of an evidence-based action plan, objective evaluation of high-risk children with OSA by obtaining a polysomnogram (PSG), reassessment of signs and symptoms of OSA within 12 months, and documentation of objective assessment of positive airway pressure adherence. When these five process measures are met, clinicians should be able to achieve the two defined outcomes: improve detection of childhood OSA and reduce signs and symptoms of OSA after initiation of a management plan. The AASM recommends the use of these measures as part of quality improvement programs that will enhance the ability to improve care for patients with childhood OSA.

Citation: Kothare SV, Rosen CL, Lloyd RM, Paruthi S, Thomas SM, Troester MM, Carden KA. Quality measures for the care of pediatric patients with obstructive sleep apnea. *J Clin Sleep Med* 2015;11(3):385–404.

Supporting Evidence and Rationale

There are over 70 million children between the ages of 0 and 17 years in the United States.[10] Between 10% and 30% (7.4 to 22 million children) habitually snore,[11] and between 1% and 5% (743,000–3,715,000 children) have obstructive sleep apnea syndrome.[1] Both habitual snoring and obstructive sleep apnea syndrome have been linked to neurodevelopmental and behavioral difficulties.[1,12,13] Data suggest that sleep disorders, including habitual snoring and obstructive sleep apnea, are under-diagnosed.[14] Because these sleep disorders are treatable when recognized, it is imperative to improve their detection and ultimately reduce the associated neurodevelopmental consequences.

Normative Data

Volumetric Airway Norms

Table 1. AVERAGE AIRWAY VOLUME

Volume	Age Group (yr) 6-8	9-11	12-14	15-17	18-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	≥56	Average	SD
Average	7.18	8.39	11.62	14.83	14.90	14.77	15.59	14.78	14.37	14.24	14.07	13.97	13.06	13.21	2.61
Average SD	3.40	3.45	4.79	6.00	5.35	5.50	5.91	5.80	6.03	7.96	5.42	5.50	5.42	5.42	1.15
Female															
Average	6.45	8.75	11.54	13.03	14.61	15.07	17.93	15.44	14.85	12.98	13.95	13.81	12.13	13.12	2.97
Average SD	3.13	3.39	4.30	4.45	4.98	5.90	6.14	5.75	5.74	5.17	5.26	4.79	4.98	4.92	0.92
Male															
Average	7.88	7.96	11.69	16.70	15.22	14.47	15.58	16.65	13.51	15.61	14.28	14.29	14.01	13.68	2.88
Average SD	3.54	3.51	5.19	6.84	5.79	5.11	5.43	5.79	6.47	10.03	5.74	6.73	5.75	5.84	1.62

Schendel et al. 3D Analysis of Airway Growth. J Oral Maxillofac Surg 2012.

1300 individuals

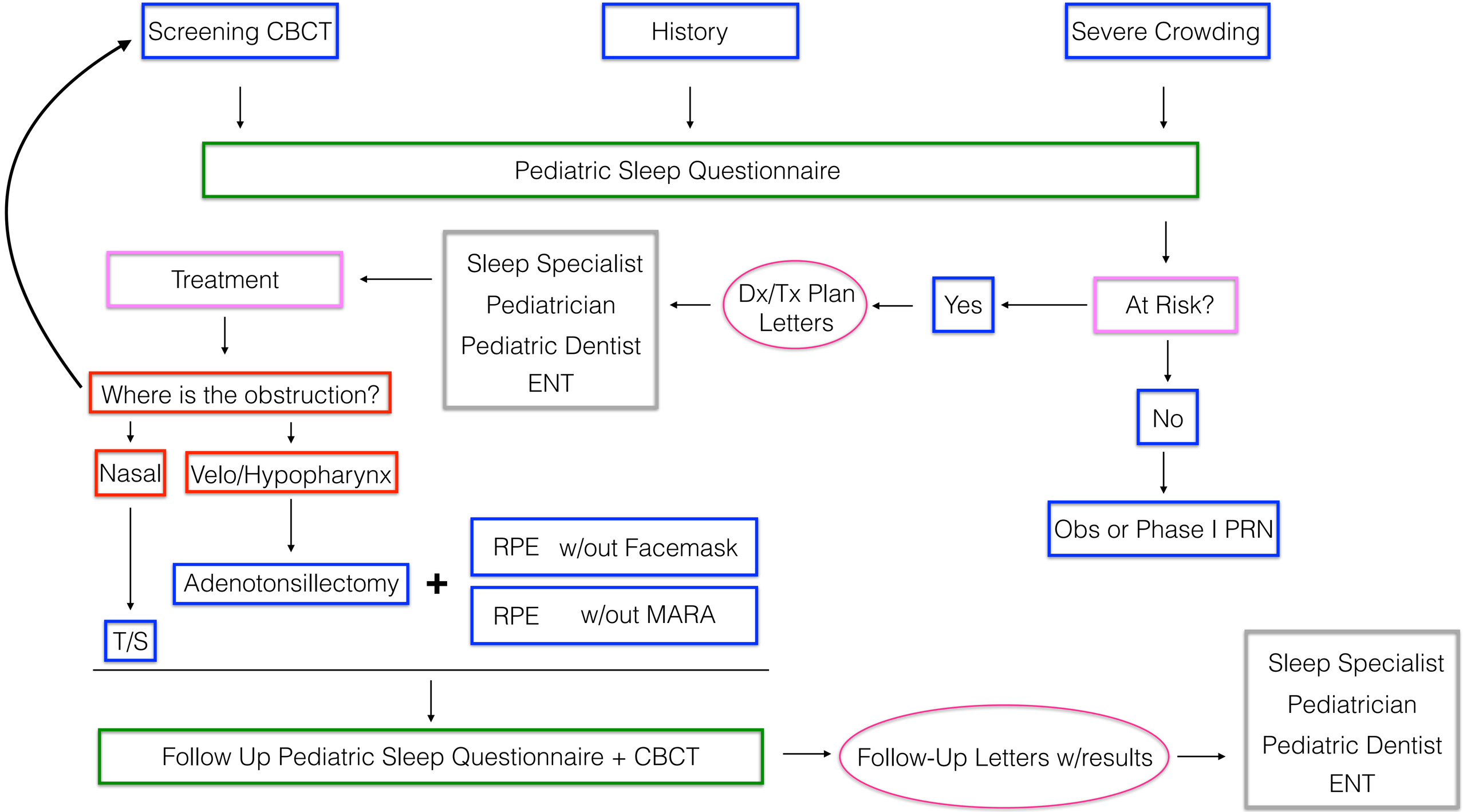
Volumetric Airway Norms

Table 4. AVERAGE SMALLEST AIRWAY AREA

Smallest Airway Area	Age Group (yr) 6-8	9-11	12-14	15-17	18-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	≥56	Average	SD
Average	77.70	89.89	128.64	169.13	171.55	160.97	172.18	159.22	157.31	149.26	144.39	143.18	121.83	141.94	30.15
Average SD	48.78	47.77	66.31	86.19	113.98	80.97	81.28	81.68	84.54	120.83	75.44	81.66	82.15	80.89	20.63
Female															
Average	70.92	95.38	138.21	150.16	185.97	184.49	177.77	168.70	171.63	137.98	150.29	146.19	107.28	145.00	35.48
Average SD	44.29	49.10	70.00	72.98	140.55	94.27	84.86	80.33	86.31	75.44	74.45	79.61	65.99	78.32	23.32
Male															
Average	84.21	83.47	120.80	188.87	155.92	137.53	159.15	143.06	132.92	161.48	134.34	137.33	136.99	136.62	29.03
Average SD	52.35	45.85	62.68	94.84	73.82	56.89	71.90	82.53	76.51	155.84	77.08	86.44	94.46	79.32	27.56

Schendel et al. 3D Analysis of Airway Growth. J Oral Maxillofac Surg 2012.

1300 individuals


Screening CBCT
History
Severe Crowding
Pediatric Sleep Questionnaire
At Risk?
Yes
No
Dx/Tx Plan Letters
Sleep Specialist
Pediatrician
Pediatric Dentist
ENT
Treatment
Where is the obstruction?
Nasal
Velo/Hypopharynx
T/S
Adenotonsillectomy
+
RPE w/out Facemask
RPE w/out MARA
Obs or Phase I PRN
Follow Up Pediatric Sleep Questionnaire + CBCT
Follow-Up Letters w/results
Sleep Specialist
Pediatrician
Pediatric Dentist
ENT

Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials

Gordon C S Smith, Jill P Pell

Abstract

Objectives To determine whether parachutes are effective in preventing major trauma related to gravitational challenge.

Design Systematic review of randomised controlled trials.

Data sources: Medline, Web of Science, Embase, and the Cochrane Library databases; appropriate internet sites and citation lists.

Study selection: Studies showing the effects of using a parachute during free fall.

Main outcome measure Death or major trauma, defined as an injury severity score > 15.

Results We were unable to identify any randomised controlled trials of parachute intervention.

Conclusions As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomised controlled trials. Advocates of evidence based medicine have criticised the adoption of interventions evaluated by using only observational data. We think that everyone might benefit if the most radical protagonists of evidence based medicine organised and participated in a double blind, randomised, placebo controlled, crossover trial of the parachute.

Introduction

accepted intervention was a fabric device, secured by strings to a harness worn by the participant and released (either automatically or manually) during free fall with the purpose of limiting the rate of descent. We excluded studies that had no control group.

Definition of outcomes

The major outcomes studied were death or major trauma, defined as an injury severity score greater than 15.[6]

Meta-analysis

Our statistical apprach was to assess outcomes in parachute and control groups by odds ratios and quantified the precision of estimates by 95% confidence intervals. We chose the Mantel-Haenszel test to assess heterogeneity, and sensitivity and subgroup analyses and fixed effects weighted regression techniques to explore causes of heterogeneity. We selected a funnel plot to assess publication bias visually and Egger's and Begg's tests to test it quantitatively. Stata software, version 7.0, was the tool for all statistical analyses.

Results

Our search strategy did not find any randomised controlled trials of the parachute.

Discussion

Department of Obstetrics and Gynaecology, Cambridge University, Cambridge CB2 2QQ
Gordon C S Smith *professor*

Department of Public Health, Greater Glasgow NHS Board, Glasgow G3 8YU
Jill P Pell *consultant*

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gcss2@cam.ac.uk

BMJ 2003;327:1459–61

organised and participated in a double blind, randomised, placebo controlled, crossover trial of the parachute.

Introduction

The parachute is used in recreational, voluntary sector, and military settings to reduce the risk of orthopaedic, head, and soft tissue injury after gravitational challenge, typically in the context of jumping from an aircraft. The perception that parachutes are a successful intervention is based largely on anecdotal evidence. Observational data have shown that their use is associated with morbidity and mortality, due to both failure of the intervention[1 2] and iatrogenic complications.[3] In addition, "natural history" studies of free fall indicate that failure to take or deploy a parachute does not inevitably result in an adverse outcome.[4] We therefore undertook a systematic review of randomised controlled trials of parachutes.

Methods

Literature search

We conducted the review in accordance with the QUOROM (quality of reporting of meta-analyses) guidelines.[5] We searched for randomised controlled trials of parachute use on Medline, Web of Science, Embase, the Cochrane Library, appropriate internet sites, and citation lists. Search words employed were "parachute" and "trial." We imposed no language restriction and included any studies that entailed jumping from a height greater than 100 metres. The Our search strategy did not find any randomised controlled trials of the parachute.

Discussion

Evidence based pride and observational prejudice

It is a truth universally acknowledged that a medical intervention justified by observational data must be in want of verification through a randomised controlled

HULTON/GETTY

Parachutes reduce the risk of injury after gravitational challenge, but their effectiveness has not been proved with randomised controlled trials

trial. Observational studies have been tainted by accusations of data dredging, confounding, and bias.[7] For example, observational studies showed lower rates of ischaemic heart disease among women using hormone replacement therapy, and these data were interpreted as advocating hormone replacement for healthy women, women with established ischaemic heart disease, and women with risk factors for ischaemic heart disease.[8] However, randomised controlled trials showed that hormone replacement therapy actually increased the risk of ischaemic heart disease,[9] indicating that the apparent protective effects seen in observational studies were due to bias. Cases such as this one show that medical interventions based solely on observational data should be carefully scrutinised, and the parachute is no exception.

Natural history of gravitational challenge

The effectiveness of an intervention has to be judged relative to non-intervention. Understanding the natural history of free fall is therefore imperative. If failure to use a parachute were associated with 100% mortality then any survival associated with its use might be considered evidence of effectiveness. However, an adverse outcome after free fall is by no means inevitable. Survival has been reported after gravitation challenges of more than 10 000 metres (33 000 feet).[4] In addition, the use of parachutes is itself associated with morbidity and mortality.[1–3 10] This is in part due to failure of the intervention. However, as with all interventions, parachutes are also associated with iatrogenic complications.[3] Therefore, studies are required to calculate the balance of risks and benefits of parachute use.

What is already known about this topic

Parachutes are widely used to prevent death and major injury after gravitational challenge

Parachute use is associated with adverse effects due to failure of the intervention and iatrogenic injury

Studies of free fall do not show 100% mortality

What this study adds

No randomised controlled trials of parachute use have been undertaken

The basis for parachute use is purely observational, and its apparent efficacy could potentially be explained by a "healthy cohort" effect

Individuals who insist that all interventions need to be validated by a randomised controlled trial need to come down to earth with a bump

technology to provide effective protection against occasional adverse events.

Parachutes and the military industrial complex

However sinister doctors may be, there are powers at large that are even more evil. The parachute industry has earned billions of dollars for vast multinational corporations whose profits depend on belief in the efficacy of their product. One would hardly expect these vast commercial concerns to have the bravery to test their product in the setting of a randomised

The parachute and the healthy cohort effect

One of the major weaknesses of observational data is the possibility of bias, including selection bias and reporting bias, which can be obviated largely by using randomised controlled trials. The relevance to parachute use is that individuals jumping from aircraft without the help of a parachute are likely to have a high prevalence of pre-existing psychiatric morbidity. Individuals who use parachutes are likely to have less psychiatric morbidity and may also differ in key demographic factors, such as income and cigarette use. It follows, therefore, that the apparent protective effect of parachutes may be merely an example of the "healthy cohort" effect. Observational studies typically use multivariate analytical approaches, using maximum likelihood based modelling methods to try to adjust estimates of relative risk for these biases. Distasteful as these statistical adjustments are for the cognoscenti of evidence based medicine, no such analyses exist for assessing the presumed effects of the parachute.

The medicalisation of free fall

It is often said that doctors are interfering monsters obsessed with disease and power, who will not be satisfied until they control every aspect of our lives (*Journal of Social Science*, pick a volume). It might be argued that the pressure exerted on individuals to use parachutes is yet another example of a natural, life enhancing experience being turned into a situation of fear and dependency. The widespread use of the parachute may just be another example of doctors' obsession with disease prevention and their misplaced belief in unproved controlled trial. Moreover, industry sponsored trials are more likely to conclude in favour of their commercial product,[11] and it is unclear whether the results of such industry sponsored trials are reliable.

A call to (broken) arms

Only two options exist. The first is that we accept that, under exceptional circumstances, common sense might be applied when considering the potential risks and benefits of interventions. The second is that we continue our quest for the holy grail of exclusively evidence based interventions and preclude parachute use outside the context of a properly conducted trial. The dependency we have created in our population may make recruitment of the unenlightened masses to such a trial difficult. If so, we feel assured that those who advocate evidence based medicine and criticise use of interventions that lack an evidence base will not hesitate to demonstrate their commitment by volunteering for a double blind, randomised, placebo controlled, crossover trial.

Contributors: GCSS had the original idea. JPP tried to talk him out of it. JPP did the first literature search but GCSS lost it. GCSS drafted the manuscript but JPP deleted all the best jokes. GCSS is the guarantor, and JPP says it serves him right.

Funding: None.

Competing interests: None declared.

Ethical approval: Not required.

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