

See **Figure S1** for an illustration of the phasing of thoracic and abdominal motion. During normal breathing in healthy patients older than 3 years, the chest and abdomen move synchronously, out together and in together. (**Figure S1A**) Phasing of thoracic and abdominal motion shifts with upper airway obstruction.¹ With partial obstruction, the chest moves out slightly after the abdomen during inspiration and moves in slightly after it during expiration, asynchronously. (**Figure S1B**) With total obstruction, the chest and abdomen move in completely opposite directions. This is referred to as paradoxical breathing. (**Figure S1C**)

Phase angle is the most common quantitative expression of the phase relation of TAA, and it is measured on a scale from 0° (complete synchrony) to 180° (paradoxical breathing).² For any given breath, there will be a positive and negative deflection in the adjacent thoracic and abdominal tracings, approximating the period of a sine wave in each tracing. Phase angle is equal to the proportion of the period in the earlier tracing that precedes the period in the other tracing (to a maximum of ½), multiplied by 360 degrees.

Labored breathing index (LBI) is a common quantitative expression of the efficiency of respiratory movement and is indicative of the degree of TAA. For any given breath, LBI equals the sum of the integrals of the absolute values of the derivatives of the inspiratory portion of the adjacent thoracic and abdominal tracings, divided by the integral of the derivative of the inspiratory portion of the tidal volume.^{3,4} The tidal volume tracing can be estimated using a predictive model; it is more accurate if calibrated using a spirometer, but it is a reasonable estimate even without calibration.^{2,5,6} With perfect synchrony LBI equals 1, and the LBI will increase more above 1 with increasing TAA.

Table S1 shows how clinical characteristics relate to OAI. **Table S2** shows RIP parameters by OAI group, OAI less than 1 versus greater than or equal to 1.

Supplemental References

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Figure S1. Phasing of thoracic and abdominal motion. (A) Synchronous phasing, (B) asynchronous phasing, and (C) paradoxical motion.

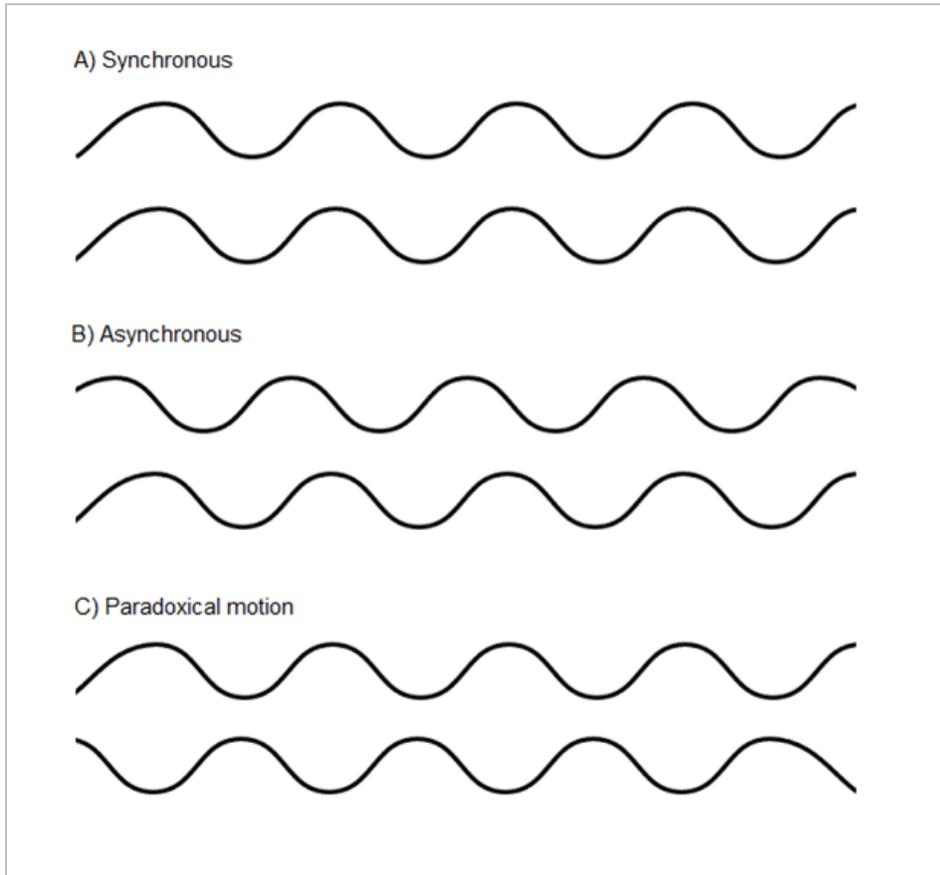


Table S1. Effect of clinical characteristics on OAI.

Characteristic		No. Persons (%) OAI < 1	No. Persons (%) OAI ≥ 1
Sex	Female	15 (0.83)	3 (0.17)
	Male	17 (0.77)	5 (0.23)
Snoring symptom	No	4 (1)	0 (0)
	Yes	28 (0.78)	8 (0.22)
Behavior	No	21 (0.78)	6 (0.22)
	Yes	11 (0.85)	2 (0.15)
Restless sleep	No	13 (0.72)	5 (0.28)
	Yes	19 (0.86)	3 (0.14)
Pauses	No	27 (0.84)	5 (0.16)
	Yes	5 (0.63)	3 (0.38)
Daytime sleepiness	No	25 (0.78)	7 (0.22)
	Yes	7 (0.88)	1 (0.13)
Headache	No	31 (0.79)	8 (0.21)
	Yes	1 (1)	0 (0)
Asthma	No	22 (0.81)	5 (0.19)
	Yes	10 (0.77)	3 (0.23)
Allergies	No	24 (0.77)	7 (0.23)
	Yes	8 (0.89)	1 (0.11)
Obesity	No	26 (0.79)	7 (0.21)
	Yes	6 (0.86)	1 (0.14)
No comorbidities	No	27 (0.79)	7 (0.21)
	Yes	5 (0.83)	1 (0.17)
Obstructive sleep apnea syndrome	No	27 (0.96)	1 (0.04)
	Yes	5 (0.42)	7 (0.58)
Abnormal gas exchange	No	28 (0.85)	5 (0.15)
	Yes	4 (0.57)	3 (0.43)
Upper airway resistance syndrome	No	24 (0.83)	5 (0.17)
	Yes	8 (0.73)	3 (0.27)

Characteristic		No. Persons (%) OAI < 1	No. Persons (%) OAI ≥ 1
Snoring on PSG	No	23 (0.85)	4 (0.15)
	Yes	9 (0.69)	4 (0.31)
Abnormal sleep architecture	No	31 (0.82)	7 (0.18)
	Yes	1 (0.5)	1 (0.5)
Periodic limb movement disorder	No	30 (0.79)	8 (0.21)
	Yes	2 (1)	0 (0)
Sleep-related breathing disorder	No	20 (0.8)	5 (0.2)
	Yes	12 (0.8)	3 (0.2)
Age (years), mean (SD)		5.9 (1.6)	4.7 (1.2)
Tonsil size, median (IQR)		3(1)	3 (0.5)

OAI, obstructive apnea index; SD, standard deviation; IQR, interquartile range.

Table S2. RIP parameters by OAI group.

RIP Parameters	OAI < 1	OAI ≥ 1	Wilcoxon <i>P</i> value
	Median (IQR)	Median (IQR)	
N3 θ_{avg}	12.12 (11.91)	17.64 (8.72)	0.164
N3 LBI _{avg}	1.03 (0.07)	1.03 (0.06)	0.396
REM θ_{avg}	27.29 (35.65)	59.46 (27.71)	0.075
REM LBI _{avg}	1.07 (0.20)	1.18 (0.57)	0.141

RIP, respiratory inductance plethysmography; OAI, obstructive apnea index; IQR, interquartile range; N3, stage 3 sleep; θ_{avg} , average phase angle; LBI_{avg}, average labored breathing index; REM, rapid eye movement sleep.