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Introduction

This section is intended to tap into a relatively unique feature of sleep science: images with great educational and conceptual content (e.g., electroencephalograms, electromyograms, polysomnograms, portable devices, actigrams, scans including functional images, pathology specimens, brain slice preparations, fluorescent microscopy and other cutting edge techniques). Please see our web site's (http://ees.elsevier.com/sleep/) **Guide for Authors** for instructions. We hope this section will be enriched by the contributions of our colleagues who wish to offer stimulating opportunities for discussion and new insights into the field of sleep.

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Effects of vertical opening on pharyngeal dimensions in patients with obstructive sleep apnoea

Anneclaire V.M.T. Vroegop [a,*], Olivier M. Vanderveken [a], Paul H. Van de Heyning [a], Marc J. Braem [b]

[a] Department of ENT, Head and Neck Surgery, Antwerp University Hospital, University of Antwerp, Antwerp, Belgium
[b] Department of Special Care Dentistry, Antwerp University Hospital, University of Antwerp, Antwerp, Belgium

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ABSTRACT

Background: It is still subject to controversy if an increased vertical opening (VO) is beneficial in oral appliance therapy for the treatment of obstructive sleep apnoea. Each oral appliance has a given thickness causing VO. Therefore, evaluation of the effects of the amount of VO on pharyngeal dimensions is mandatory.
Methods: The effects of VO on the cross-sectional area of the upper airway at the level of the tongue base during sleep endoscopy were scored and categorised.
Results: The figures demonstrate the possible effects of VO on pharyngeal collapse relative to the baseline cross-sectional area and the maximal comfortable protrusion of the mandible. Thirty-two patients (80%) showed an adverse effect of VO (Fig. 1), one patient (2.5%) had a positive effect (Fig. 2), and seven patients (17.5%) demonstrated an indifferent effect (Fig. 3).
Conclusion: Based on literature, the effect of VO on pharyngeal collapse is unclear and the therapeutic impact of VO is not determined. The results of the present study indicate that the effect of VO on the degree of pharyngeal collapse as assessed during sleep endoscopy tends to be adverse, causing an increase in collapsibility in the majority of patients.

1. Introduction

Oral appliance therapy (OAT) is an alternative to continuous positive airway pressure therapy for the treatment of obstructive sleep apnoea (OSA) [1]. Mandibular advancement devices (MADs) are the most common type of oral appliances used for the treatment of OSA, and custom-made MADs are preferred [1,2].

It is still controversial whether or not an increased vertical opening (VO) is beneficial in OAT [1,3–5]. Each oral appliance has a given thickness causing VO. Therefore, evaluation of the effects of the amount of VO on pharyngeal dimensions is mandatory.

In the present study, the effect of VO on pharyngeal collapsibility was assessed video-endoscopically during sleep endoscopy. Images of sleep endoscopies in 40 patients (80% male; mean age 48 [standard deviation-SD-9] years; mean apnoea/hypopnoea index 16 [SD 12]/h sleep; mean body mass index 26 [SD 3] kg/m^2) were registered. During sleep endoscopy, an experienced dental sleep professional induced VO of up to 20 mm by manual downwards movement of the mandible, starting from an initial

* Corresponding author. Address: Department of ENT, Head and Neck Surgery, Antwerp University Hospital, University of Antwerp, Wilrijkstraat 10, 2650 Edegem, Antwerp, Belgium. Tel.: +32 (0) 3 821 34 36; fax: +32 (0) 3 821 42 71.
E-mail address: anneclaire.vroegop@uza.be (A.V.M.T. Vroegop).

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mean VO of 6.8 (SD 1.0) mm and a mean maximal comfortable protrusion of 7.2 (SD 1.8) mm ($n = 40$). The effects of VO on the cross-sectional area of the upper airway at the level of the tongue base were scored and categorised as adverse (narrowing), positive (widening) or indifferent (no change in pharyngeal dimensions).

2. Image analysis

Figs. 1–3 show the possible effects of VO on pharyngeal collapse relative to the baseline cross-sectional area and the maximal comfortable protrusion of the mandible.

Thirty-two patients (80%) showed an adverse effect of VO (Fig. 1), one patient (2.5%) had a positive effect (Fig. 2), and seven patients (17.5%) demonstrated an indifferent effect (Fig. 3).

3. Discussion

This study found that an increase in VO tends to have an adverse effect on pharyngeal cross-sectional area at the level of the tongue base, as assessed during sleep endoscopy. In the majority of patients (80%), VO led to a decrease in pharyngeal cross-sectional area.

There are several reports in the literature on the effects of increased VO on the efficacy and side-effects of OAT for OSA [3–5]. One study indicated that the amount of VO did not affect treatment efficacy, but that patients preferred oral appliances with minimal VO as they were more comfortable [3]. Another study reported that OSA is more effectively treated with increased VO [4]. However, Ferguson et al. concluded that the effect of VO on the efficacy of OAT remains unclear [1]. Meurice et al. suggested that mouth opening was associated with a significant increase in total respiratory resistance, which could lead to increased collapsibility of the upper airways [5].

The present results are of primary clinical relevance as VO is a variable characteristic in oral appliance construction. A VO manoeuvre, although not yet standardised, can easily be added to a sleep endoscopy, which is one of the evaluation techniques used to identify the pattern of pharyngeal obstruction.

Fig. 1. Adverse effect of vertical opening on pharyngeal dimensions: baseline (left panel), maximal comfortable protrusion (middle panel), vertical opening (right panel).

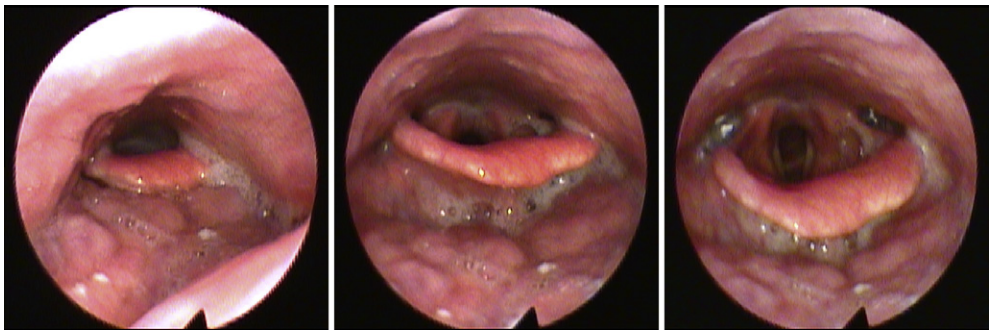

Fig. 2. Positive effect of vertical opening on pharyngeal dimensions: baseline (left panel), maximal comfortable protrusion (middle panel), vertical opening (right panel).

Fig. 3. Indifferent effect of vertical opening on pharyngeal dimensions: baseline (left panel), maximal comfortable protrusion (middle panel), vertical opening (right panel).

The present results indicate that increased VO in OAT has an adverse effect on pharyngeal dimensions in most patients.

Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: doi:10.1016/j.sleep.2011.08.005.

References

[1] Ferguson KA, Cartwright R, Rogers R, Schmidt-Nowara W. Oral appliances for snoring and obstructive sleep apnea: a review. Sleep 2006;29:244–62.

[2] Vanderveken OM, Devolder A, Marklund M, Boudewyns AN, Braem MJ, Okkerse W, et al. Comparison of a custom-made and a thermoplastic oral appliance for the treatment of mild sleep apnea. Am J Crit Care Med 2008;178:197–202.

[3] Pitsis AJ, Darendeliler MA, Gotsopoulos H, Petocz P, Cistulli PA. Effect of vertical dimension on efficacy of oral appliance therapy in obstructive sleep apnea. Am J Respir Crit Care Med 2002;166:860–4.

[4] Rose E, Staats R, Virchow C, Jonas IE. A comparative study of two mandibular advancement appliances for the treatment of obstructive sleep apnoea. Eur J Orthod 2002;24:191–8.

[5] Meurice JC, Marc I, Carrier G, Sériès F. Effects of mouth opening on upper airway collapsibility in normal sleeping subjects. Am J Respir Crit Care Med 1996;153:255–9.