A Summary of:

Mouth Leak With Nasal Continuous Positive Airway Pressure Increases Nasal Airway Resistance

G.N. Richards, P.A. Cistulli, R.G. Ungar, M. Berthon-Jones and C.E. Sullivan
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TAKE HOME POINTS

- Mouth leak during CPAP causes unidirectional nasal airflow.
- Nasal resistance increases when a mouth leak is simulated during CPAP use.
- During mouth leak, using heated humidification in conjunction with CPAP will minimise and largely prevent increases in nasal airway resistance.
- Cold pass-over humidification, in conjunction with CPAP, did not prevent increases in nasal airway resistance.
- This study suggests that CPAP treatment if not tempered by humidification will irritate nasal mucosa increasing nasal airway resistance. The increased resistance would promote mouth breathing, increase unidirectional airflow and exacerbate the effect on the nasal mucosa.

AIM

To determine the effect of mouth leak with CPAP on nasal airway resistance.

To determine the influence of humidification under mouth leak conditions.

METHOD

Six healthy subjects were presented with a nasal airway challenge when using CPAP at 12 cmH20 with room air, cold pass-over humidification and heated humidification. Nasal airway resistance was measured prior to the challenge, to determine a baseline value, and then every two minutes following the challenge for a total of 20 minutes.

Nasal Airway Challenge

The challenge was produced by asking the subjects to simulate a mouth leak by mouth breathing for ten minutes while on CPAP. This allowed air to pass through their nose and out through their mouths between breaths, causing unidirectional airflow.

Seven tests/challenges were carried out :

Challenge	Details of Challenge
1	10 min Nasal breathing no mouth leak
2	10 min Mouth leak no humidification
3	10 min Mouth leak cold Passover humidification
4	10 min Mouth leak heated humidification (end of hose temperature 23^{o}C)
5	10 min Mouth leak heated humidification (end of hose temperature 30^{o}C)
6	10 min Mouth leak heated humidification (end of hose temperature 37^{o}C)
7	Repeated 3 min mouth leaks

Challenges were carried out on separate days in random order.

RESULTS

When breathing room air using nasal CPAP without a mouth leak, in challenge one and seven, there were no apparent increases in nasal airflow resistance, from baseline recordings, for any of the participants.

After mouth breathing with room air during CPAP (challenge two), nasal airway resistance increased from the baseline measurement in all participants (Figure 1). A similar increase in resistance was seen in challenge three, when CPAP was used in conjunction with cold passover humidification (Figure 2).

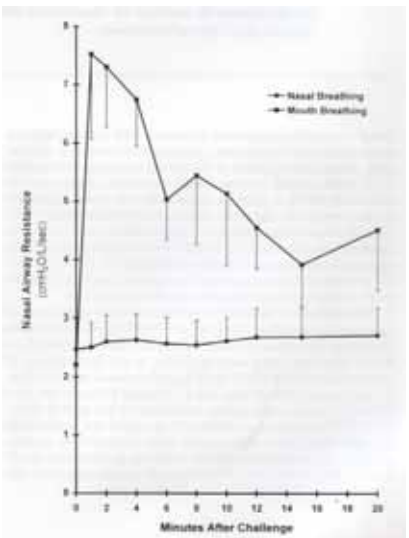

Figure 1. Group mean nasal resistance after nasal and mouth breathing of room air. Error bars show SEM. Mouth breathing causes a large increase in nasal resistance, which falls rapidly in the first 5 min but remains considerably elevated over baseline levels at 20 min.

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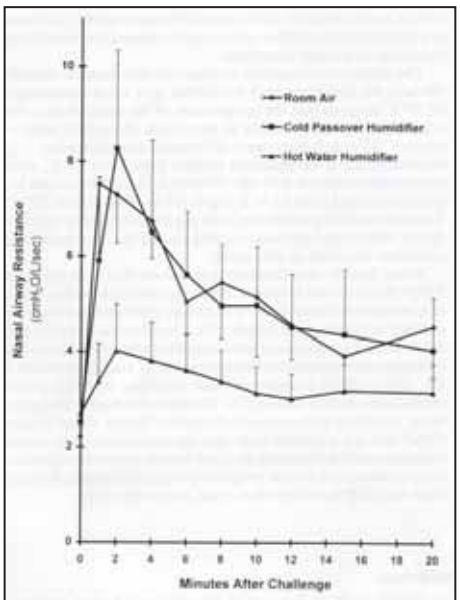

Figure 2. Mean nasal resistance after challenges at room temperature (23° C) with differing humidities. Error bars show SEM.

Hot water humidification used in conjunction with nasal CPAP (challenge four) prevented the large increase in nasal airway resistance that was observed in challenges two and three (Figure 2).

Challenges four, five and six were compared in order to ascertain if air temperature or humidity was the main determinant in reducing the effect of mouth leak on nasal resistance. It was demonstrated that changing the end of hose temperature produced little further benefit (Figure 3).

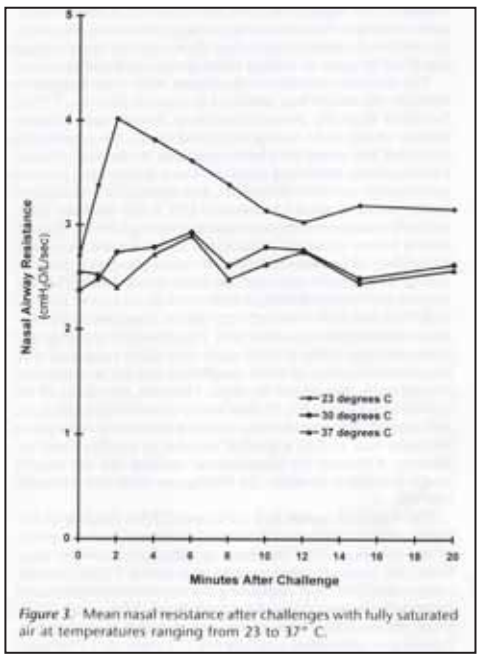

Figure 3. Mean nasal resistance after challenges with fully saturated air at temperatures ranging from 23 to 37° C.

This study also illustrated that once increased, nasal resistance did not remain amplified, but rather returned to the baseline value 40-60 minutes after the challenge had ceased. The transient nature of the rise in nasal airway resistance remained even after repetitive challenges (Figure 4).

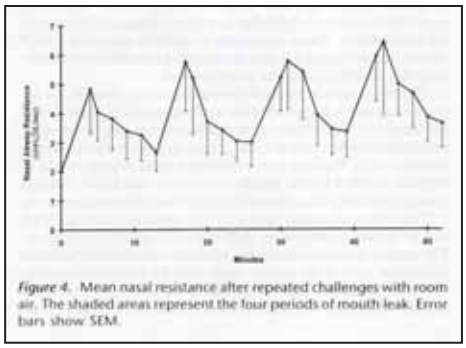

Figure 4. Mean nasal resistance after repeated challenges with room air. The shaded areas represent the four periods of mouth leak. Error bars show SEM.

CONCLUSIONS

Simulating a mouth leak during nasal CPAP causes a unidirectional nasal airflow which results in increased nasal airway resistance.

Cold pass-over humidification does not prevent the observed increase in nasal airway resistance.

Heated humidification used in conjunction with nasal CPAP during simulated mouth leak, prevents nasal airway resistance from substantially increasing.