Nasopharyngoscopy during wakefulness for predicting treatment outcome of OSA with mandibular advancement splints

Mandibular advancement splints (MAS) are an alternative to continuous positive airway pressure for the treatment of obstructive sleep apnoea (OSA). This study aimed to evaluate the potential of nasopharyngoscopy during wakefulness in the supine position for identifying responders and nonresponders to treatment with MAS.

Message

Velopharyngeal calibre is modified by MAS treatment, and nasopharyngoscopy during wakefulness may have clinical utility in predicting the outcome of treatment of OSA with MAS; therefore, determination of velopharyngeal calibre may improve the selection of patients for this treatment modality.

Competing interests
None declared.

Original article
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Methods

Patients commencing treatment of obstructive sleep apnoea with a custom-made mandibular advancement splint were recruited. Patients were included if at least two symptoms of OSA were present, and in case of evidence of OSA on polysomnography, defined as an apnoea/hypopnoea index (AHI) ≥10 events per h. Patients were excluded if they had periodontal disease, insufficient number of teeth or an exaggerated gag reflex. Nasopharyngoscopy was performed during wakefulness in the supine position, with and without mandibular advancement, and each time during quiet tidal breathing, as well as with the Müller manoeuvre. Mandibular advancement was provided using the custom-made MAS, following individual titration of the appliance until the maximum comfortable limit of mandibular advancement was achieved. For the Müller manoeuvre, patients were asked to perform a maximal inspiration against a closed airway. Image analysis software was used to determine cross-sectional areas of the upper airway lumen at the level of the velopharynx, the oropharynx and the hypopharynx.

Polysomnography was performed to confirm the diagnosis of OSA and to determine treatment outcome. Response to treatment was defined as a ≥50% reduction in AHI.

Results

Nasopharyngoscopy was performed in 18 responders and 17 nonresponders. There was no significant difference between responders and nonresponders in the degree of mandibular advancement (mean 75% of maximum mandibular protrusion). Mandibular advancement increased the calibre of the velopharynx by 40%, with relatively minor changes occurring in the oropharynx and hypopharynx. The increase in the cross-sectional area of the velopharynx with mandibular advancement occurred to a greater extent in responders than nonresponders ($p<0.05$). No significant differences in change in cross-sectional area were found in the oropharynx and hypopharynx. The extent of upper airway collapse during the Müller manoeuvre, relative to the baseline cross-sectional area, was greater in nonresponders than responders in the velopharynx ($p<0.01$) and oropharynx ($p<0.01$). When the Müller manoeuvre was performed with mandibular advancement, airway collapse was greater in nonresponders than responders at the level of the velopharynx ($p<0.001$), oropharynx ($p<0.05$) and hypopharynx ($p<0.05$).

An increase in the velopharyngeal cross-sectional area induced by mandibular advancement during tidal breathing was significantly associated with a treatment response as determined by polysomnography (sensitivity 88.9%, specificity 47.1%, positive predictive value 64% and negative predictive value 80%). An increase in the cross-sectional area of the upper airway lumen induced by mandibular advancement when the Müller manoeuvre was performed, was significantly associated with a treatment response on polysomnography for the velopharyngeal (sensitivity 83.3%, specificity 76.5%, positive predictive value 78.9 % and negative predictive value 81.3%) and hypopharyngeal segments (sensitivity 58.8%, specificity 87.5%, positive predictive value 83.3% and negative predictive value 66.7%).

A logistic regression analysis identified an increase in the cross-sectional area of the velopharynx when the Müller manoeuvre was performed with mandibular advancement as a predictor of a treatment response as determined by polysomnography ($p<0.01$).

Conclusion

The results indicate that velopharyngeal calibre is modified by MAS treatment, and that nasopharyngoscopy performed during wakefulness is able to distinguish between responders and nonresponders. The results of this study suggest that this method may have clinical utility in predicting the outcome of treatment of OSA with MAS and, therefore, may improve the selection of patients for this treatment modality.

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Editorial comment

Oral appliances have emerged as a noninvasive treatment for OSA [1, 2]. Research into the different tools for assessing upper airway changes, thereby predicting treatment outcome, is clinically relevant in order to select patients and provide a more effective treatment. Among other techniques, the use of flow–volume curves, the measurement of nasal resistance during wakefulness, awake nasopharyngoscopy with the Müller manoeuvre, drug-induced sleep endoscopy with or without simultaneous mandibular advancement, and the use of upper airway imaging have recently been studied as methods to predict treatment outcome in OSA treatment [1, 3–5].

In this study, promising results were obtained using nasopharyngoscopy during wakefulness. An increase in the velopharyngeal calibre with mandibular advancement and an increase in the velopharyngeal and hypopharyngeal calibre when the Müller manoeuvre was performed with mandibular advancement were significantly associated with a treatment response as determined by polysomnography. The nasopharyngoscopic finding of increased velopharyngeal calibre with MAS during the Müller manoeuvre was identified as a predictor of a treatment response using a logistic regression analysis.

However, the results observed in the present study, performed during wakefulness, may differ from the changes occurring in the upper airway during sleep. Also, in this study, mandibular advancement during nasopharyngoscopy was obtained using the MAS custom-made for the patient. The method described in this study needs, therefore, to be validated in a prospective study with nasopharyngoscopic prediction prior to the construction of the MAS.

Optimal prediction of treatment outcome remains an unresolved issue in the treatment of OSA with MAS. This study provides evidence that nasopharyngoscopy performed during wakefulness might provide a useful method to predict the outcome of the treatment of OSA with MAS, thereby improving the selection of OSA patients for this treatment modality.

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