

Nasal ePAP – Efficacy and Physiologic Mechanism of Action

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INTRODUCTION

Provent™ (Ventus Medical, Inc.) is an adhesive nasal resistive valve which has been proposed as an alternative treatment for OSAHS.

In a prior study, Provent™ reduced AHI by 80% in half of the patients with response independent of SDB severity (JCSM 4:426).

The valve in Provent™ is designed to produce nasal expiratory positive airway pressure (nEPAP), with no intended effect on inspiratory pressures. How this improves SDB remains to be defined.

PURPOSE

To evaluate the efficacy and physiologic mechanism by which nEPAP improves SDB.

METHODS

11 patients (9M/2F) aged 26–77y/o with SDB (RDI=24.0–97.4/hr) 5 normal control subjects

Patients underwent 3 NPSGs, and all patients and subjects underwent measurements of FRC in 3 positions.

1) Three NPSGs (patients only):

- Full night diagnostic in supine/lateral positions:
 - Flow measured via nasal cannula
- Full night with nEPAP (Provent™) applied:
 - Flow measured via external pneumotachograph / nasal mask
 - Pressure and End tidal CO2 measured intra-nasally
- Full night with nasal CPAP:
 - Flow measured by external pneumotachograph / nasal mask
 - Passive Pcrit measurements made in NREM

RDI was defined as sum of apneas and hypopneas associated with either 4% desaturation and/or arousal by AASM criteria.

2) Awake Lung volumes - Functional Residual Capacity (FRC)

measured awake via N2 washout in 3 positions:

- sitting
- supine
- lateral

PROVENT™



RESULTS

Responder Partial Responder Non-Responder

Overall Effect of nEPAP on RDI (Events/hr)

Subj#	Diagnostic NPSG		nEPAP NPSG			
	Overall RDI	REM RDI	Overall RDI	%Change from Dx	REM RDI	% Change from Dx
1	55.3	74.8	7.3	-87%	22.8	-70%
2	97.4	---	18.6	-81%	42.6	---
9	40.7	32.0	20.7	-49%	---	---
14	41.4	75.8	12.6	-70%	60.0	-20%
23	24.0	6.0	2.8	-88%	---	---
	Mean 51.8	47.2	12.4	-75%	41.8	-45%
6	33.5	40.8	18.6	-44%	28.3	-31%
15	44.7	84.8	24.9	-44%	69.9	-18%
17	77.6	40.8	34.4	-56%	25.7	-37%
	Mean 51.9	55.5	26.0	-48%	41.3	-29%
8	35.7	14.6	57.6	+61%	24.0	+64%
10	88.3	71.4	66.1	-25%	46.3	-35%
	Mean 62.0	43.0	61.9	+18%	52.0	+15%
5	51.6	53.7	No Sleep		No sleep	

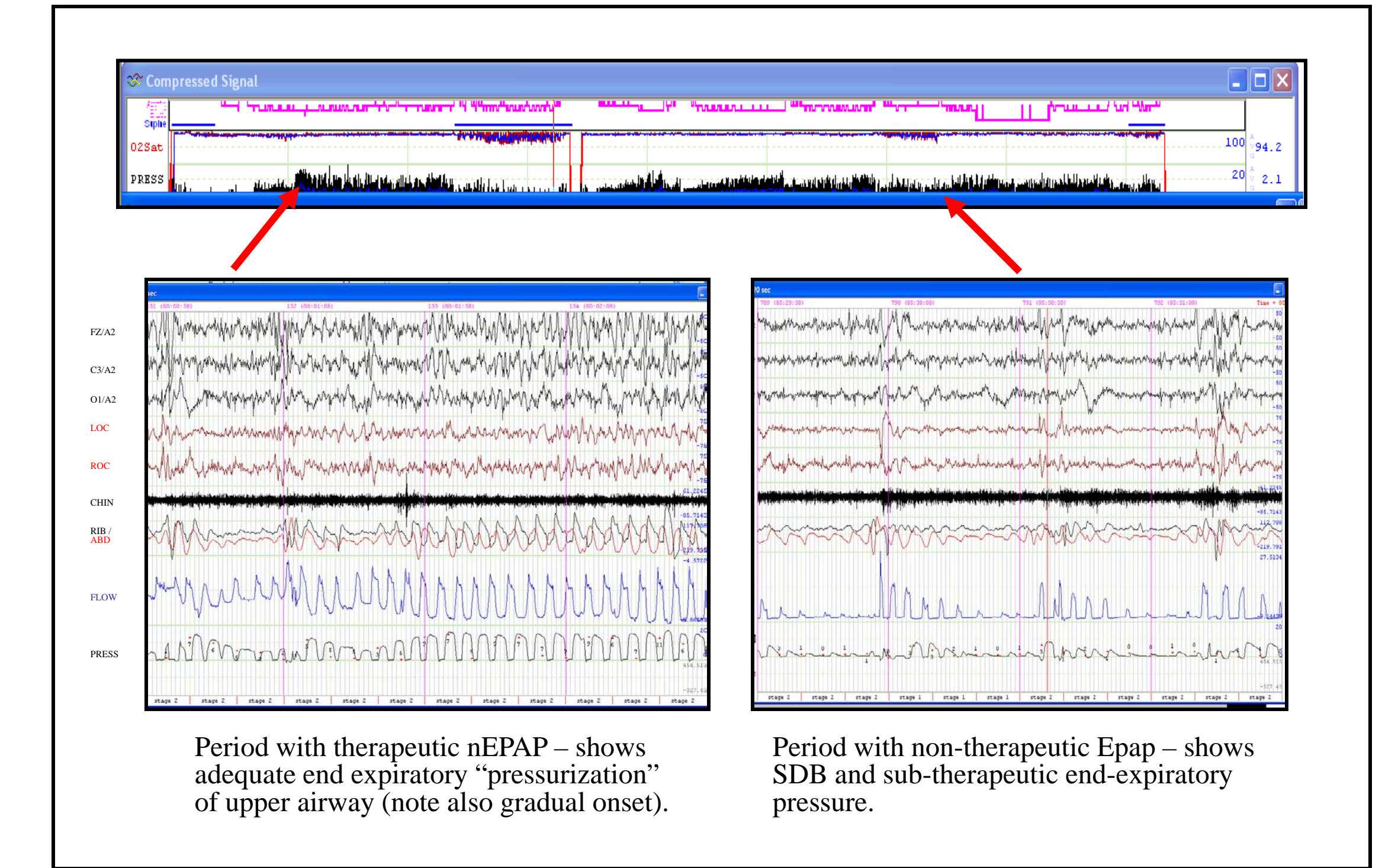
Predictors of nEPAP Response (Sleep)

Subj #	End Expiratory Press (Overall) (cm H2O)	End Exp Press (REM) (cm H2O)	End tidal PCO2		RDI (Diagnostic)		RDI (Diagnostic)	
			nEPAP Effective	nEPAP Ineffective	Lateral	Supine	N-REM	REM
1	20.3	11.2	46.0	49.2	14.9	77.3	51.5	74.8
2	15.7	9.7	40.7	39.7	---	97.4	97.4	---
9	10.0	---	43.6	40.2	40.7	---	41.8	32.0
14	9.4	4.9	42.0	41.5	50.9	40.9	35.0	75.8
23	9.8	---	49.7	48.0	9.3	51.3	29.7	6.0
	Mean 13.0	8.6	44.4	44.1	29.0	49.2	51.1	47.2
6	18.0	---	35.3	35.5	19	97.4	32.4	40.8
15	12.1	1.8	48.0	---	38.8	47.6	39.3	84.8
17	15.7	6.7	51.5	52.5	7.4	82.3	80.3	40.8
	Mean 15.3	4.3	45	44	21.7	75.8	50.7	55.5
8	3.9	2.8	---	---	29.1	36.2	37.7	14.6
10	3.5	2.7	44.3	42.0	87.3	119.9	90.9	71.4
	Mean 3.7	2.8	44.3	42.0	58.2	78.1	64.3	43.0
5	No sleep				33.6	63.8	51.65	53.7

Predictors of nEPAP Response (Other)

Subj #	BMI	Gender	Therapeutic CPAP (cm H2O)	Pcrit	FRC Sitting		FRC Supine		FRC Lateral	
					Liters	% Pred	Liters	% change from Sitting	Liters	% change from Supine
1	33.8	M	10	+2	2.45	68%	2.25	-8%	2.42	+7%
2	34.0	M	12	+4	3.31	93%	3.26	-2%	3.13	-4%
9	25.7	M	7	-2	2.26	67%	1.75	-23%	2.05	+15%
14	33.2	M	13	-3	2.73	77%	2.13	-22%	2.41	+12%
23	32.1	M	5	-2	1.65	51%	1.23	-25%	0.93	-33%
	Mean 30.8		9.4	0	2.48	71%	2.12	-16%	2.18	-1%
6	34.5	F	11	-1 (lat)	2.04	63%	1.58	-23%	1.70	+7%
15	37.5	M	11	+1	Study Pending		Study Pending		Study Pending	
17	34.2	M	12	+1	2.19	59%	2.75	-26%	2.74	0%
	Mean 35.4		11.3	0	2.12	61%	2.17	-25%	2.22	+4%
8	28.5	M	7	---	3.44	91%	2.23	-35%	2.95	+24%
10	32.0	M	9	---	1.97	47%	1.40	-29%	1.40	0%
	Mean 30.3		8.0		2.70	69%	1.82	-32%	2.18	+12%
5	40.6	F	13	+3 (lat)	1.93	59%	1.95	-1%	1.88	-4%
Five Normals	Mean 24.7	2F/3M	---	---	3.32	84%	2.35	-30%	3.05	+23%

Sample PSG Data on nEPAP (Subject # 10)



SUMMARY:

- nEPAP improved SDB in 8/11 subjects.
 - 5 successes (50% fall in RDI and final RDI≤20)
 - 3 partial successes
 - 2 failures
 - one subject unable to sleep with nEPAP
- Therapeutic nEPAP response was associated with higher intranasal pressures.
- nEPAP response was not associated with:
 - Baseline severity of SDB
 - Elevated end tidal PCO₂
 - Baseline REM dependence of RDI
 - Therapeutic CPAP
 - Baseline or positional change in FRC
- Higher Pcrit values did not predict failure of nEPAP
- There was a suggestion that positional RDI was more commonly associated with success.

CONCLUSIONS

nEPAP produces a significant effect on SDB in the majority of subjects tested.

The effectiveness of nEPAP appears strongly associated with the end expiratory pressure. This suggests an effect through increased tracheal traction from increased end expiratory lung volume.

We could not demonstrate an association between therapeutic success/failure of nEPAP and any pre-study value of demographics, SDB or lung volumes.

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