

The effects of posture and mandibular advancement on nasal resistance and obstructive sleep apnea treatment outcome with a novel oral appliance therapy device

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Introduction: Oral appliance therapy is the leading alternative to continuous positive airway pressure in the treatment of obstructive sleep apnea (OSA). However, treatment efficacy is often poor in people with high nasal resistance. The physiological effects of changes in body position and mandibular advancement on nasal resistance in people with OSA remain unclear. We have recently shown that a new oral appliance therapy device that incorporates an opening to the oral cavity (Oventus, O₂Vent T) to allow breathing through the device airway minimizes pharyngeal pressure swings during sleep. This may be therapeutically beneficial including for patients with high nasal resistance. Accordingly, this study aimed to: 1) assess the effects of body position and mandibular advancement on nasal resistance in OSA and 2) the efficacy of the O₂Vent T device in OSA patients including in those with high nasal resistance.

Materials and Methods: To date, seven individuals with OSA (AHI range 5.4-63.3 events/h) have been studied in our sleep physiology laboratory (4 males, aged 35-78 years, BMI: 24-35 kg/m²). To quantify nasal resistance using gold standard methodology, participants were instrumented with a choanal pressure transducer (Pcho), nasal mask and pneumotachograph. Awake nasal resistance (Pcho/flow@200ml/s) was quantified during 5 minutes of quiet nasal breathing in the following 5 positions (order randomized): seated and supine (with and without mandibular advancement) and lateral (without mandibular advancement). Standard split night in-laboratory polysomnography was also performed with and without oral appliance therapy (order randomized).

Results: Awake nasal resistance tended to increase from seated, to supine, to lateral body positions (2.5±0.7, 3.6±1.2, 4.3±1.6 cmH₂O/ml/s, respectively). Mandibular advancement did not systematically alter nasal resistance in either the seated (3.1±0.9 cmH₂O/ml/s) or supine positions (4.7±2.1 cmH₂O/ml/s). Oral appliance therapy reduced the median supine non-REM AHI from 34.4 [5.1, 55.0] to 7.0 [3.1, 22.7] events/h sleep, p=0.03). Two patients had high nasal resistance (>3 cmH₂O/ml/s). The non-REM supine AHI reduced by 33% in one of these patients and by 40% in the other.

Conclusions: Preliminary findings indicate that nasal resistance is posture dependent in OSA. Increases in nasal resistance of 33±17% from seated to supine in OSA patients are greater than those reported in healthy non-OSA individuals (<10%). The novel oral appliance device with built-in oral airway significantly reduced OSA severity including comparable reductions in people with high nasal resistance.

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Role of posture on nasal resistance and OSA severity with a novel mandibular advancement device



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Introduction

- Oral appliance therapy is the leading alternative to CPAP to treat obstructive sleep apnoea (OSA)
- Compliance is higher but efficacy varies & is difficult to predict
- ↑ nasal resistance has been associated with treatment failure

Oventus - O₂ Vent T

- Oral appliance device that incorporates an opening to the oral cavity
- ↓ pharyngeal pressure swings during sleep which may benefit OSA patients including those with ↑ nasal resistance



Aims

1. Assess the effects of posture and mandibular advancement on nasal resistance in people with OSA
2. Determine the efficacy of the O₂Vent T device in OSA patients including those with high nasal resistance

Methods

7 people with OSA (AHI range: 5.4-63.3 events/hour) [4 males, 3 females, age: 35-78 years, BMI: 24-35kg/m²] have been studied to date (ACTRN12617000492358)

Experimental design

Awake nasal resistance measured in 5 postures (order randomised):

- Seated upright (with and without MAS)
- Supine (with and without MAS)
- Lateral (without MAS)

Standard split night in-laboratory PSG

- With & without MAS (order randomised)

Participant set up (Awake nasal resistance)

- Participants were instrumented with a choanal pressure transducer, nasal mask, pneumotachograph and pressure transducer attached (Figure 1)

Measurements (Awake nasal resistance)

- Awake nasal resistance was measured at Flow = 200mL/s
- 5 minutes of quiet nasal breathing in each of the 5 postures

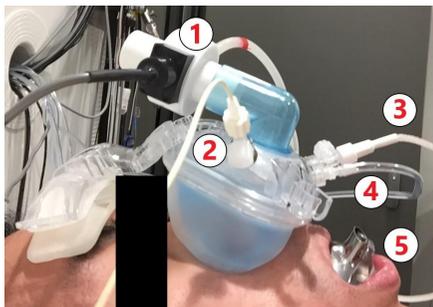


Figure 1: Awake nasal resistance set up

1: Pneumotachograph, 2: Choanal pressure, 3: End tidal CO₂, 4: Mask pressure, 5: MAS (O₂ Vent T)

Results

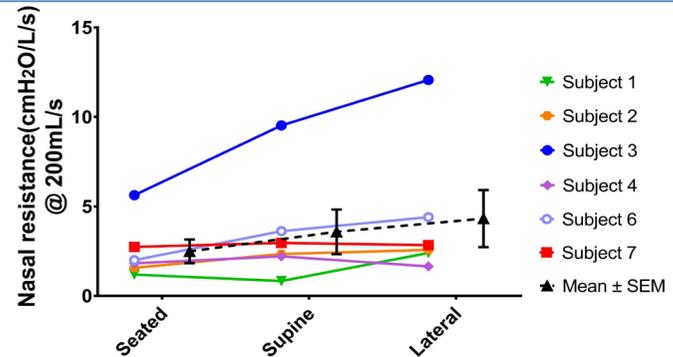


Figure 2: Changes in awake nasal resistance with posture

Awake nasal resistance tends to increase from seated to supine to lateral posture (data obtained in n=6)

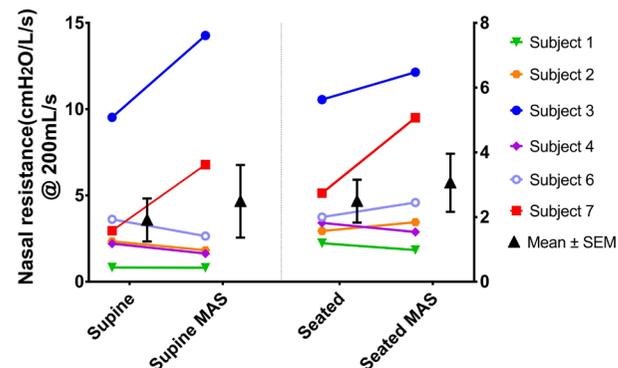


Figure 3: Changes in nasal resistance with posture and mandibular advancement (MAS)

MAS did not systematically change nasal resistance in either supine or seated postures (data obtained in n=6)

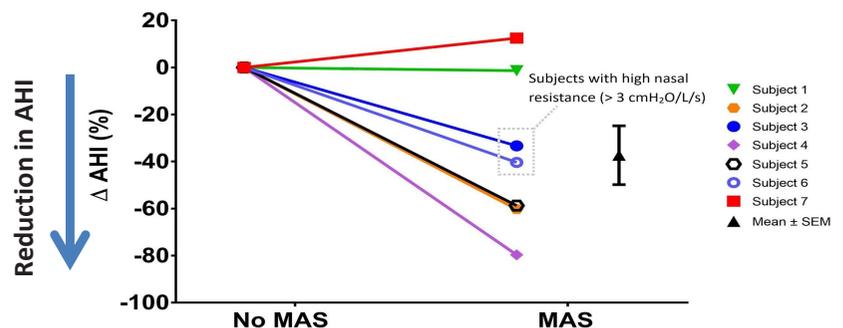


Figure 4: Changes in NREM supine AHI with mandibular advancement (MAS) therapy

Overall, there was a significant reduction in the NREM supine AHI with MAS therapy of ~40% including in participants with high nasal resistance (>3 cmH₂O/L/s) (data obtained in n=7)

Preliminary findings

- Nasal resistance appears to be posture dependent in OSA
- A novel mandibular advancement device with a built in oral airway reduced OSA severity in NREM supine sleep with comparable reductions in people with high nasal resistance

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