



# Mouth breathing in preschool children

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 **LIÈGE**  
université

Morgane Warnier  
PhD candidate @University of Liège, BE

# My experience

## Education

**Erasmus** @University of Geneva, Switzerland  
**Master degree** @University of Liège, Belgium  
**PhD training program** with Guy's & St Thomas' NHS Foundation Trust Sleep Center, England

## Training

**30+** courses and conferences on MFT's topic

## Work

**SLP specialized in OMT** @orthodontic practices  
specialized in paediatric dentofacial orthopaedics  
and sleep disordered breathing  
**PhD candidate** @University of Liège, Belgium

## Scientific

**Reviewer** for MFT in international journals  
**International lecturer**  
**International trainer** for OMT  
**Founding member** @BAOMT  
**Vice-president** @SFOP



# Declaration

- The author of this presentation benefits from a grant from the National Fund for Scientific Research (F.N.R.S.) to carry out his doctoral thesis
- No financial compensation is received for this presentation
- No product or material is sold as part of this presentation
- The author is a founding member and co-president of the Belgian Association of Myofunctional Orofacial Therapy
- The author is vice-president of the French Society of Pediatric Orthodontics
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# Functional role of nasal breathing

Defense

Air conditioning

Olfaction

NO production

Balanced orofacial  
myofunctional development

# PREVALENCE OF MB IN PRESCHOOL CHILDREN

<b>Authors</b>	<b>Age range</b>	<b>Prevalence</b>
Trawitzki and coll., 2005	3 to 6 yo	64%
Abreu, Rocha, & Guerra, 2008b	2 to 16 yo (370 children)	55%
Lopes, Moura & Lima, 2014	2,5 to 4 yo (252 children)	43.1%
Soares and coll., 2018	2 to 5 yo	1,39 %
Trawitzki and coll., 2005	3 to 6 yo	64%
Paolantonio and coll., 2019	3 to 6 yo	23%



A close-up photograph of a young child's face, looking slightly upwards and to the right. The child has dark, wavy hair and is wearing a red mouse-ear headband. The background is a bright blue sky. The text 'Etiologies of MB in preschoolers' is overlaid in white at the top.

# Etiologies of MB in preschoolers

- allergic rhinitis +++
- functional MB
- hypertrophic adenoids
- hypertrophic tonsils

# Early etiologies of MB



Bottle feeding



Pacifier use



Mouth breathing

« Breastfeeding for 24 months or more, as well as exclusive breastfeeding in the first 6 months, was associated with the development of nasal breathing»

(Limeira et coll., 2013)



# Unexplored early etiologies of MB



## ■ REFLUX

Possible relationship with chronic sinusitis, chronic rhinitis, otitis media, enlarged tonsils and SDB

→ All factors linked to MB !

## ■ POLLUTION

Relationship with upper airway infections and allergic symptoms

## ■ FOOD

Soft and processed food impedes orofacial growth



# Consequences of MB in preschoolers

A young child with brown hair and black-rimmed glasses is riding a bicycle. The child is wearing a blue and red plaid jacket over a dark shirt. The background is a blurred outdoor setting with a paved ground.

**Polmonary function**

*(Veron an coll., 2016)*

**Upper airway infections**

*(Kukwa and coll., 2018)*

**Otitis media**

*(Van Bon, 1984)*

**Asthma**

*(Stensson and coll., 2010)*

**Poor oral health**

*(Ballikaya and coll. 2018)*

**Caries and gengivitis inflammation**

*(Nascimento Filho and coll., 2004)*

**Halitosis**

*(Motta and coll., 2011)*



# Orofacial Myofunctional Disorders

Future changes in upper airway

LOW POSITION OF THE TONGUE



SMALL NASO-PHARYNGEAL AIRSPACE

ATYPICAL SWALLOWING



RETRUDED MANDIBLE

TROUBLES CHEWING



INCINATION OF MANDIBULAR PLANE

(De Lemos, 2009 ; Ikenaga, 2013; Milanesi and coll., 2018 )

(Juliano et al., 2009; Chung Leng Munoz & Beltri Orta, 2014 ; Zhao and coll., 2020 )



# Consequences of MB in preschoolers





# Consequences of MB in preschoolers

## Could mouth breathing lead to obstructive sleep apnea syndromes. A preliminary study

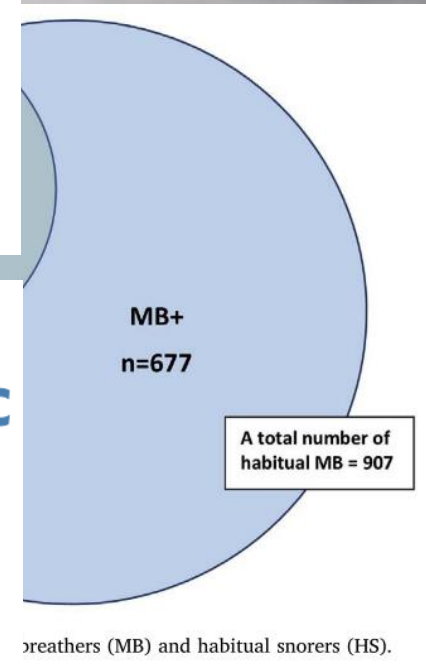
Raskin S, Limme M, Poirrier R

*L'Orthodontie Francaise*, 01 Jan 2000, 71(1):27-35

Arq Neuropsychiatr 2009;67(3-B):860-865

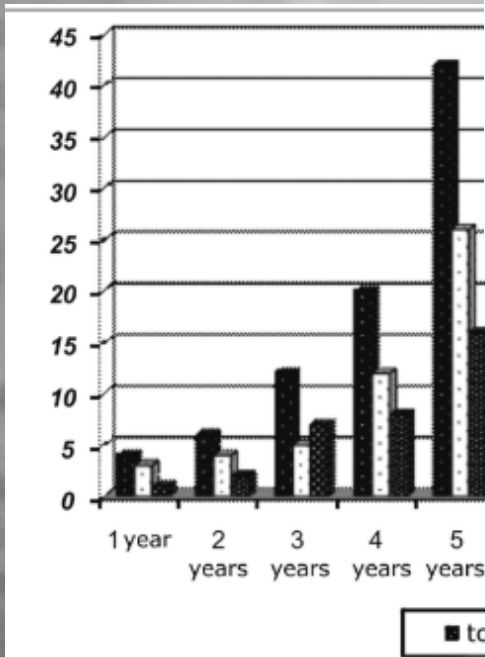
## MOUTH BREATHING CHILDREN HAVE CEPHALOMETRIC PATTERNS SIMILAR TO THOSE OF ADULT PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME

Maria Ligia Juliano<sup>1</sup>, Marco Antonio Cardoso Machado<sup>2</sup>, Luciane Bizari Coin de Carvalho<sup>3</sup>, Lucila Bizari Fernandes do Prado<sup>4</sup>, Gilmar Fernandes do Prado<sup>5</sup>



breathers (MB) and habitual snorers (HS).

Kukwa and coll., 2018



Izu, and coll., 2010



This shows the importance of studying MB in preschool children to intercept current alterations and prevent future aggravations

- ✓ Longitudinal study
- ✓ Aim : to determine if the myofunctional development is linked or not to the speech development
- ✓ Parent questionnaires + clinical observations + clinical assessment





# POPULATION

A photograph of two young children standing outdoors. The child on the left is a boy with curly hair, wearing a dark green button-down shirt. The child on the right is a girl with long, wavy hair, wearing a bright pink coat over a white turtleneck. They are standing in front of a stone wall. The background is slightly blurred, showing a path and some foliage. The overall lighting is soft and natural.

n = 64 children (47% girls; 53% boys)

Recruitment = kindergartens schools

SES (mode) = good

Age = 3 years old (33 to 39 months)

Exclusion = no cranio-facial anomalies, no asthma, no pulmonary, neurological, cardiac or genetic pathology ; no orthodontic treatment ; no SLP treatment

Inclusion = French speaking



# How to dissociate MB from NB?

## SLP examination

- Visual observations
- Assessment

Parent  
questionnaires

ENT examination  
for obstructions


**Table 3** - Main clinical manifestations in mouth-breathing children's patient histories

Variables	p*	OR	Confidence interval of OR
Snores	0.001	45.3	23.4-87.8
Sleeps with mouth open	0.001	40.2	22.1-73.7
Drools on pillow	0.001	32.7	15.1-69.9
Blocked nose daily	0.001	78.4	10.7-72.4
Itchy nose	0.001	8.9	5.5-14.4

**Does your child keep his/her mouth open throughout the day ?**

- Never
- Rarely
- Often
- Most of the time



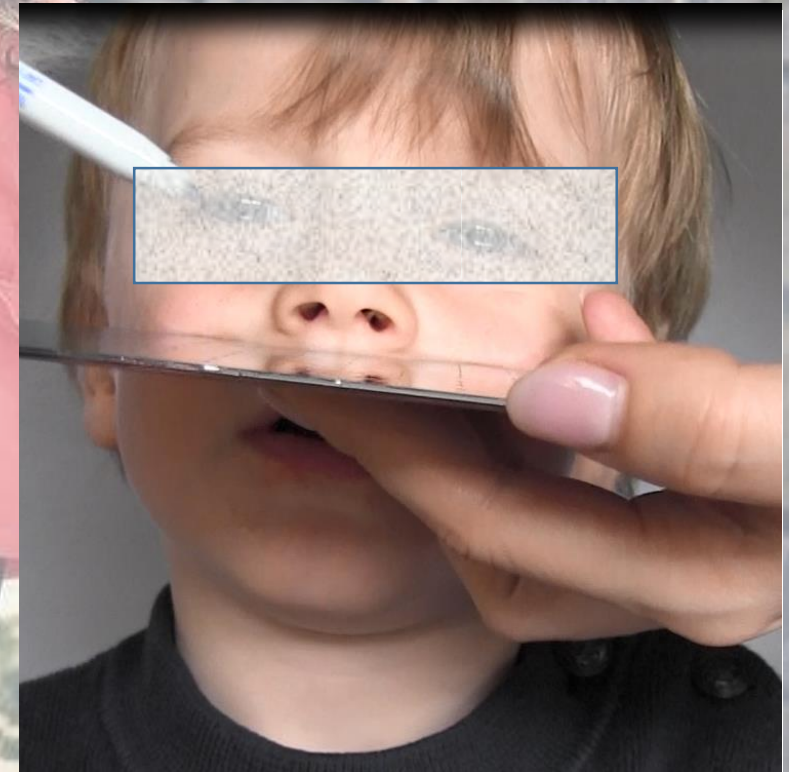
A photograph of two young children standing side-by-side outdoors. The child on the left has curly hair and is wearing a green shirt. The child on the right has long, wavy hair and is wearing a red jacket over a white turtleneck. They are standing on a paved path with a stone wall and trees in the background. The lighting is soft, suggesting a sunny day.

SLP  
- Visual observ.

**Does the child keep his/her mouth open during the video ?**

- Never
- Rarely
- Often
- Most of the time

SLP  
- Assessment





# MOUTH BREATHING IN OUR SAMPLE

Parent  
questionnaires

## Descriptive statistics with 2 criteria of Abreu (2008)

Snores

Sleeps with mouth open

Drools on pillow

Blocked nose daily

Itchy nose

### RB\_ABREU\_2CRITERES

		Fréquence	Pourcentage	Pourcentage valide	Pourcentage cumulé
Valide	RN	37	57,8	57,8	57,8
	RB	27	42,2	42,2	100,0
	Total	64	100,0	100,0	



# MOUTH BREATHING IN OUR SAMPLE: SECOND METHOD

## **ITEM RESPONSE THEORY**

“For the diagnosis of mouth breathing, the Item Response Theory (IRT) was used, which from the set of responses allowed the estimation of the parameters of items and individuals on a measurement scale. Item Response Theory takes into account the item in particular, without highlighting the total scores; therefore, the conclusions do not depend only on the test or questionnaire, but of each item that composes it. This gives us a better analysis of the questions “

Soares and coll., 2018, p.3

# MOUTH BREATHING IN OUR SAMPLE: FIRST METHOD

## Statistical treatment

### **LATENT CLASS ANALYSES**

LCA is a statistical model in which each individuals can be classified into exclusive categories (latent classes), based on their pattern of answers.

It allows to create groups of individuals based on their characteristics even when there is no gold standard diagnosis.

Test of model fit ✓  
(Chi-Square test  $p=0,974$ )

# MOUTH BREATHING IN OUR SAMPLE: FIRST METHOD

## Statistical treatment

### RESULT OF LATENT CLASS ANALYSES

Latent class 1 (n)	Latent class 2 (n)	Latent class 3 (n)
28	6	30

“sleep with mouth open”

	1	2	3
1	0.874	0.000	0.126
2	0.000	1.000	0.000
3	0.000	0.000	1.000

“s  
but other symptoms

“sleep with mouth closed”

Entropy ✓  
(score = 0,89)



# MOUTH BREATHING IN OUR SAMPLE

Parent  
questionnaires

## Descriptive statistics with latent class

### **RB\_IRT\_LATENT\_3groupes**

		Fréquence	Pourcentage	Pourcentage valide
Valide	RN	30	46,9	46,9
	RB possible	6	9,4	9,4
	RB	28	43,8	43,8
	Total	64	100,0	100,0





The image is a collage of two photographs. The top right portion shows a young boy with dark hair, wearing a blue and white striped shirt, looking down with his eyes closed. The bottom left portion shows a close-up of a baby's face, lying down with its mouth open. A dark blue horizontal bar with white text is overlaid across the middle of the image.

## AWAKE vs SLEEP MB

→ NO correlation between Abreu questionnaire & “*does your child has his/her mouth open during the day*” ( $p < 0,05$ )



## According to parents

Does your child keep his/her mouth open throughout the day ?

		Fréquence	Pourcentage	Pourcentage valide
Valide	RN	57	89,1	91,9
	RB	5	7,8	8,1
	Total	62	96,9	100,0
Manquant	,00	2	3,1	
Total		64	100,0	

## According to experts

Does the child keep his/her mouth open during the video ?

		Fréquence	Pourcentage	Pourcentage valide
Valide	RN	19	29,7	29,7
	RB	45	70,3	70,3
	Total	64	100,0	100,0

→ No agreement between experts and parents  
(Cohen's Kappa of SLP vs parent 0,118;  $p > 0,05$ )

## Are experts overestimating ?

- ✓ Observation time was too short
- ✓ Open lips posture might not be representative enough of MB in preschoolers
- ✓ Does the quantity of time count ? Or severity of MB?



## Are parents underestimating ?

- ✓ 54% of children in our sample are still bottle fed
- ✓ 65% of children in our sample are still using a pacifier





# May clinical test help to diagnose MB in preschoolers ?

SLP  
- Assessment



→48,4% are unable to maintain water more than a few seconds (spontaneous swallowing) during retention test

# May clinical test help to diagnose MB in preschoolers ?

SLP  
- Assessment

- 12,5% unable to test the tape test
- Within the sample that did the test :



Tableau croisé RB\_ABREU\_2CRITERES \* T1\_tape\_labial

		T1_tape_labial		Total	
		réussite	échec		
RB_ABREU_2CRITERES	RN	Effectif	25	3	28
		% dans T1_tape_labial	54,3%	50,0%	53,8%
	RB	Effectif	21	3	24
		% dans T1_tape_labial	45,7%	50,0%	46,2%
Total		Effectif	46	6	52
		% dans T1_tape_labial	100,0%	100,0%	100,0%



# May clinical test help to diagnose MB in preschoolers ?

SLP  
- Assessment

- Easy to perform
- halo of the steam in  $\text{cm}^2$  (Melo and coll., 2013)



Test des échantillons indépendants								
		Test de Levene sur l'égalité des variances			Test t pour égalité des moyennes			
		F	Sig.	t	ddl	Sig. (bilatéral)	Différence moyenne	Différence erreur standard
Miroir	Hypothèse de variances égales	1,745	,192	-,328	57	,744	-,55985	1,70845
	Hypothèse de variances inégales			-,394	35,845	,696	-,55985	1,42025

# Summary

- 1) There is a need for validated, sensitive and specific diagnosis tool in preschoolers
- 2) Good news, this is going to be a longitudinal study ✓
- 3) Awake and Sleep MB should be dissociated
- 4) Parents might underestimate awake MB (while experts could overestimate). Based on expert's opinion, the prevalence of awake MB could potentially be higher than sleep MB
- 5) Abreu questionnaire (2008) seems currently the more reliable assessment for sleep MB





# Orofacial Myofunctional Therapy

With a specialised SLP

- **PREVENTION**
- **INFORM AND GUIDE PARENTS**



# Orofacial Myofunctional Therapy

With a specialised SLP

From birth...

- ✓ Promote breastfeeding → !! Tongue-tie (*Ferrés-Amat and coll., 2017*)
- ✓ Follow BEFORE and AFTER releasing of tongue tie (*Zaghi et coll., 2019*)
- ✓ Stop pacifier and CHEW
- ✓ Therapy for pediatric feeding and swallowing disorders (*Gosa et coll., 2017*)





# Orofacial Myofunctional Therapy

With a specialised SLP

From preschool...

- ✓ **Somatosensoriality** (*Limme & Nicolai, 1991*)
- ✓ Nasal breathing (sleep and awake)
- ✓ Proper chewing with masticatory muscles
- ✓ Position of the tongue through active and passive proprioception

## The impact of speech therapy on asthma and allergic rhinitis control in mouth breathing children and adolescents

*O impacto do tratamento fonoaudiológico no controle da asma e da rinite alérgica em crianças e adolescentes respiradores orais*

Silvia M. A. Campanha<sup>1</sup>, Maria J. F. Fontes<sup>2</sup>, Paulo A. M. Camargos<sup>3</sup>,  
Lincoln M. S. Freire (*in memoriam*)<sup>4</sup>

## Systematic review of the effectiveness of breathing retraining in asthma management

*Expert Rev. Respir. Med.* 5(6), 789–807 (2011)

Burgess an coll.







*Siquijor, Philippines (2020)*



MERCI POUR VOTRE ATTENTION  
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