DIU « le Sommeil et sa Pathologie »

SAOS de l'enfant: épidémiologie, pathophysiologie, clinique, complications et traitement

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SFRMS Société Française de Recherche et Médecine du Sommeil

SPLF SOCIÉTÉ DE PNEUMOLOGIE DE LANGUE FRANÇAISE

Liens d’intérêt

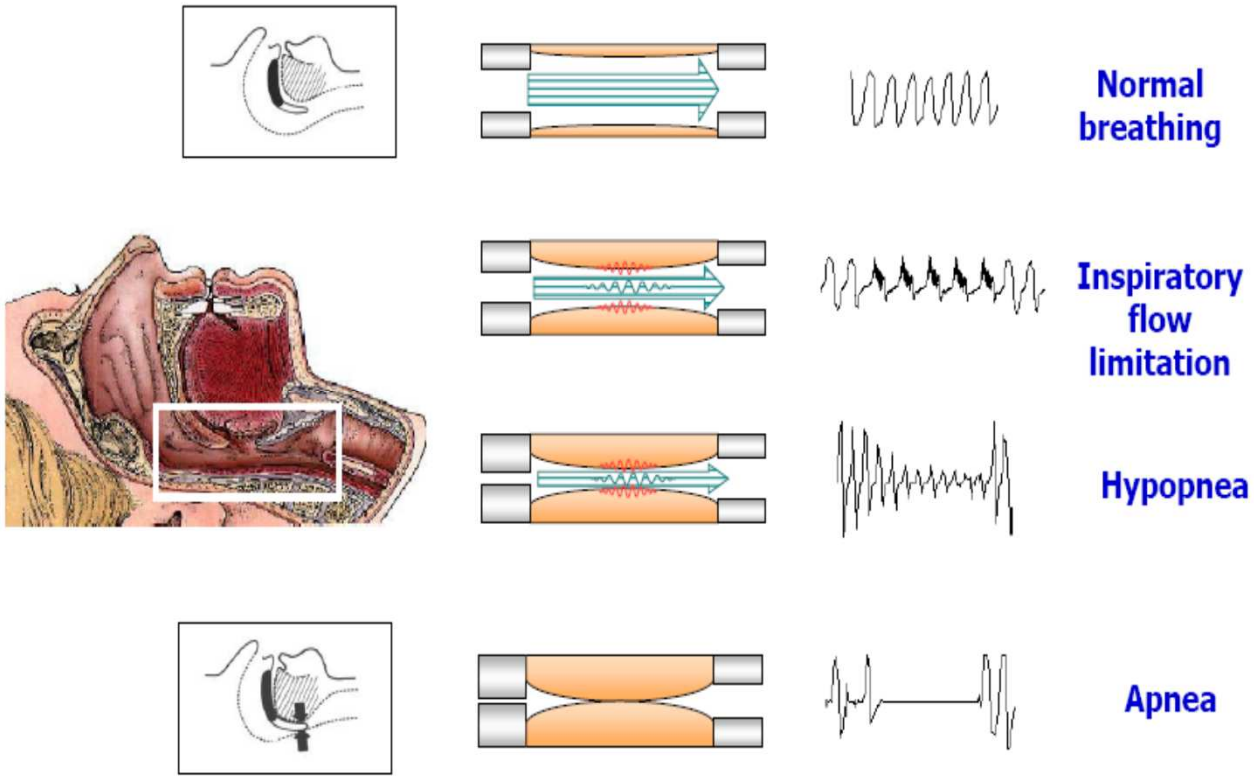
Période 2013-2019	Industrie pharmaceutique, prestataire, fabriquant
Coordonnateur études	non
Investigateur études	ASV Santé, S2A, ADEP Assistance, Elivie
Consultant	Cidelec, SenTec, Respironics
Invitation à des congrès	Cidelec, S2A, Elivie
Orateur rémunéré	Cidelec, SenTec
Actionnaire	non

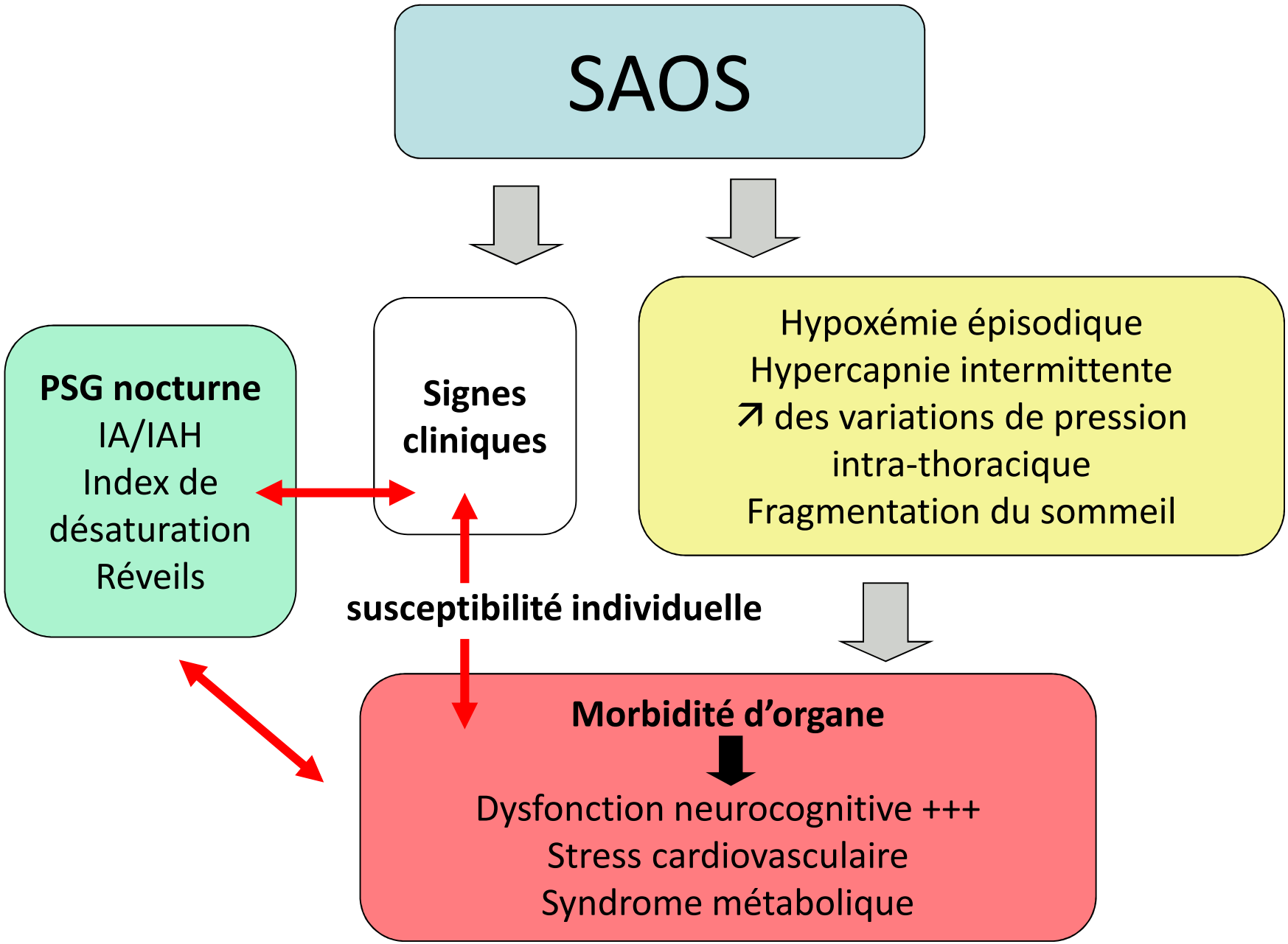
Objectifs du cours

- Connaître: les 3 types de SAOS de l'enfant avec leur particularités
  - Épidémiologiques
  - Pathophysiologiques
  - Symptômes et signes cliniques
  - Complications
  - Prise en charge

Définition du SAOS

Episodes répétés d'obstruction des voies aériennes supérieures (VAS) pendant le sommeil




SAOS
PSG nocturne
IA/IAH
Index de
désaturation
Réveils
Signes
cliniques
Hypoxémie épisodique
Hypercapnie intermittente
↗ des variations de pression
intra-thoracique
Fragmentation du sommeil
susceptibilité individuelle
Morbidité d'organe
Dysfonction neurocognitive +++
Stress cardiovasculaire
Syndrome métabolique

3 phénotypes de SAOS

- Type 1: hypertrophie adéno-amygdalienne
- Type 2: obésité
- Type 3: malformation et/ou étroitesse anatomique des voies aériennes

SAOS de type 1

Hypertrophie adéno-amygdalienne

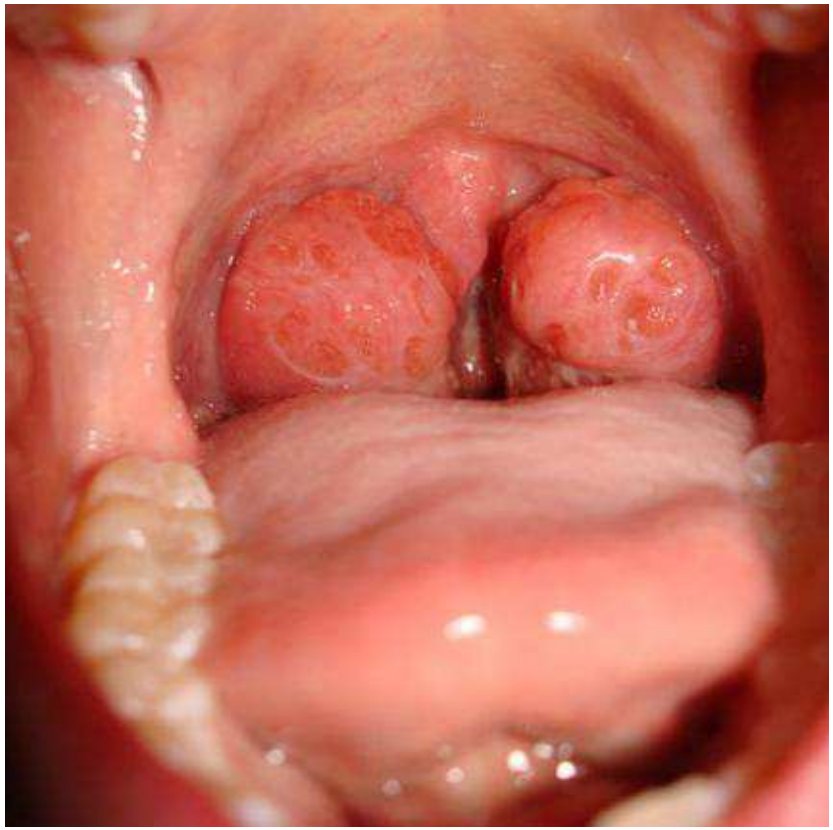
- Fréquence : 1 à 4% des enfants
- Pic de fréquence : 3 à 5 ans
- Pathophysiologie: hypertrophie adéno-amygdalienne
- Symptômes et signes cliniques

Symptômes du SAOS de l'enfant

Signes nocturnes	Signes à l'éveil
ronflement pauses respiratoires sueurs nycturie parasomnie sommeil agité position anormale pendant le sommeil (tête en hyperextension)	difficultés de réveil irritabilité, hyperactivité, troubles de l'attention et de la mémoire asthénie, somnolence diurne céphalées ou vomissements anorexie au petit déjeuner respiration buccale troubles de la croissance (tardifs)

« Amygdalectomie de l'enfant »
Recommandation pour la pratique clinique, SFORL 2009 - 2010

Examen clinique



Version française (adapté de Spruyt-Gozal 2012)

Merci de cocher pour tous les items suivants (sauf question 5)

0 si la fréquence, au cours des 6 derniers mois, de l'évènement est : « jamais »
1 « rare » (1 nuit par semaine) **2 « occasionnelle » (2 nuits)**
3 « fréquente » (3 à 4 nuits) **4 « quasi toujours » (plus de 4 nuits)**

Q1. Avez-vous déjà été obligé de secouer votre enfant dans son sommeil pour qu'il se remette à respirer ?

0 1 2 3 4

Q2. Est-ce que votre enfant s'arrête de respirer pendant son sommeil ?

0 1 2 3 4

Q3. Est-ce que votre enfant a des difficultés pour respirer pendant son sommeil ?

0 1 2 3 4

Q4. Est-ce que la respiration de votre enfant pendant son sommeil a déjà été un motif d'inquiétude pour vous ?

0 1 2 3 4

Q5.*Quel est l'intensité du bruit de son ronflement ?

0 1 2 3 4

•On utilise les valeurs suivantes 0 légèrement perceptible ou faible,1 modérément fort, 2 fort, 3 très fort, 4 extrêmement fort

Q6. A quelle est la fréquence votre enfant ronfle-t-il ?

0 1 2 3 4

Nguyen XL, Sleep Medicine 2016

96 enfants ronfleurs
2.5 à 13 ans

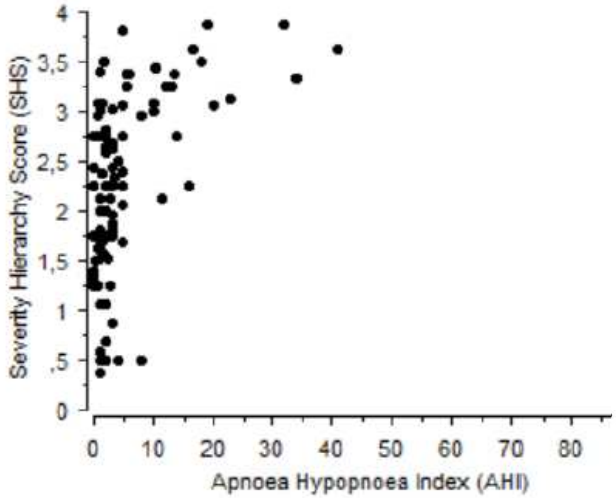


Table 2. Characteristics of the children according to the presence (apnoea-hypopnoea index ≥5/hrsTST) or absence of obstructive sleep apnoea syndrome.

	OSAS+ (*n*=28)	OSAS– (*n*=68)	*p*
Age (years)	6.5±2.5	7.3±2.3	0.06
BMI *z*-score	–0.2±1.7	0.04±1.4	0.59
SHS	3.1±0.7	1.9±0.9	<0.0001
AHI (/hrsTST)	16.5±17.1	1.8±1.3	<0.0001
ODI (/hrsTST)	12.5±19.3	1.0±1.3	<0.0001
TST (minutes)	524±57.5	505.9±71.1	0.44

Table 3. Cut-off value for the severity hierarchy score yielding optimal prediction of obstructive sleep apnoea syndrome (AHI ≥5/hrsTST)

SHS value	Sensitivity (%)	Specificity (%)	PPV (%)	PVN (%)
2.75	82.1	80.9	63.9	91.7
95% CI	74.4-89.8	73.0-88.8	54.3-73.5	86.2-97.2

SHS, severity hierarchy score; PPV, positive predictive value; NPV, negative predictive value; CI, confidence intervals.

Nguyen XL, Sleep Medecine 2016

L'exploration du sommeil n'est pas systématique

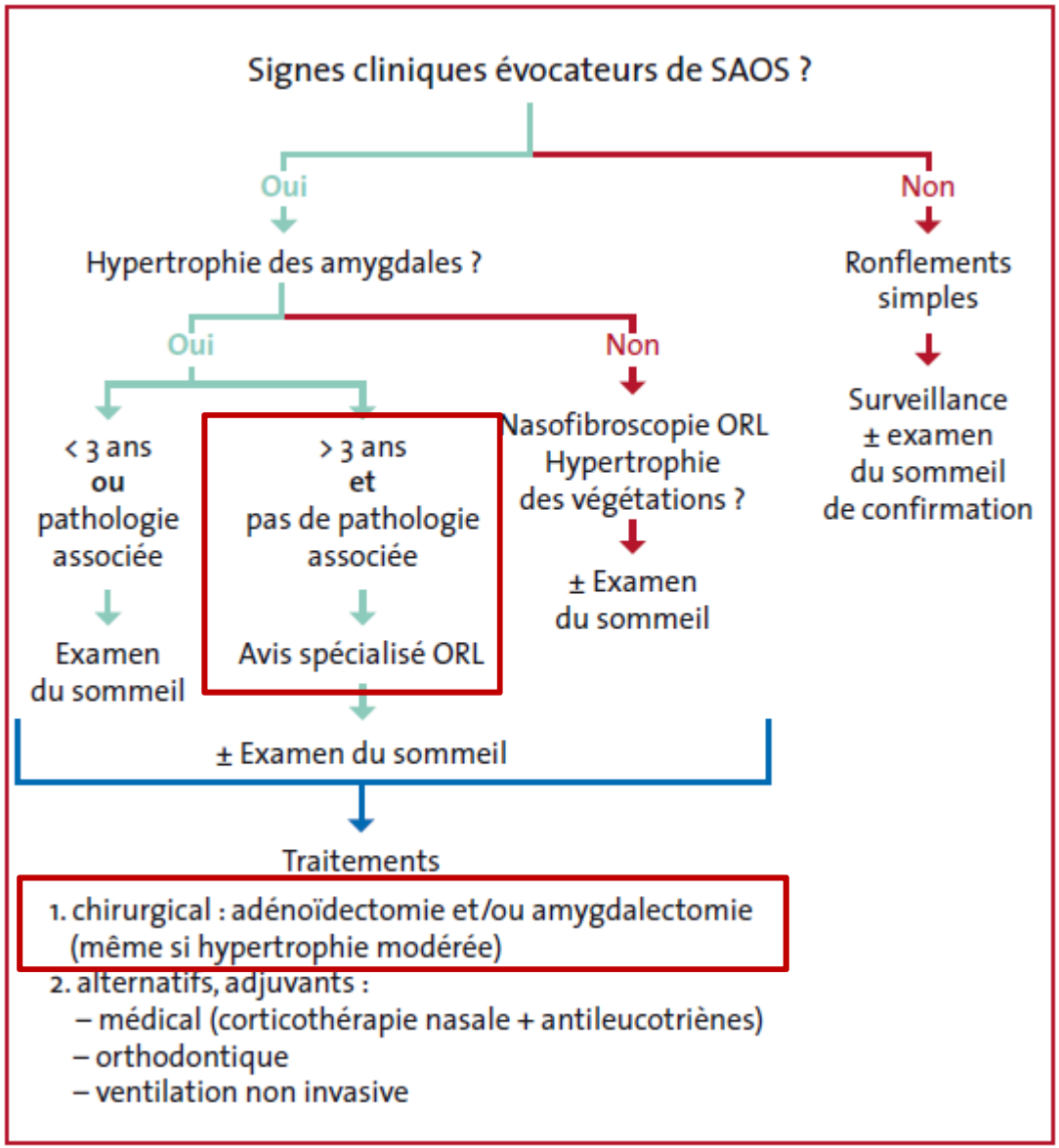
1. L'amygdalectomie risque de ne pas être suffisante pour corriger le trouble obstructif du sommeil : pathologie associée: obésité morbide, anomalie cranio-faciale ou des voies aériennes supérieures, maladie neuromusculaire.
2. Existence d'une discordance entre l'examen clinique et les troubles respiratoires: absence d'obstacle amygdalien ou adénoidien
3. Enfant âgé de moins de 3 ans
4. Existence d'un risque opératoire élevé: troubles de l'hémostase, anomalie cardiaque

« Amygdalectomie de l'enfant »
Recommandation pour la pratique clinique, SFORL 2009 - 2010

Complications du SAOS de l'enfant

- Dysfonction neurocognitive +++
  - Troubles de concentration et de la mémoire
- Troubles du comportement +++
  - Irritabilité, hyperactivité
- Stress cardiovasculaire
  - HTA
- Syndrome métabolique

Algorithme thérapeutique



Efficacité de la chirurgie ORL

464 enfants, 5 à 9 ans avec SAOS défini par IAH ≥ 2 ou un IAO ≥ 1
Cas sévères (IAH ≥ 30 ou IAO ≥ 20 ou SpO_2 < 90 ≥ 2% du temps) exclus

Table 2. Outcome Measures.*

Outcome	Normative Mean	Watchful Waiting		Early Adenotonsillectomy		Effect Size†	P Value
		Baseline	Change from Baseline to 7 Mo	Baseline	Change from Baseline to 7 Mo		
Primary outcome							
NEPSY attention and executive-function score‡	100±15	101.1±14.6	5.1±13.4	101.5±15.9	7.1±13.9	0.15	0.16
Secondary outcomes							
Conners' Rating Scale score§	50±10						
Caregiver rating		52.6±11.7	−0.2±9.4	52.5±11.6	−2.9±9.9	0.28	0.01
Teacher rating		55.1±12.8	−1.5±10.7	56.4±14.4	−4.9±12.9	0.29	0.04
BRIEF score¶	50±10						
Caregiver rating		50.1±11.5	0.4±8.8	50.1±11.2	−3.3±8.5	0.28	<0.001
Teacher rating		56.4±11.7	−1.0±11.2	57.2±14.1	−3.1±12.6	0.18	0.22
PSQ-SRBD score‖	0.2±0.1	0.5±0.2	−0.0±0.2	0.5±0.2	−0.3±0.2	1.50	<0.001
PedsQL score**	78±16	76.5±15.7	0.9±13.3	77.3±15.3	5.9±13.6	0.37	<0.001
Apnea–hypopnea index — no. of events/hr††	NA						
Median		4.5	−1.6	4.8	−3.5	0.57	<0.001‡‡
Interquartile range		2.5 to 8.9	−3.7 to 0.5	2.7 to 8.8	−7.1 to −1.8		

comportement

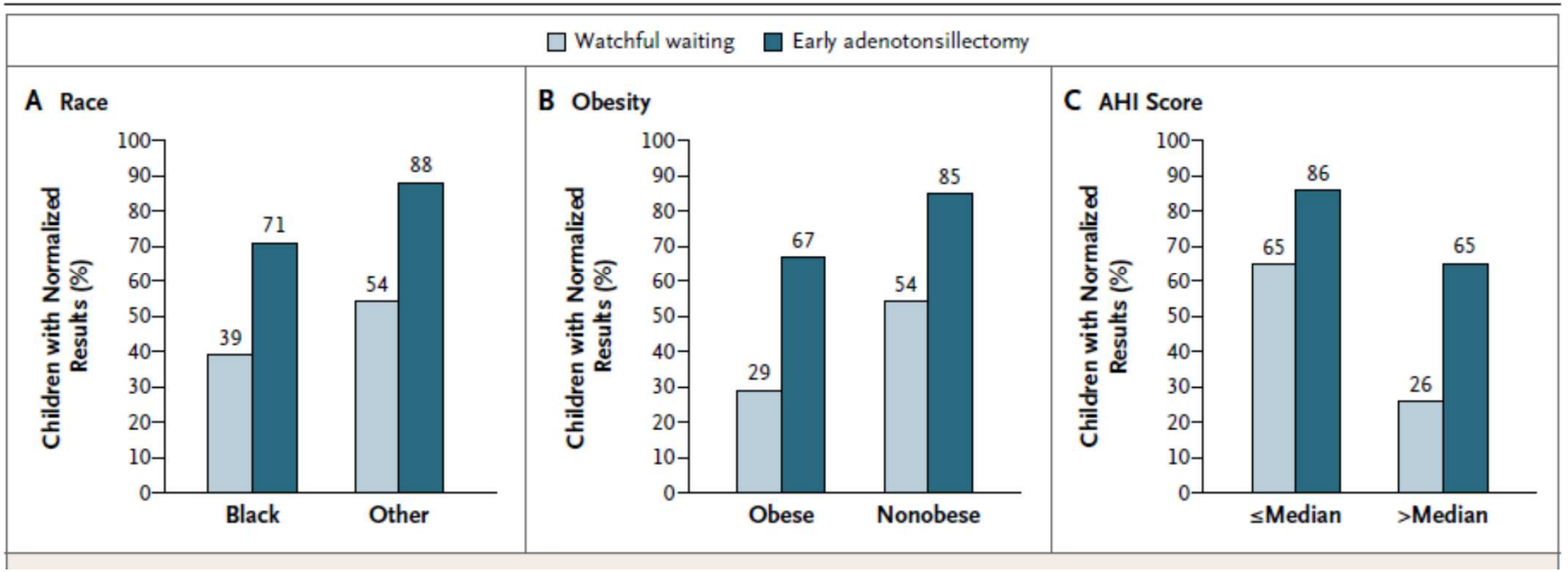
comportement

quest. TRS

Marcus *et al.* NEJM 2013

Bénéfices de l'amygdalectomie

Amélioration de la PSG



Marcus *et al.* NEJM 2013

Efficacité d'un traitement anti-inflammatoire dans le SAOS résiduel modéré

Children with residual sleep apnea after tonsillectomy and adenoidectomy	12 weeks montelukast + intranasal steroids n=22		No treatment n=14	
	Pre treatment	Post treatment	Pre placebo	Post placebo
respiratory arousal index	4.6 ± 0.6	0.8 ± 0.3*	4.7 ± 0.7	5.9 ± 1.3
apnea index	1.9 ± 0.3	0.1 ± 0.3*	1.7 ± 0.2	2.4 ± 0.5
obstructive AHI	3.9 ± 1.2	0.3 ± 0.3*	3.6 ± 1.4	4.7 ± 1.5
nadir SpO_2 (%)	87.3 ± 3.1	92.5 ± 3.0*	87.4 ± 3.4	84.0 ± 4.9

Kheirandish *et al.* Pediatrics 2006;117:e61

Conduite thérapeutique selon le type de SAOS

- Type 1: hypertrophie adéno-amygdalienne
- Type 2: obésité
- Type 3: malformation et/ou étroitesse anatomique des voies aériennes

SAOS de type 2

Obésité

- Fréquence du SAOS : 10 à 60%
- Pic de fréquence : adolescent et enfant
- Pathophysiologie: hypertrophie adéno-amygdalienne
- Signes cliniques : somnolence > hyperactivité

The prevalence, anatomical correlates and treatment of sleep-disordered breathing in obese children and adolescents

Stijn L. Verhulst [a,*], Luc Van Gaal [b], Wilfried De Backer [c], Kristine Desager [a]

Sleep Medicine Reviews (2008) 12, 339–346

Table 1 Studies assessing the prevalence of obstructive sleep apnea syndrome by polysomnography in obese children and adolescents

Refs.	Subject characteristics	Obesity	OSAS	Prevalence of OSAS (%)
Mallory et al.[21]	45 subjects, mean age of 10.3 years (SD=4.4), average ideal body weight was 208% (SD=42.2); all had a history suggesting abnormal breathing during sleep, referred to a sleep clinic	Ideal body weight >150%	AHI>5	24
Silvestri et al.[22]	32 subjects, mean age of 8.6 years (SD=3.3), average ideal body weight was 196% (SD=45%); all had a history suggesting abnormal breathing during sleep	Weight >95th percentile or ideal body weight >120% or BMI >90th percentile	Occurrence of ≥1 obstructive apnea	59
Marcus et al.[24]	22 subjects, mean age of 10 years (SD=5), average ideal body weight was 184% (SD=36%); none presented with sleep or respiratory complaints, referred to routine patient care	Ideal body weight >120%	OAI>1, and/or desaturation and/or hypercapnia	36
Chay et al.[23]	60 subjects; recruited from a pediatric obesity clinic	Ideal body weight ≥180%	AHI>5	13
Wing et al.[26]	46 subjects; mean age of 10.8 years (SD=2.3), average BMI was 27.4 kg/m^2 (SD=5.1); recruited from a pediatric obesity clinic	Ideal body weight ≥120%	OAI≥1	26.1
Verhulst et al.[25]	64 subjects; mean age of 11.2 years (SD=2.6), average BMI z-score was 2.3 (SD=0.5); recruited from a pediatric obesity clinic	International Obesity Task[28]	OAI≥1 and/or obstructive AHI≥2	19

Is there a clear link between overweight/obesity and sleep disordered breathing in children?

Mark J. Kohler*, Cameron J. van den Heuvel

Sleep Medicine Reviews (2008) 12, 347–361

Table 1 (*continued*)

Author	Referral source *N* (mean age ± SD)	Ethnicity	Definition of obesity	Inclusion criteria	% (*n*) Obese	% (*n*) obese with OAHI ≥ 5	Rel^{n} between obesity and SDB severity
Silvestri et al.[41]	SIDS clinic 32 (8.6 ± 3.3 y)	41% (13/32) AA 22% (7/32) Caucasian 34% (11/31) Hispanic 3% (1/32) Asian	IBW > 120% and BMI > 90th percentile	Obesity and SDB	100% (32/32)	59% (19/32) apnea and 66% (21/32) hypopnea[a]	No significant association
Spilsbury et al.[47]	Community 803 Control (9.5 ± 0.8 y) 40 OSAS (9.3 ± 0.9 y)	36% (390/843) AA 64% (453/843) Other	BMI > 95th percentile	Random community sample	15.7% (132/843)	Not reported	OR obesity to OAHI ≥ 5 = 1.47
Stepanski et al.[37]	Hospital clinic 196 (5.9 ± 3.7 y)	68% (133/196) AA 12% (24/196) Caucasian 19% (37/196) Hispanic 1% (2/196) Arabic	BMI > 95th percentile	SDB	28% (55/196)	NR	Non-SDB BMI < SDB BMI (only for children > 8 y)
Verhulst et al.[49]	Obesity clinic 91 (11.2 ± 2.6 y)	NR	BMI > 95th percentile	Overweight and obesity	70% (64/91)	8% of obese (5/64) 22% of overweight (6/27)	No significant association
Wing et al.[55]	Obesity clinic/community 46 Obese (10.8 ± 2.3 y) 44 Control (11.7 ± 2.1 y)	100% Chinese	IBW ≥ 120%	Obesity (obese group only)	51% (46/90)	15% (7/46)	OR obesity to RDI ≥ 5 = 1.2
Xu et al.[46]	Hospital clinics 99 Non-obese (8.9 ± 1.8 y) 99 Obese (9.2 ± 1.5 y)	100% Chinese	BMI *z*-score > 1.96	Obesity (obese group only)	50% (99/198)	78% (77/99) (AHI > 5 or OAI > 1)	Obesity correlated with AHI (r = 0.54)

⇨ Pas d'association claire entre obésité, IAHO et RDI

The prevalence, anatomical correlates and treatment of sleep-disordered breathing in obese children and adolescents

Stijn L. Verhulst [a,*], Luc Van Gaal [b], Wilfried De Backer [c], Kristine Desager [a]

Meilleure corrélation avec la SpO_2 minimale

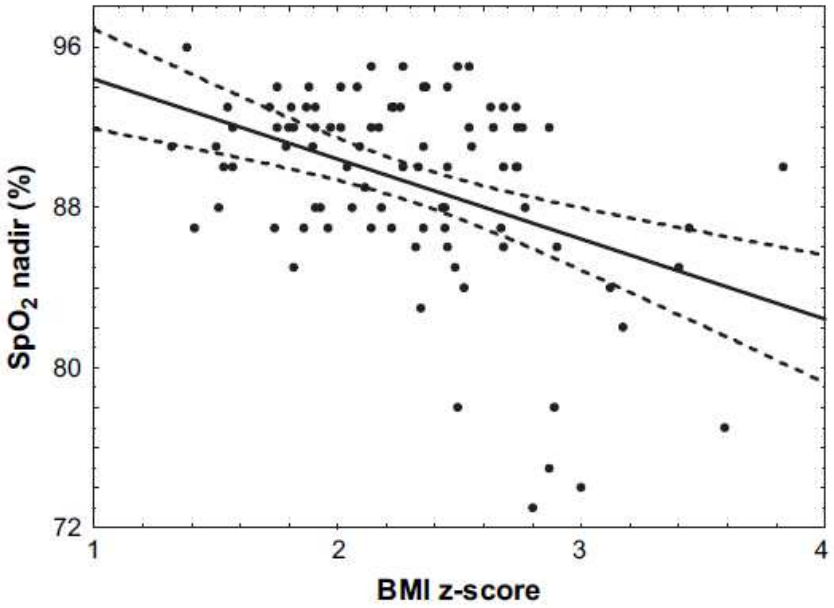


Figure 1 The degree of obesity is associated with the severity of desaturation during sleep (r=−0.43; p=0.00003).[25]

Et l'obésité abdominale

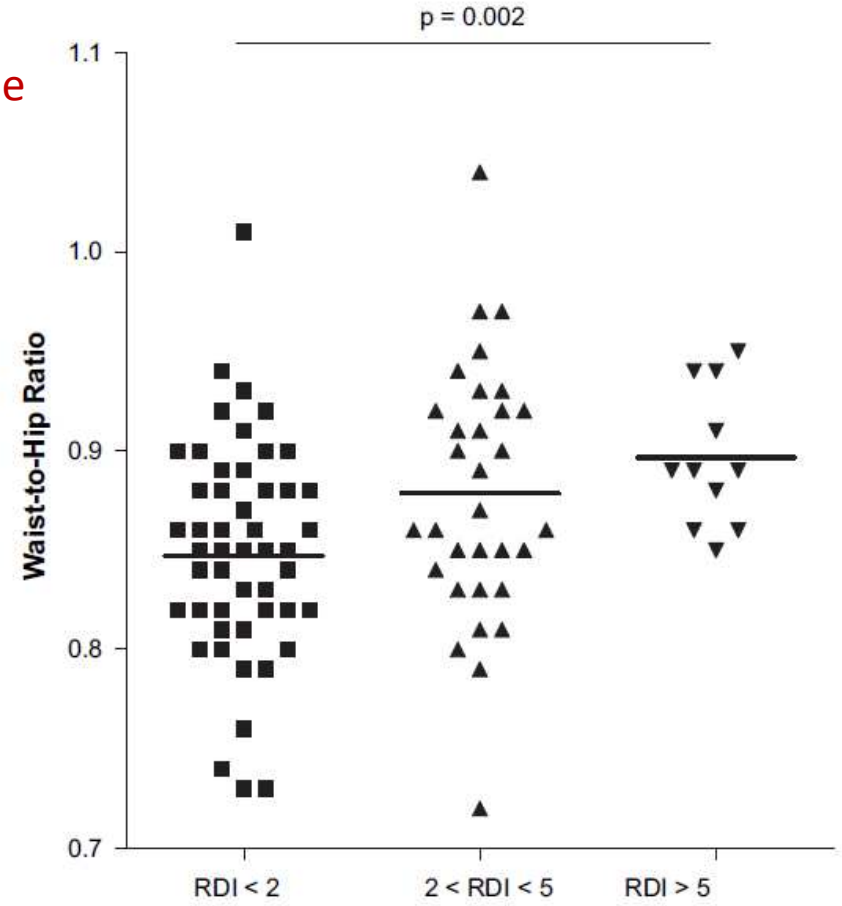


Figure 2 The severity of sleep-disordered breathing is associated with abdominal obesity, as expressed by the waist-to-hip ratio (RDI=respiratory disturbance index).[5]

Sleep Medicine Reviews (2008) 12, 339—346

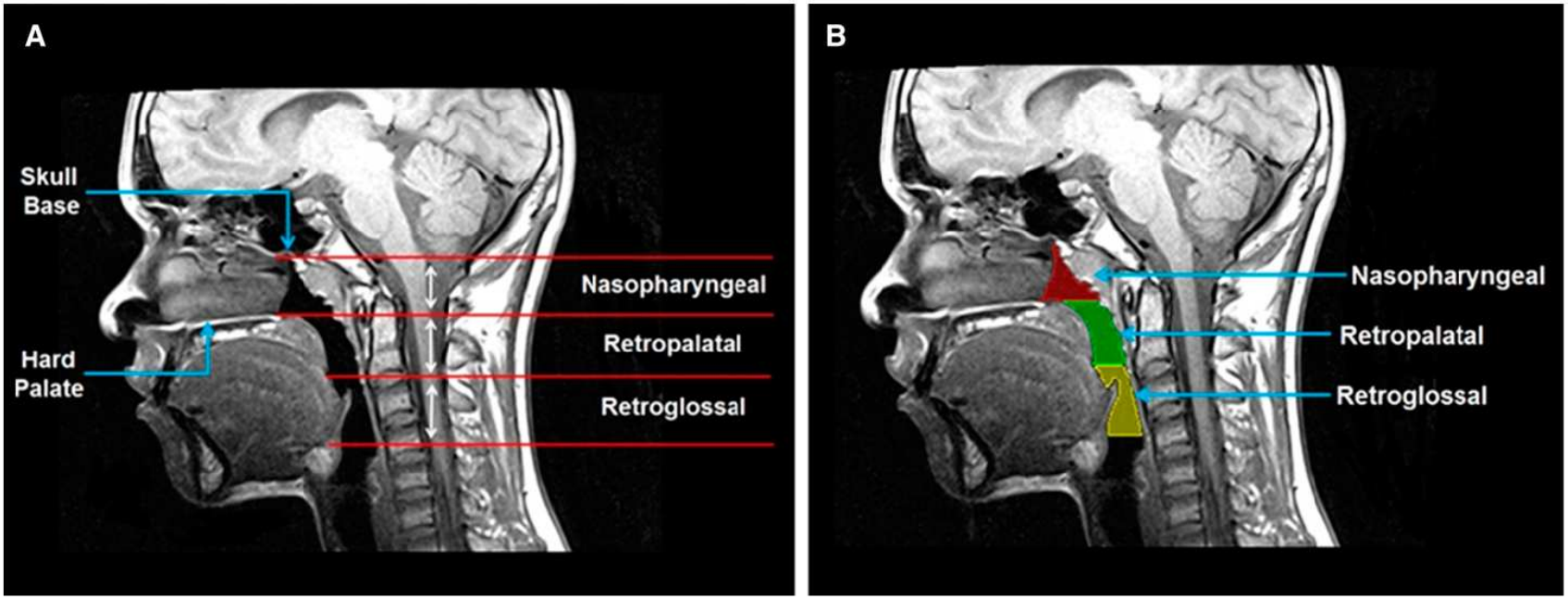
Understanding the Anatomic Basis for Obstructive Sleep Apnea Syndrome in Adolescents

Richard J. Schwab[1], Christopher Kim[1], Sheila Bagchi[1], Brendan T. Keenan[1], François-Louis Comyn[1], Stephen Wang[1], Ignacio E. Tapia[1,2], Shirley Huang[3], Joel Traylor[1,2], Drew A. Torigian[4], Ruth M. Bradford[1,2], and Carole L. Marcus[1,2]

Am J Respir Crit Care Med Vol 191, Iss 11, pp 1295–1309, Jun 1, 2015

Adolescents avec (n= 49) et sans SAOS (obèses, n=38 et non obèses, n=50) de 12 à 16 ans

PSG + IRM avec 4 analyses: voies aériennes, tissus mous, VG et amygdales, os



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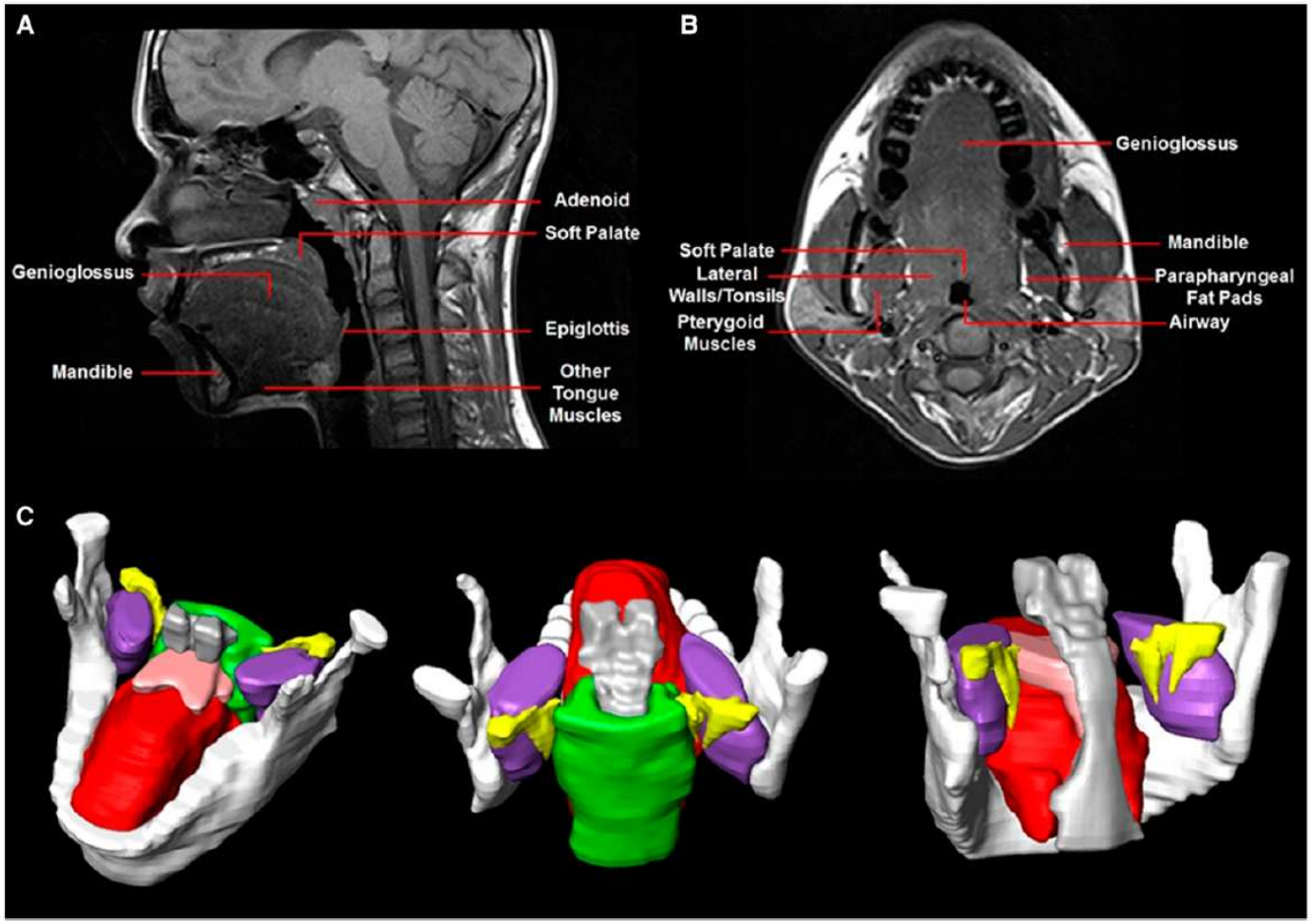
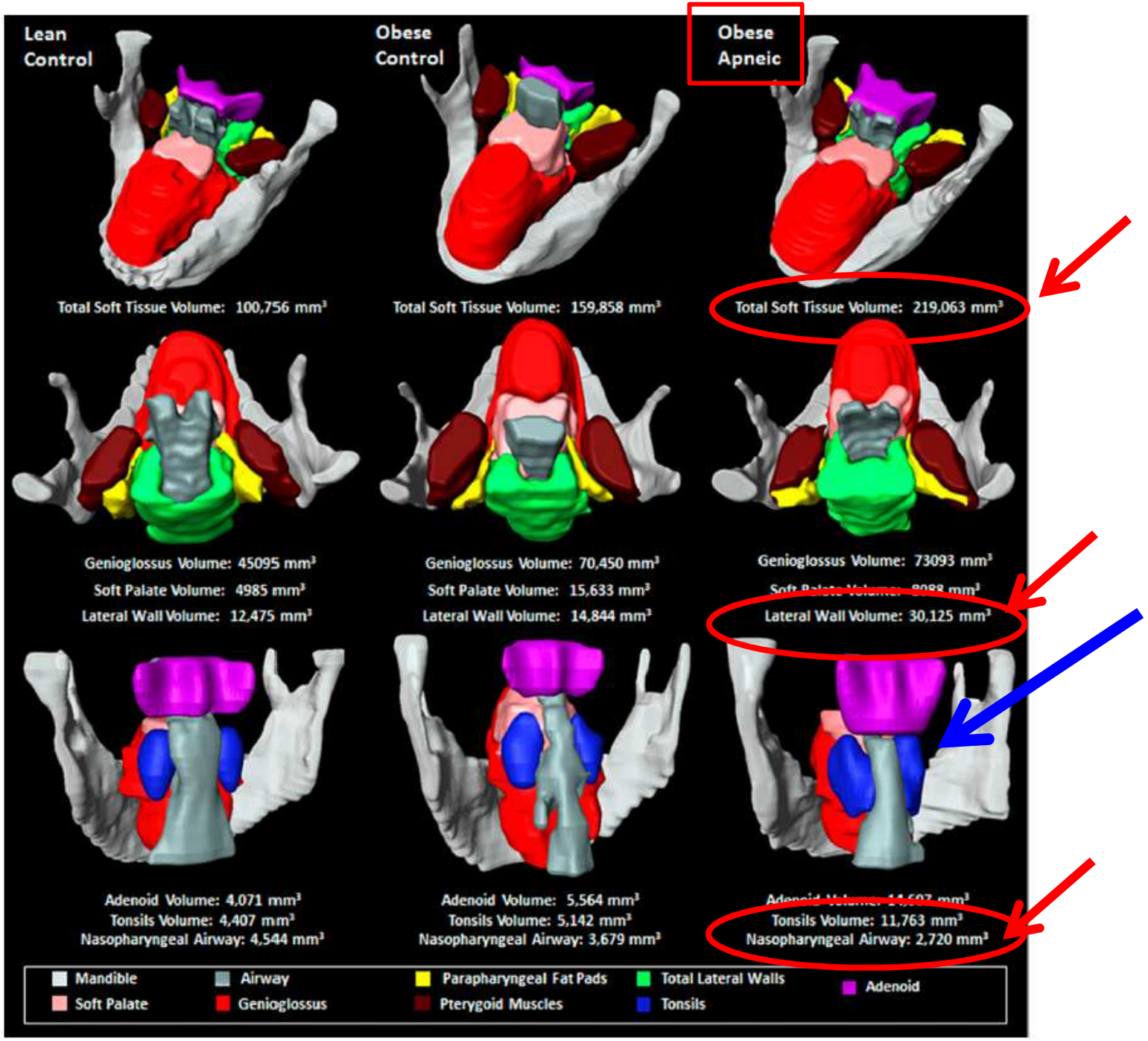
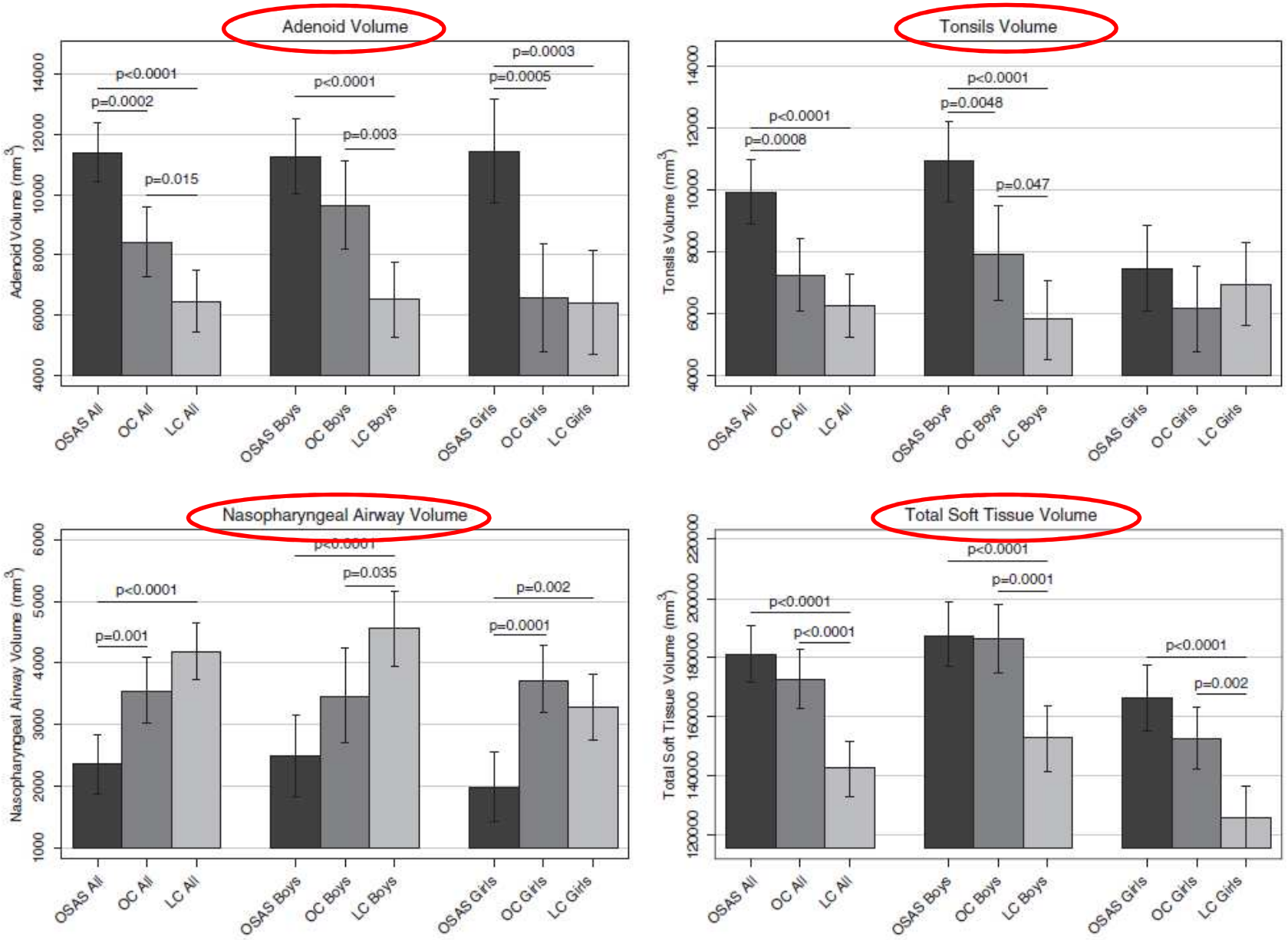


Palais mou
Graisse parapharyngée
Parois pharyngées
Genioglosse
Muscles pterygoidiens
Voies aériennes


Lean Control
Obese Control
Obese Apneic
Total Soft Tissue Volume: 100,756 mm³
Total Soft Tissue Volume: 159,858 mm³
Total Soft Tissue Volume: 219,063 mm³
Genioglossus Volume: 45095 mm³
Soft Palate Volume: 4985 mm³
Lateral Wall Volume: 12,475 mm³
Genioglossus Volume: 70,450 mm³
Soft Palate Volume: 15,633 mm³
Lateral Wall Volume: 14,844 mm³
Genioglossus Volume: 73093 mm³
Lateral Wall Volume: 30,125 mm³
Adenoid Volume: 4,071 mm³
Tonsils Volume: 4,407 mm³
Nasopharyngeal Airway: 4,544 mm³
Adenoid Volume: 5,564 mm³
Tonsils Volume: 5,142 mm³
Nasopharyngeal Airway: 3,679 mm³
Tonsils Volume: 11,763 mm³
Nasopharyngeal Airway: 2,720 mm³
Mandible
Soft Palate
Airway
Genioglossus
Parapharyngeal Fat Pads
Pterygoid Muscles
Total Lateral Walls
Tonsils
Adenoid


Adenoid Volume
Adenoid Volume (mm3)
4000
6000
8000
10000
12000
14000
p<0.0001
p=0.0002
p=0.015
p<0.0001
p=0.003
p=0.0003
p=0.0005
OSAS All
OC All
LC All
OSAS Boys
OC Boys
LC Boys
OSAS Girls
OC Girls
LC Girls
Tonsils Volume
Tonsils Volume (mm3)
4000
6000
8000
10000
12000
14000
p<0.0001
p=0.0008
p<0.0001
p=0.0048
p=0.047
OSAS All
OC All
LC All
OSAS Boys
OC Boys
LC Boys
OSAS Girls
OC Girls
LC Girls
Nasopharyngeal Airway Volume
Nasopharyngeal Airway Volume (mm3)
1000
2000
3000
4000
5000
6000
p<0.0001
p=0.001
p<0.0001
p=0.035
p=0.002
p=0.0001
OSAS All
OC All
LC All
OSAS Boys
OC Boys
LC Boys
OSAS Girls
OC Girls
LC Girls
Total Soft Tissue Volume
Total Soft Tissue Volume (mm3)
120000
140000
160000
180000
200000
220000
p<0.0001
p<0.0001
p<0.0001
p=0.0001
p<0.0001
p=0.002
OSAS All
OC All
LC All
OSAS Boys
OC Boys
LC Boys
OSAS Girls
OC Girls
LC Girls

Understanding the Anatomic Basis for Obstructive Sleep Apnea Syndrome in Adolescents

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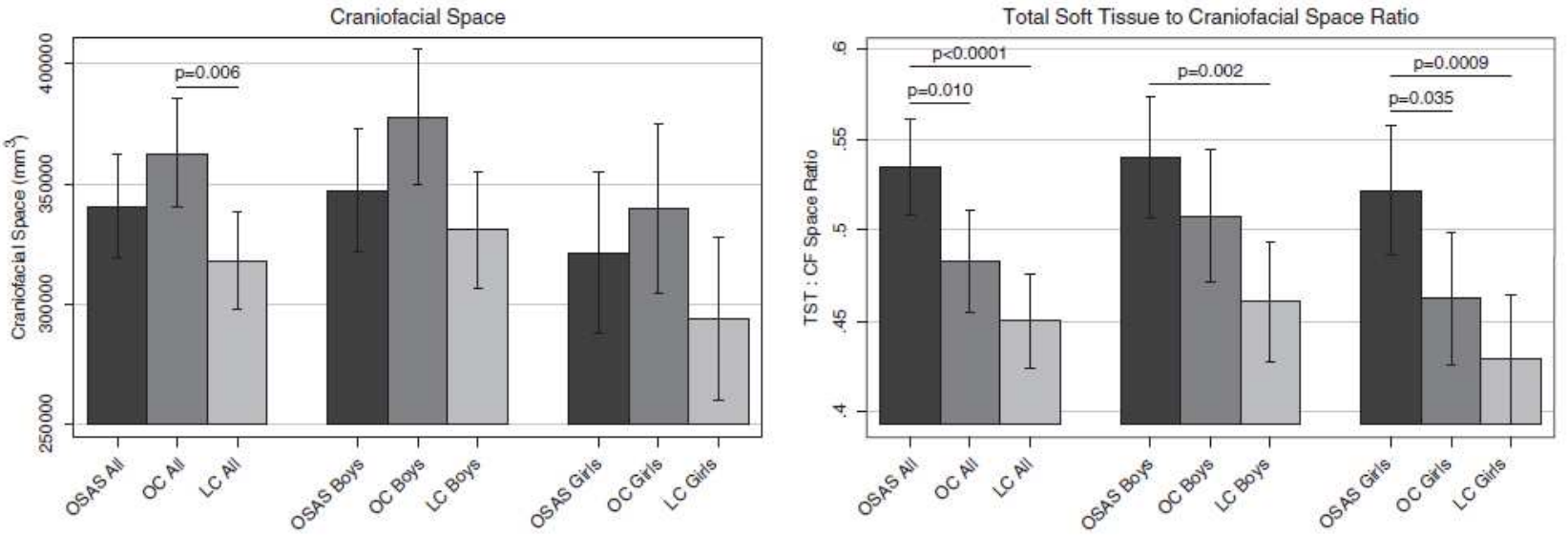


- L'augmentation de la taille des tissues lymphoides pharyngés est le facteur de risque anatomique principal chez l'adolescent obèse avec SAOS
- L'adéno-amygdalectomie constitue le TT de 1ère intention chez l'adolescent obèse + SAOS

Characteristics and Surgical and Clinical Outcomes of Severely Obese Children with Obstructive Sleep Apnea

Gulnur Com, MD[1]; John L. Carroll, MD[1]; Xinyu Tang, PhD[2]; Maria S. Melguizo, MS[2]; Charles Bower, MD[3]; Supriya Jambhekar, MD[1]

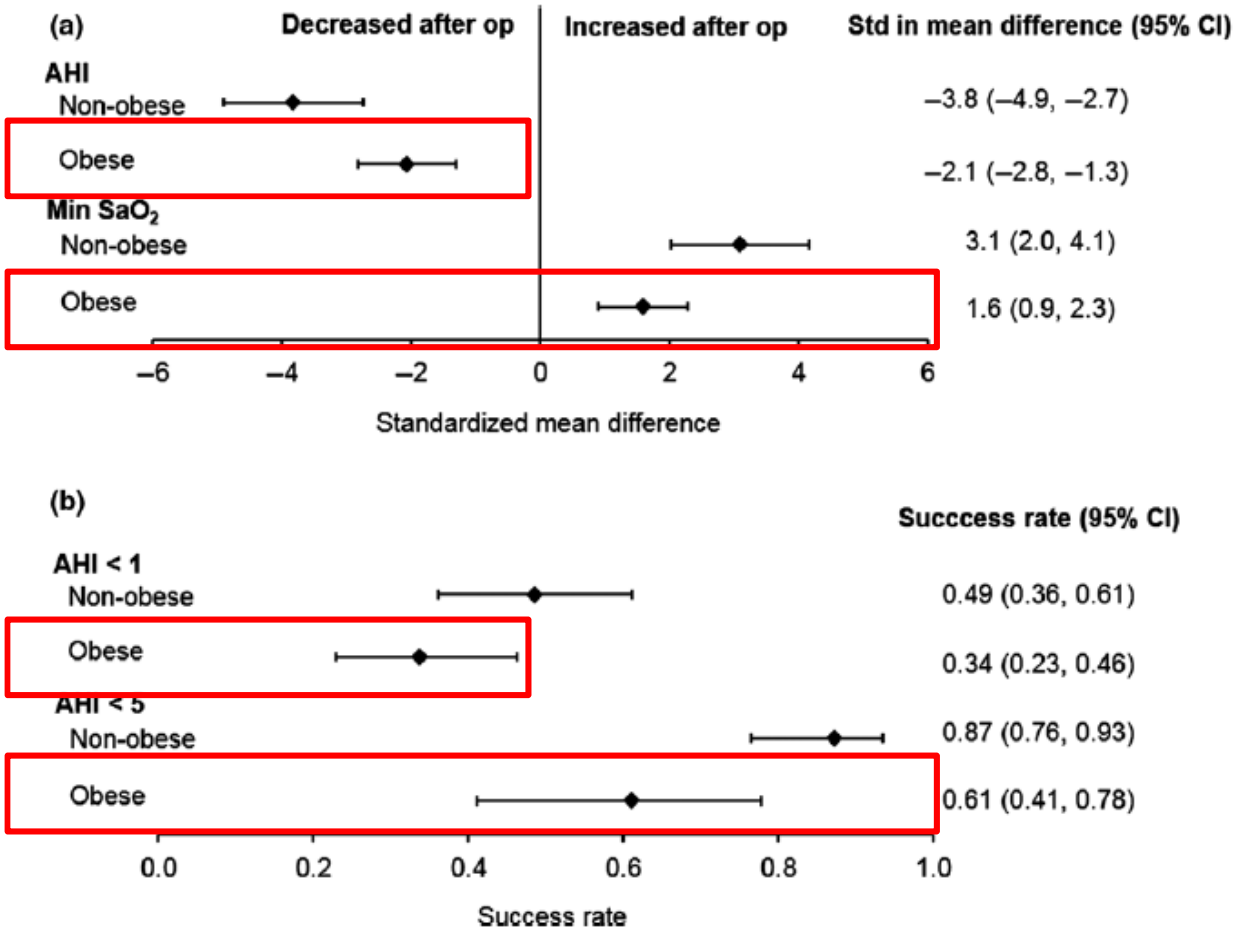
L'amygdalectomie est la chirurgie la plus efficace

	Postsurgery OSA					
	None	Mild	Moderate	Severe	Total	p value
Uvulopharyngopalatoplasty (UPPP) Only (n = 8)						
Presurgery severity						
Mild OSA	0% (0/0)	0% (0/0)	0% (0/0)	0% (0/0)	0% (0/8)	p = NS
Moderate OSA (2)	0% (0/2)	50% (1/2)	0% (0/2)	50% (1/2)	25% (2/8)	
Severe OSA (6)	17% (1/6)	0% (0/6)	0% (0/6)	83% (5/6)	75% (6/8)	
Tonsillectomy + Adenoidectomy (n = 23)						
Presurgery severity						
Mild OSA (4)	25% (1/4)	25% (1/4)	25% (1/4)	25% (1/4)	17% (4/23)	p = 0.008
Moderate OSA (6)	67% (4/6)	17% (1/6)	0% (0/6)	17% (1/6)	26% (6/23)	
Severe OSA (13)	23% (3/13)	38% (5/13)	31% (4/13)	8% (1/13)	57% (13/23)	
Adenoidectomy + UPPP (n = 11)						
Presurgery severity						
Mild OSA (1)	100% (1/1)	0% (0/1)	0% (0/1)	0% (0/1)	9% (1/11)	p = 0.317
Moderate OSA (1)	0% (0/1)	100% (1/1)	0% (0/1)	0% (0/1)	9% (1/11)	
Severe OSA (9)	11% (1/9)	0% (0/9)	11% (1/9)	78% (7/9)	82% (9/11)	
Tonsillectomy + Adenoidectomy + UPPP (n = 27)						
Presurgery severity						
Mild OSA (2)	0% (0/2)	0% (0/2)	0% (0/2)	100% (2/2)	7% (2/27)	p = 0.072
Moderate OSA (5)	20% (1/5)	0% (0/5)	40% (2/5)	40% (2/5)	19% (5/27)	
Severe OSA (20)	20% (4/20)	30% (6/20)	10% (2/20)	40% (8/20)	74% (20/27)	

Polysomnographic findings after adenotonsillectomy for obstructive sleep apnoea in obese and non-obese children: a systematic review and meta-analysis

Lee, C.-H.,*† Hsu, W.-C.,‡§ Chang, W.-H.,*§¶ Lin, M.-T.†‡** & Kang, K.-T.*†§

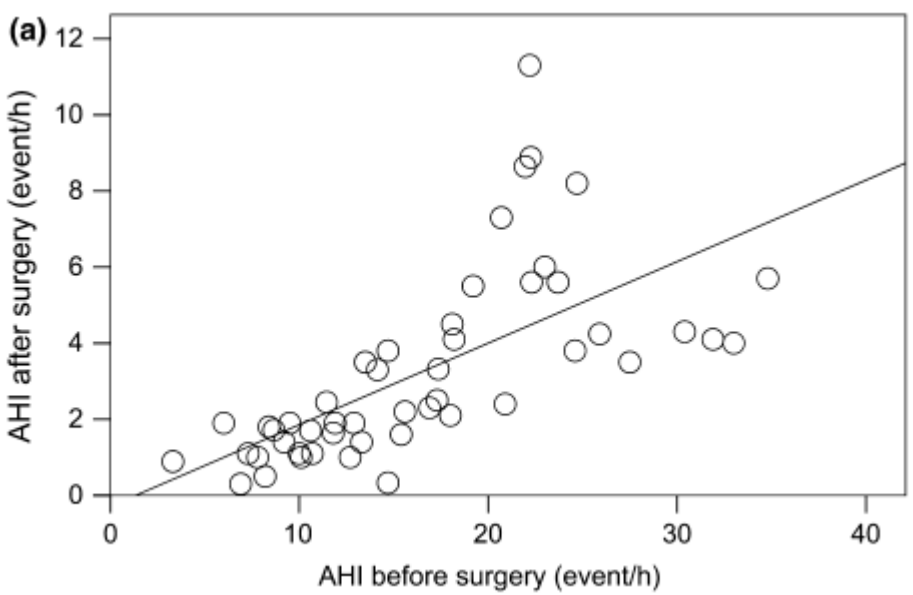
L'adéno-amygdalectomie est moins efficace chez l'enfant obèse

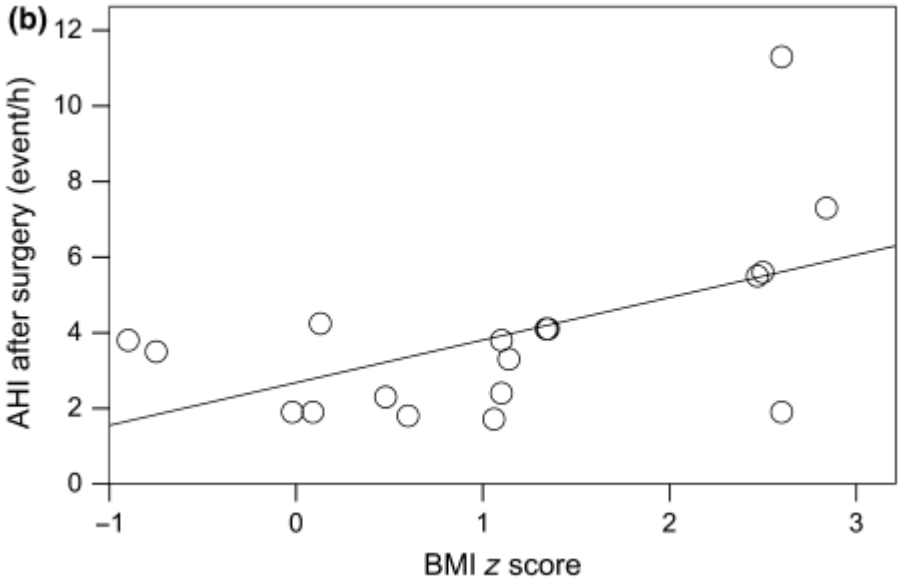


Polysomnographic findings after adenotonsillectomy for obstructive sleep apnoea in obese and non-obese children: a systematic review and meta-analysis

Lee, C.-H.,*† Hsu, W.-C.,‡§ Chang, W.-H.,*§¶ Lin, M.-T.†‡** & Kang, K.-T.*†§

L'adéno-amygdalectomie est moins efficace si IAH pré-op ou IMC ↗

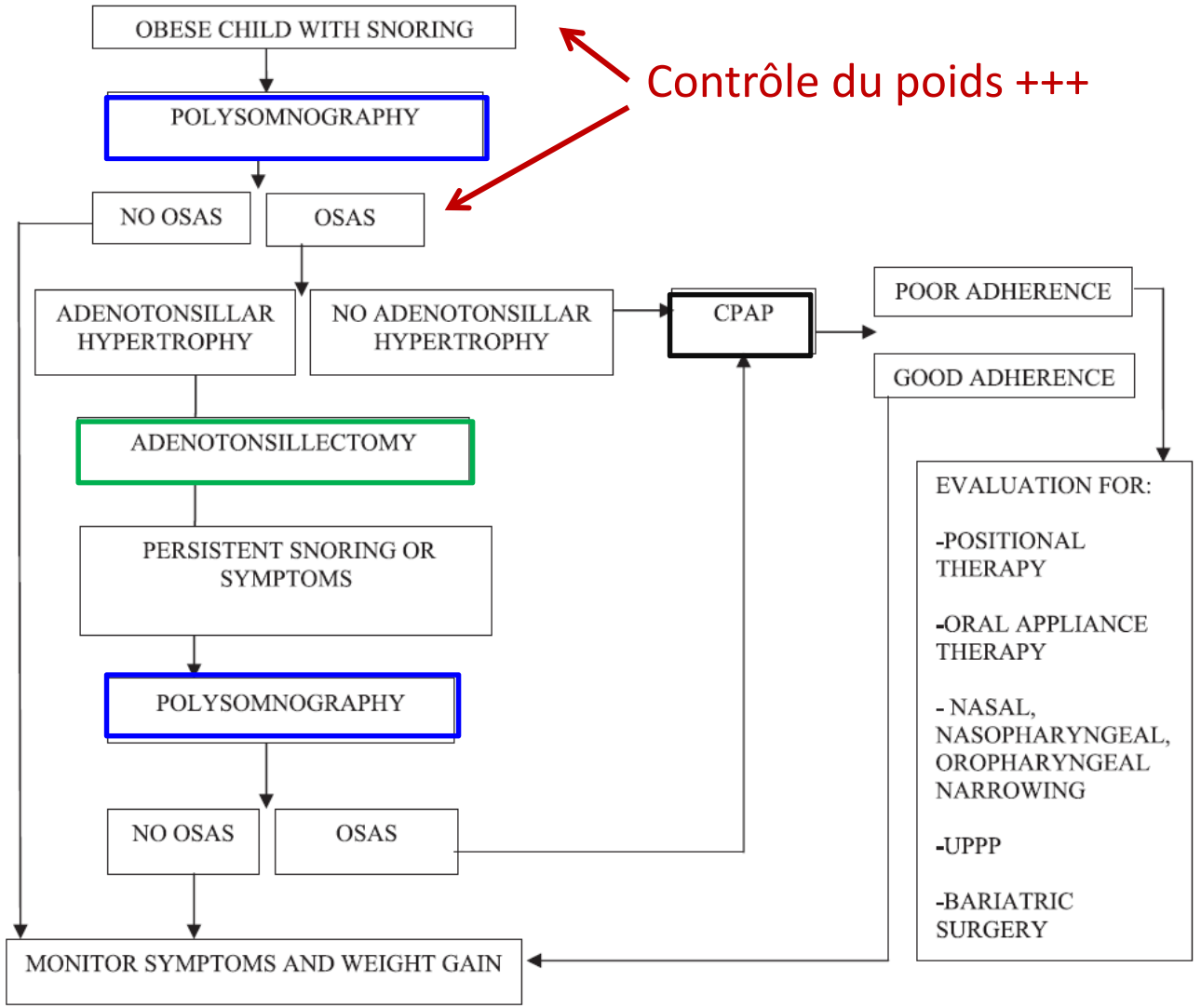




Childhood obesity and obstructive sleep apnea syndrome

Raanan Arens and Hiren Muzumdar

J Appl Physiol 108: 436–444, 2010.



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journal homepage: http://www.ijporlonline.com/

Review

Obstructive sleep apnea in obese children and adolescents, treatment methods and outcome of treatment – A systematic review

Ida Gillberg Andersen [a, b, *], Jens-Christian Holm [b, c], Preben Homøe [a, d]

Effect of behavioral weight loss intervention on OSA.

Authors	Type of study	No. of patients	Mean age (yr; range)	Type of sleep study	Definition of OSA	Definition of obesity	Prevalence of OSA	No. of OSA-patients with follow-up	Mean follow-up (mo)	BMI decrease/weight loss in OSA-patients	AHI decline	Prevalence of persistent OSA
Verhulst et al. [9]	P	61	14.8 (10–18)	PG	AHI ≥ 2	n/a	37/61 (61%)	21	5.2	Relative decrease in BMI z-score 34.8%. Median weight loss of 24.0 kg (range = 11.0–48.0)	From a median of 3.8 (range 2.2–58.3) to 1.9 (range 0.6–27.7) (p = 0.002)	8/21 (38%)
Siegfried et al. [10]	P	38	18.0	PG	RDI ≥ 5	BMI > 40 kg/m2	9/38 (24%)	9	5.9	n/a	From a mean of 10.3 to 5.2 (p = 0.022)	3/9 (33%)

Effect of surgical weight loss intervention on OSA.

Authors	Type of study	No. of patients	Mean age (yr; range)	Type of sleep study	Definition of OSA	Definition of obesity	Prevalence of OSA	No. of OSA-patients with follow-up	Mean follow-up (mo)	BMI decrease/weight loss in OSA-patients	AHI decline	Prevalence of persistent OSA
Kalra et al. [7]	R	34	17.6 (13–18)	PSG	AHI ≥ 5	BMI ≥ 95th percentile	19/34 (56%)	10	5.1	Mean BMI decreased from 60.8 (SD = 11.07) to 41.6 (SD = 9.5) (p < 0.01). Mean weight loss of 58 kg.	From a median of 9.1 to 0.65. (p < 0.01)	1/10 (10%)
Alqahtani et al. [8]	R	226	14.4 (5–21)	PSG	AHI > 2	BMI ≥ 40 kg/m^2	98/226 (43%)	98	6.0	n/a	n/a	18/98 (18%)

L’adéno-amygdalectomie chez l’enfant obèse avec un SAOS

- Par rapport à l’enfant ayant un poids normal:
  - moins efficace
  - plus de complications post-opératoires
  - prise de poids post-opératoire plus fréquente et importante
- Doit toujours être associée à une prise en charge du surpoids/obésité

Conduite thérapeutique selon le type de SAOS

- Type 1: hypertrophie adéno-amygdalienne
- Type 2: obésité
- Type 3: malformation et/ou étroitesse anatomique des voies aériennes

SAOS de type 3
Malformations craniofaciales

- Fréquence du SAOS : fréquent dans de nombreuses maladies rares
- Pic de fréquence : tout âge
- Pathophysiologie: multifactorielle et multi-étage
- Signes cliniques : frustes ou absents

SAOS et anomalies congénitales

- Analyse des SAOS dans l'état de Washington entre 1987 et 2003 (CIM-9)
- 1203 cas de SAOS appariés avec 6015 cas sans SAOS (1/5)
- Un SAOS est associé à
  - toute anomalie cranio-faciale RR 38
  - fente faciale RR 40
  - trisomie 21 RR 51
  - autre malformation RR 4.1

Maladies responsables d'un SAOS sévère (type 3)

Long-term non-invasive ventilation in children

Alessandro Amaddeo, Annick Frapin, Brigitte Fauroux

***Lancet Respir Med* 2016;**
4: 999–1008

Increase in respiratory load

Anatomical abnormalities of the upper airway

- Treacher Collins syndrome
- Craniofaciostenosis
- Pierre Robin syndrome
- Pycnodysostosis
- Achondroplasia
- Tracheomalacia or laryngomalacia
- Congenital or acquired laryngotracheal stenosis
- Vocal cord paralysis
- Other upper airway malformation
- Storage diseases
- Neck masses or tumours
- Down's syndrome
- Beckwith-Wiedemann syndrome

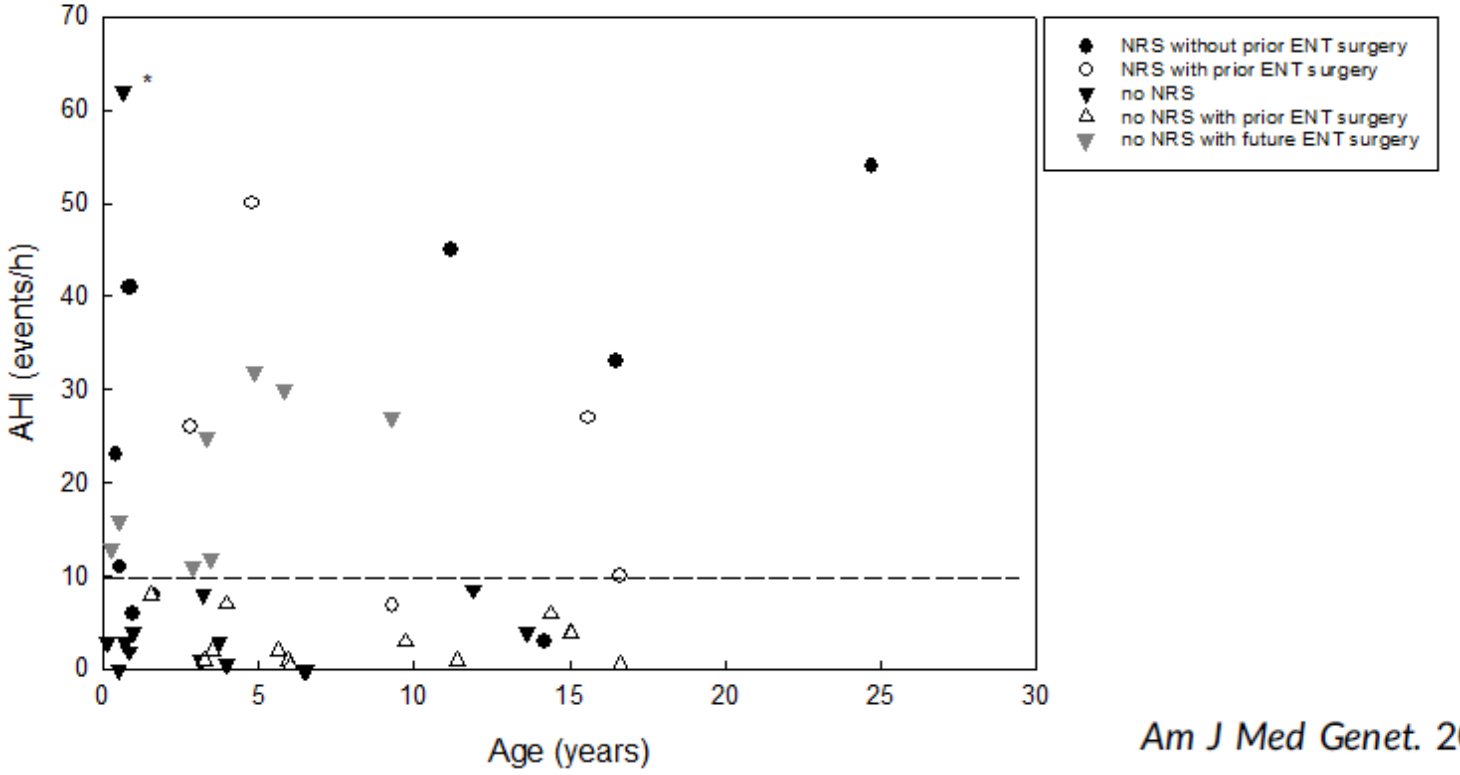
Lower airway obstruction

- Cystic fibrosis
- Bronchopulmonary dysplasia
- Bronchiolitis obliterans

Obstructive sleep apnea in Down syndrome: Benefits of surgery and noninvasive respiratory support

Benjamin Dudoignon[1] | Alessandro Amaddeo[1,2,3] | Annick Frapin[1] | Briac Thierry[4] | Livio de Sanctis[1] | Jorge Olmo Arroyo[1] | Sonia Khirani[1,5] | Brigitte Fauroux[1,2,3]

AMERICAN JOURNAL OF medical genetics PART A

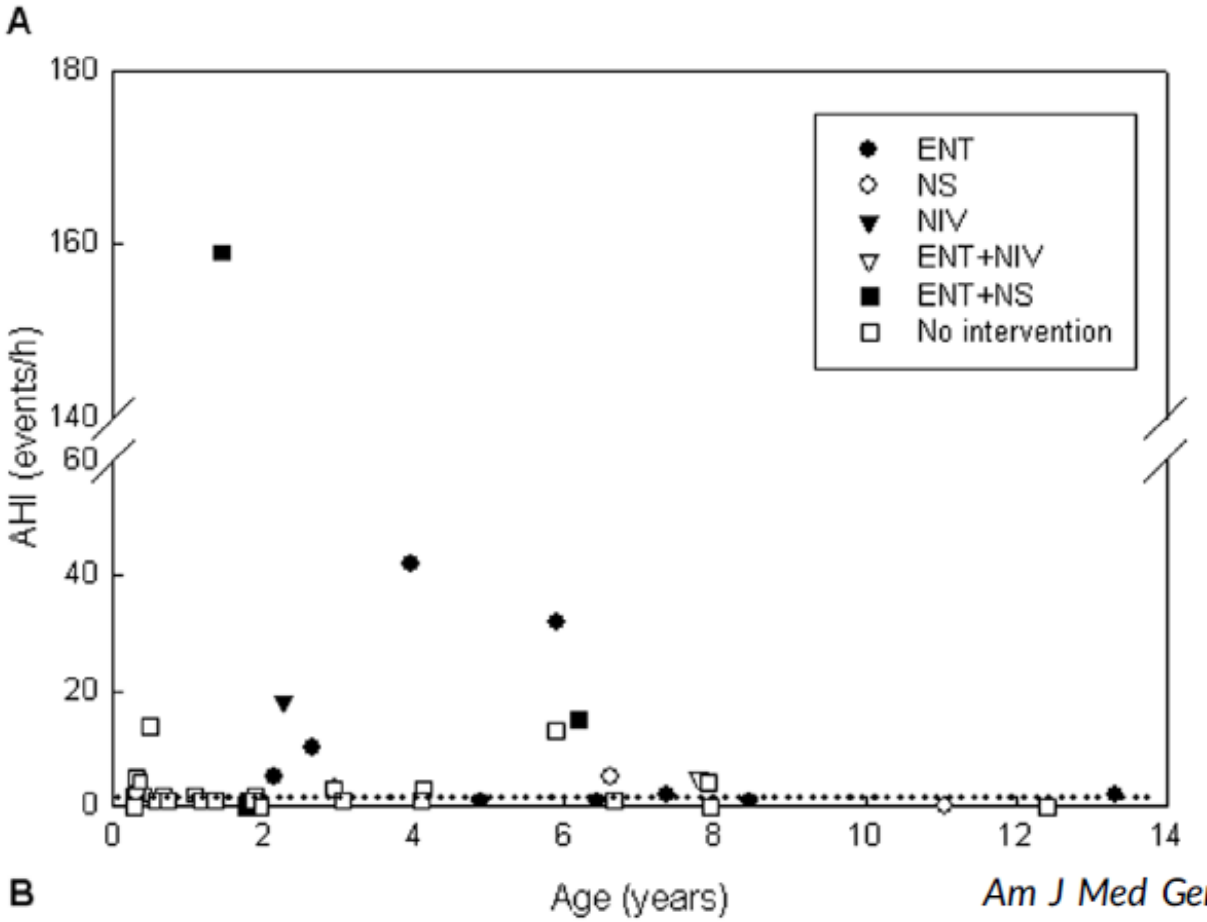


Am J Med Genet. 2017;9999:1–7.

Sleep-disordered breathing and its management in children with achondroplasia

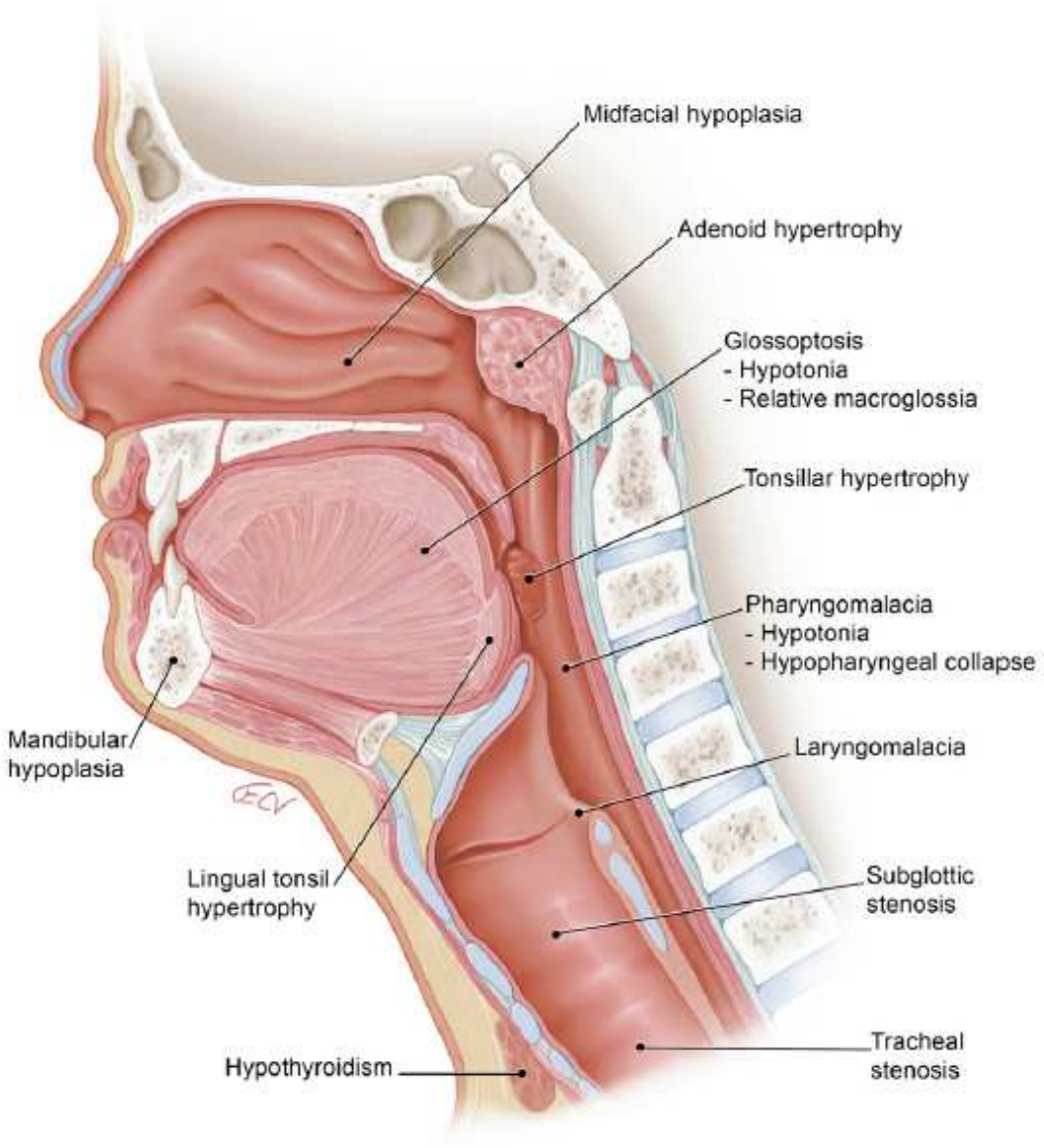
AMERICAN JOURNAL OF medical genetics PART A

Rossana Tenconi[1,2] | Sonia Khirani[2,3] | Alessandro Amaddeo[2,4,5] | Caroline Michot[6] | Geneviève Baujat[6] | Vincent Couloigner[7] | Livio De Sanctis[2] | Syril James[8] | Michel Zerah[4,8] | Valérie Cormier-Daire[6] | Brigitte Fauroux[2,4,5]



Am J Med Genet 2017; 9999: 1–11

Facteurs anatomiques



Lal *et al.* Chest 2015;147:570

Obstructive sleep apnea syndrome and cognition in Down syndrome

JENNIFER BRESLIN[1]* | GOFFREDINA SPANÒ[1]* | RICHARD BOOTZIN[1,2] | PAYAL ANAND[1] | LYNN NADEL[1,3] | JAMIE EDGIN[1,3,4]

Enfants T21, âge moyen 9 ans

Table II: Polysomnographic variables and caregiver reports of sleep in children with Down syndrome

Measure	No OSAS (*n*=12), mean (SD)	OSAS (*n*=19), mean (SD)	*t* (Mann–Whitney *U*)	*p*
Total sleep time (min)	507.46 (86.38)	491.90 (60.78)	94.00	0.44
Apnea hypopnea index (events per hour)	0.82 (0.43)	8.93 (11.54)	228.00	<0.001
Apnea episodes per hour	0.31 (0.36)	6.37 (10.90)	215.00	<0.001
Hypopnea episodes per hour	0.50 (0.36)	2.55 (2.76)	179.00	0.007
Arousal index score events per hour	7.13 (2.18)	10.34 (4.35)	−2.72	0.01
Respiratory related arousals per hour	0.42 (0.36)	2.75 (2.86)	209.50	<0.001
Awake SaO_2	96.58 (0.52)	96.16 (1.02)	85.50	0.25
Average SaO_2 desaturation	2.50 (2.02)	4.00 (1.16)	−2.34	0.03
Children's Sleep Habits Questionnaire daytime sleepiness subscale	14.78 (3.15)	13.00 (3.16)	1.37	0.19
Children's Sleep Habits Questionnaire sleep-disordered breathing subscale	5.43 (2.51)	4.40 (1.35)	1.02	0.34

Obstructive sleep apnea syndrome and cognition in Down syndrome

JENNIFER BRESLIN[1]* | GOFFREDINA SPANÒ[1]* | RICHARD BOOTZIN[1,2] | PAYAL ANAND[1] | LYNN NADEL[1,3] | JAMIE EDGIN[1,3,4]

Enfants T21, âge moyen 9 ans

connaissance verbale

Table III: Cognition and behavior in children with Down syndrome with and without OSAS

Measure	No OSAS (n=12), mean (SD)	OSAS (n=19), mean (SD)	t (Mann–Whitney U)	p
KBIT-2, Full-scale IQ	48.92 (10.65)	43.84 (6.18)	82.50	0.21
KBIT-2, Non-verbal IQ	52.67 (13.55)	48.53 (9.92)	95.50	0.46
KBIT-2, Verbal IQ	54.42 (11.54)	45.11 (8.83)	48.50	0.006
Scales of Independent Behavior-Revised standard score	60.25 (29.16)	51.56 (17.36)	1.03	0.31
CANTAB Paired-Associates Learning task mean errors to success	6.05 (3.89)[a]	8.18 (4.04)	133.00	0.13
CANTAB Intra-Extra Dimensional Set Shift stages completed	8.09 (0.83)[a]	5.32 (3.59)	55.50	0.03
CANTAB Simple Reaction Time task median correct latency	745.05 (203.26)[a]	706.58 (280.64)	85.00	0.42
Conners ADHD Index[b]	7.67 (5.57)	6.76 (5.75)	0.42	0.68
Experimenter rating of attention (Scale: 1–5)	4.22 (0.55)	3.93 (0.71)	1.11	0.28

flexibilité cognitive

Sleep Disturbance and Expressive Language Development in Preschool-Age Children with Down Syndrome

J.O. Edgin[1,2,3], **U. Tooley**[1], **B. Demara**[1], **C. Nyhuis**[1], **P. Anand**[1], and **G. Spanò**[1,2]

29 NRS T21 et 20 NRS témoins, âge moyen 40 mois, actigraphie 5 jours

Measures Mean (*SD*)	DS PS (SE < 80%) (*n* = 19)	DS GS (SE > 80%) (*n* = 10)	TD (*n*=20)	F/χ^2	*p*	Group Differences
MacArthur-Bates CDI Vocabulary and Word Use						
Vocabulary production total score	85.47 (104.34)	275.50 (198.20)	605.10 (123.65)	71.03	<0.001	DS PS<DS GS<TD
Word use total score	1.84 (1.61)	3.20 (1.99)	5.00 (0.00)	26.06	<0.001	DS PS§<DS GS<TD
MacArthur-Bates CDI Syntactic and Morphological Development						
% Combining words	31.6	80.0	100.0	18.96	<0.001	DS PS<DS GS,TD
Sentence length, morphemes	2.01 (1.89)	4.33 (3.96)	10.15 (5.11)	21.79	<0.001	DS PS<DS GS<TD
LENA (Language ENvironment Analysis) System						
Child vocalizations	1305.89 (857.74)	1560.40 (1077.65)	2924.74 (1823.20)	7.36	<0.01	DS<TD
Parent/caregiver utterances	8311.26 (8360.01)	12228.90 (8595.04)	11680.37 (7434.22)	1.14	0.33	---
Conversational turns	262.74 (300.09)	366.30 (268.24)	561.47 (544.28)	2.49	0.09	---
Length of longest utterance, morphemes	1.37 (1.34)	3.60 (3.78)	12.53 (6.36)	32.16	<0.001	DS PS<DS GS<TD

Child Dev. 2015 November ; 86(6): 1984–1998

Traitement du SAOS de type 3

- Centre pédiatrique multi-disciplinaire spécialisé
- Tenir compte
  - pathologie sous-jacente: évolution naturelle (Robin)
  - âge et croissance
- Chirurgie
  - ORL (adéno-amygdalectomie + turbinectomie, résection des replis ary-épiglottiques, amygdalectomie linguale)
  - maxillo (distraction maxillaire) et orthodontique
  - neurochirurgicale
- PPC: pour les SAOS les plus sévères

Trends in management of obstructive sleep apnea in pediatric patients with Down syndrome☆

Jennifer Best[a], Sean Mutchnick[b], Jonathan Ida[a,c], Kathleen R. Billings[a,c,*]

Variable Measured	Prevalence n (%)[a]
Age at Initial T&A (average years, SD, n = 62)	4.8, SD = 3.8
Age < 5 years	40 (64.5)
Age > 5 years	22 (35.5)
Gender (males)	34 (52)
Age at Post-T&A PSG (average years, SD)	6.9, SD = 4.3
OSA Severity (measured as AHI)	
Normal (< 1 events/hour)	7 (10.8)
Mild (1–5 events/hour)	28 (43.1)
Moderate (5.1–10 events/hour)	10 (15.4)
Severe (> 10 events/hour	20 (30.8)
Patients undergoing additional surgery after T&A	23 (35.4)

Intervention (n)	Pre-intervention AHI Mean/median (range)	Post-intervention AHI Mean/median (range)	*p* value
Adenotonsillectomy (39)	23.2/14.5 (0–108.0)	8.2/4.0 (0–42.0)	**< 0.0001**
Additional surgical intervention (20)	13.7/9.6 (1.0–64.0)	9.0/4.0 (0–36.6)	0.21
DISE directed surgical intervention (13)	12.9/9.1 (1.0–64.0)	8.8/4.0 (1.3–25.0)	0.37
Lingual tonsillectomy (9)	12.8/7.8 (1.0–64.0)	7.0/4.0 (1.3–25.0)	0.38
Revision adenoidectomy (7)	17.1/10.0 (2.0–64.0)	10.3/4.0 (1.1–36.6)	0.48
Supraglottoplasty (3)	13.1/12.9 (8.0–18.4)	10.2/11.7 (3.5–15.5)	0.10
Medical therapy (3)	6.7/7.0 (5.0–8.0)	2.9/2.0 (0.8–6.0)	0.26

International Journal of Pediatric Otorhinolaryngology 110 (2018) 1–5

Expansion maxillaire rapide

14 enfants avec un SAOS (7 ± 2 ans) & malocclusion dentaire
Evaluation après 12 mois

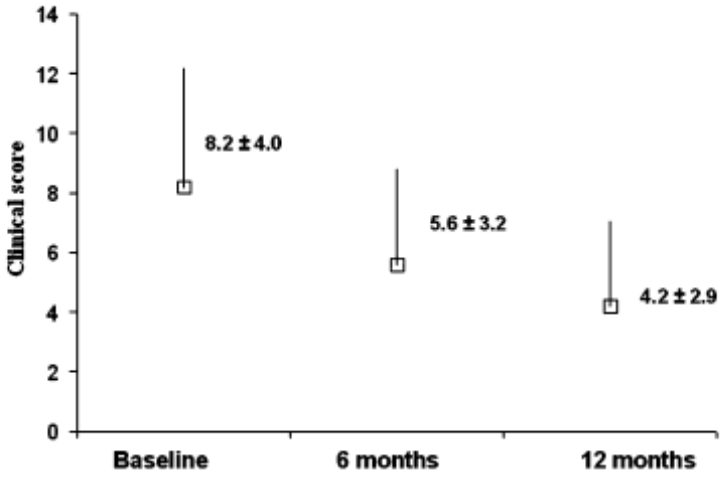


Fig. 1. Clinical score in treated subjects before and after 6 and 12 months of orthodontic treatment. Values are means ± SD. *ANOVA (Friedman) for differences between months of therapy. Definition of abbreviations: NS, not significant.

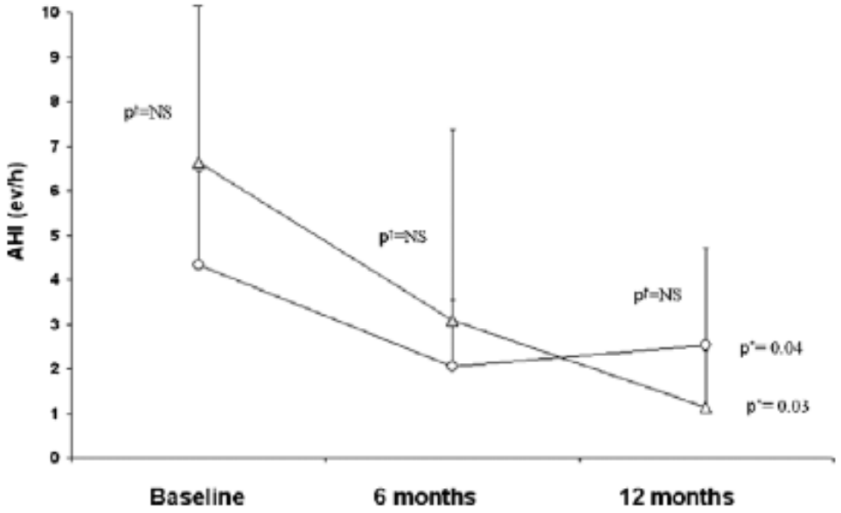
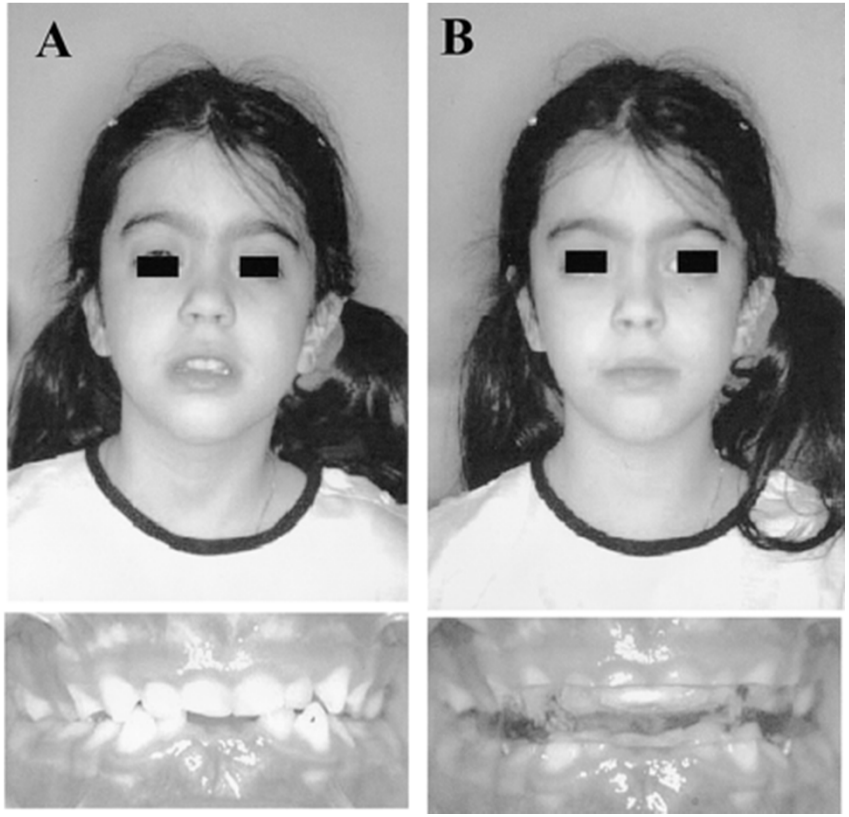


Fig. 2. Fall in the apnea–hypopnea index in patients with crossbite (open circles) and deep/retrusive bite (Open triangles) before and after 6 and 12 months of orthodontic treatment. *ANOVA (Friedman) for

Villa *et al.* Sleep Med 2007;8:128

Orthèse d'avancement mandibulaire

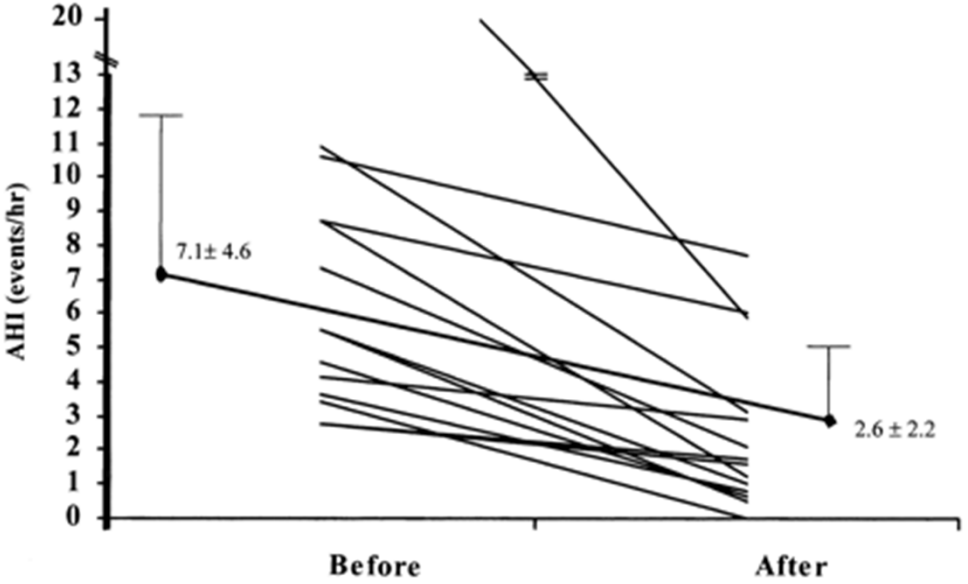


23 enfants avec SAOS & malocclusion

14 avec appareil orthodontique

9 témoins

Evaluation après 3 mois de traitement



Villa *et al.* AJRCCM 2002;165:123

Efficacité d'un traitement combiné

Table 2

Polysomnography Results at Entry from 32 Children

Variable	T and A Group 1	Orthodontics Group 2
AHI, events/h	11 ± 3.5	12.2 ± 4.0
RDI, events/h	19 ± 4.4	21 ± 4.9
Lowest SaO_2%	92 ± 1.9	92 ± 2.3
TST, min	432 ± 20	421 ± 14

Data are presented as mean ± standard deviation. There were 16 children per group. T and A refers to adenotonsillectomy; AHI, apnea-hypopnea index, RDI, respiratory disturbance index, SaO_2, oxygen saturation; TST, total sleep time.

Table 3

Results after Stage 1 Treatment in 32 Children

Variable	T and A n = 16	Orthodontics n = 16	Orthodontics n = 14
AHI, events/h	5 ± 3	5.1 ± 3.8	5.5 ± 3.7
RDI, events/h	8 ± 4.2	6.7 ± 5.4	7 ± 5.1
Lowest SaO_2 %	95 ± 1	96 ± 2	96 ± 2.2
TST, min	429 ± 21	425 ± 19	418 ± 23

Data are presented as mean ± SD. The 2 children who had normal clinical evaluations and polysomnograms after orthodontics are included in column 2 (used to calculate statistical differences) and omitted in column 3. T and refers to adenotonsillectomy; AHI, apnea-hypopnea index, RDI, respiratory disturbance index, SaO_2, oxygen saturation; TST, total sleep time.

Table 4

Results of Both Procedures

Variable	T and A and Orthodontics n = 30	T and A and Orthodontics n = 28
AHI, events/h	0.94 ± 1.30	0.61 ± 0.37
RDI, events/h	1.67 ± 2.60	1.01 ± 0.51
Lowest SaO_2, %	97.57 ± 1.75	98.00 ± 0.58

Data are presented as mean ± SD. The 2 children with persistence of clinical complaints and symptoms are included in the first column of the table (n = 30) but are excluded in the second column (n = 28). As indicated in text, their polysomnograms confirmed the presence of obstructive sleep apnea syndrome. T and A refers to adenotonsillectomy; AHI, apnea-hypopnea index, RDI, respiratory disturbance index, SaO_2, oxygen saturation; TST, total sleep time.

Guilleminault *et al.* Sleep 2008;31:953

THE COCHRANE COLLABORATION®

Oral appliances and functional orthopaedic appliances for obstructive sleep apnoea in children (Review)

Carvalho FR, Lentini-Oliveira DA, Machado MAC, Saconato H, Prado LBF, Prado GF

Main results

The initial search identified 384 trials. One of them, reporting results from a total of 23 patients, was suitable for inclusion in the review. Data provided in the published report did not answer all the questions from this review, but some of them were, and the presented results favour treatment.

Authors' conclusions

At present there is no sufficient evidence to state that oral appliances or functional orthopaedic appliances are effective in the treatment of OSAS in children. Oral appliances or functional orthopaedic appliances may be helpful in the treatment of children with craniofacial anomalies which are risk factors for apnoea.

Obstructive sleep disordered breathing in 2- to 18-year-old children: diagnosis and management

Athanasios G. Kaditis[1], Maria Luz Alonso Alvarez[2], An Boudewyns[3], Emmanouel I. Alexopoulos[4], Refika Ersu[5], Koen Joosten[6], Helena Larramona[7], Silvia Miano[8], Indra Narang[9], Ha Trang[10], Marina Tsaoussoglou[1], Nele Vandenbussche[11], Maria Pia Villa[12], Dick Van Waardenburg[13], Silke Weber[14] and Stijn Verhulst[15]

TASK FORCE REPORT
ERS STATEMENT

Eur Respir J 2016; 47: 69–94

Indications d'un traitement du SAOS chez l'enfant

- IAH > 5/h
- IAH 1-/h si morbidité cardiovasculaire, SNC, énurésie, trouble de croissance, diminution de la qualité de vie, facteurs de risque de persistance du SAOS
- Enfant à risque de SAOS et P(S)G non disponible si oxymétrie et/ou questionnaires pathologiques
- SAOS de type 3

Obstructive sleep disordered breathing in 2- to 18-year-old children: diagnosis and management

Athanasios G. Kaditis[1], Maria Luz Alonso Alvarez[2], An Boudewyns[3], Emmanouel I. Alexopoulos[4], Refika Ersu[5], Koen Joosten[6], Helena Larramona[7], Silvia Miano[8], Indra Narang[9], Ha Trang[10], Marina Tsaoussoglou[1], Nele Vandenbussche[11], Maria Pia Villa[12], Dick Van Waardenburg[13], Silke Weber[14] and Stijn Verhulst[15]

TASK FORCE REPORT
ERS STATEMENT

Eur Respir J 2016; 47: 69–94

STEP 6: Stepwise treatment approach to SDB#:

6.1 A stepwise treatment approach (from 6.2 to 6.9) is usually implemented until complete resolution of SDB
6.2 Weight loss if the child is overweight or obese
6.3 Nasal corticosteroids and/or montelukast *p.o.*
6.4 Adenotonsillectomy
6.5 Unclear whether adenoidectomy or tonsillectomy alone are adequate
6.6 Rapid maxillary expansion or orthodontic appliances
6.7 CPAP or NPPV (for nocturnal hypoventilation)
6.8 Craniofacial surgery
6.9 Tracheostomy

Obstructive sleep disordered breathing in 2- to 18-year-old children: diagnosis and management

Athanasios G. Kaditis[1], Maria Luz Alonso Alvarez[2], An Boudewyns[3], Emmanouel I. Alexopoulos[4], Refika Ersu[5], Koen Joosten[6], Helena Larramona[7], Silvia Miano[8], Indra Narang[9], Ha Trang[10], Marina Tsaoussoglou[1], Nele Vandenbussche[11], Maria Pia Villa[12], Dick Van Waardenburg[13], Silke Weber[14] and Stijn Verhulst[15]

TASK FORCE REPORT
ERS STATEMENT

Eur Respir J 2016; 47: 69–94

STEP 7: Recognition and management of persistent SDB:

7.1

a) Outcomes monitored after intervention (6 weeks-12 months): symptoms, PSG, quality of life, cardiovascular or central nervous system morbidity, enuresis, growth rate
b) If PSG not available: polygraphy, oximetry/capnography
c) PSG ⩾6 weeks after adenotonsillectomy (persistent SDB symptoms or at risk of persistent OSAS preoperatively); after 12 weeks of montelukast/nasal steroid
d) PSG after 12 months of rapid maxillary expansion (earlier if symptoms persist) and after 6 months with an oral appliance
e) PSG for titration of CPAP, NPPV and then annually; PSG as predictor of successful decannulation with tracheostomy
f) Airway re-evaluation by nasopharyngoscopy, drug-induced sleep endoscopy, MRI

Les 3 types de SAOS de l'enfant

	Type 1	Type 2	Type 3
Prévalence	1 – 4%	?	?
Age	3 – 5 ans	enfant/adolescent	tout âge
Physiopathologie	hypertrophie des végétations et amygdales	Obésité ± hypertrophie des amygdales	> anomalies anatomiques
Sévérité	modérée	modérée à sévère	modérée à sévère
Evolution	parfois favorable	dépend du poids	variable
Facteurs de risque	allergie - âge	obésité	Pathologie sous-jacente, obésité
Diagnostic	clinique ± PSG	PSG systématique	PSG systématique
Conséquences	dysfonction neurocognitive + stress cardiovasculaire syndrome métabolique	?	dysfonction neurocognitive + retard de langage ?
Traitement	adéno-amygdalectomie	perte de poids adéno-amygdalectomie	spécialiste (chirurgie – PPC)

Take home messages

- Le traitement du SAOS dépend du type du SAOS
  - le SAOS de type 1 est le plus fréquent: adéno-amygdalectomie sans exploration du sommeil
  - type 2: perte de poids ± chirurgie ORL
- Les indications d'une PSG sont bien codifiées
- La normalisation du SAOS doit être vérifiée sur
  - la disparition des symptômes dans le SAOS de type 1
  - la PSG dans le SAOS de type 2 et 3