Articles of the Month – December 2020

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Acoustic pharyngometry - A new method to facilitate oral appliance therapy

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Background: There is lack of reliable and accurate methods to predict treatment outcomes of oral appliance (OA) treatment. Acoustic pharyngometry (AP) is a non-invasive technique to evaluate the volume and minimal cross-sectional area of the upper airway, which may prove useful to locate the optimal position of OAs.

Objective: This retrospective study aimed to evaluate the effect of applying AP to OA treatment of patients with obstructive sleep apnoea (OSA).

Methods: All patients (n = 244) treated with OAs following an AP protocol at two dental clinics between 2013 and 2018 were invited to participate. A total of 129 patients accepted the invitation, and 120 patients (75 men, 45 women) were included in the analyses. Mean baseline age, BMI and apnoea hypopnea index (AHI) were 59.1 ± 0.9 years, 27.8 ± 0.4 and 21.9 ± 1.1, respectively. Mean follow-up time was 318 ± 24 days.

Results: AHI at follow-up was 6.4 ± 0.7, resulting in a treatment success rate of 86.7% (≥50% reduction of baseline AHI). The number of failures (<50% reduction of baseline AHI) did not differ significantly among patients with mild, moderate and severe OSA. 87.6% of the patients reported OA usage every night, and 95.5% reported > 5 hours usage per night, when worn.

Conclusion: The AP protocol applied seems to contribute to the excellent effect of OA treatment in this study. Further research on the application of AP in OA treatment is necessary in order to clarify its possible beneficial contribution to improving OA therapy.

==EADSM== comment:
A welcome evaluation of an interesting new method for the identification of the therapeutic mandibular position of oral appliance therapy. Although retrospective, the results are promising and inspires to RCT´s for more evaluation of this method that might facilitate oral appliance therapy for the clinician.

Objective adherence to dental device versus positive airway pressure treatment in adults with obstructive sleep apnea

Liyue Xu [1 2], Dawei Xie [3], Kara S Griffin [4], Bethany Staley [2], Ying Wang [5], Deborah A Nichols [6], Ruth M Benca [7 8], Allan I Pack [2], Susan Redline [9 10 11], James K Walsh [4], Clete A Kushida [5], Samuel T Kuna [2 12]

Although mandibular advancement device (MAD) treatment of adults with obstructive sleep apnea (OSA) is generally less efficacious than positive airway pressure (PAP), the two treatments are associated, with similar clinical outcomes. As a sub-analysis of a randomized trial comparing the effect of MAD versus PAP on blood pressure, this study compared objectively measured adherence to MAD versus PAP treatment in adults with OSA. Adults with OSA (age 54.1 ± 11.2 [standard deviation] years, 71.1% male, apnea-hypopnea index 31.6 ± 22.7 events/h) were randomized to MAD (n = 89) or PAP (n = 91) treatment for 3-6 months. Objective adherence was assessed with a thermal sensor embedded in the MAD and a pressure sensor in the PAP unit. In a per protocol analysis, no difference was observed in average daily hours of use over all days in participants on MAD (n = 35, 4.4 ± 2.9 h) versus PAP (n = 51, 4.7 ± 1.6 h, p = .597) treatment when days with missing adherence data were included as no use. MAD was used on a lower percentage of days (62.5 ± 36.4% versus 79.9 ± 19.8%, p = .047), but with greater average daily hours of use on days used (6.4 ± 1.9 h versus 5.7 ± 1.2 h, p = .013). Average daily hours of use in the first week were associated with long-term adherence to MAD (p < .0001) and PAP (p = .0009) treatment. Similar results were obtained when excluding days with missing adherence data. In conclusion, no significant difference was observed in objectively measured average daily hours of MAD and PAP adherence in adults with OSA, despite differences in the patterns of use. MAD adherence in the first week predicted long-term use.

EADSM comment:
Interesting results that early adherence, already during the first week of treatment, is strongly related to longer term treatment success with both MAD and PAP. This study highlights the need for studies that facilitates the quick finding of a therapeutic mandibular position of MAD.

Computational fluid dynamics simulation of changes in the morphology and airflow dynamics of the upper airways in OSAHS patients after treatment with oral appliances

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Objectives: To explore the changes of morphology and internal airflow in upper airways (UA) after the use of oral appliances (OAs) in patients with obstructive sleep apnea hypopnea syndrome (OSAHS), and investigate the mechanisms by which OAs function as a therapy for OSAHS.

Methods: Eight OSAHS patients (all male, aged 37-58, mean age 46.25) underwent CT scans before and after OA use. Then, computational fluid dynamics(CFD) models were built on the base of the CT scans using Mimics and ANSYS ICEM CFD software. The internal airflow of the upper airways was simulated using ANSYS-FLUENT and the results were analyzed using ANSYS-CFD-Post. The data were analyzed to identify the most important changes of biomechanical properties between patients with and without OA intervention. Upper airway morphology and the internal airflow changes were compared using t-tests and Spearman correlation coefficient analysis.

Results: The narrowest area of upper airways was found to be located in the lower bound of velopharynx, where the volume and pressure were statistically significantly increased (P<0.05) and the air velocity was statistically significantly decreased (P<0.05) in the presence of the OA(P<0.05). After wearing OA, pharyngeal resistance was significantly decreased (P<0.05), from 290.63 to 186.25Pa/L, and the airflow resistance of the pharynx has reduced by 35.9%.

Conclusion: The enlargement of the upper airway after wearing the OA changed its airflow dynamics, which decreased the negative pressure and resistance in narrow areas of the upper airways. Thus, the collapsibility of the upper airways was reduced and patency was sustained.

EADSM comment:
A study elucidating the complex mechanism of OAs on upper airway physiology, where a positive effect on the velopharyngeal level of OAs was found. This is in accordance with previous literature in this field. More research is needed in order to explain these results in relation to the findings about a oropharyngeal collapse without the appliance in situ predicting a successful outcome with OA.

The relationship between specific nasopharyngoscopic features and treatment deterioration with mandibular advancement devices: a prospective study

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Study objectives: The variable efficacy of mandibular advancement device (MAD) treatment necessitates both accessible and accurate methods for patient selection. However, the role of awake nasopharyngoscopy for this purpose remains dubious. We introduced an assessment method based on anatomical upper airway features during tidal breathing for nasopharyngoscopy. The current study aimed to relate these features to MAD treatment outcome.

Methods: One hundred patients diagnosed with obstructive sleep apnea were prospectively recruited for MAD treatment in a fixed 75% degree of maximal protrusion. Nasopharyngoscopic observations during Müller's maneuver and tidal breathing were recorded both with and without MAD. Treatment outcome, confirmed by 3-month follow-up polysomnography with MAD, was classified as (1) apnea-hypopnea index reduction $\geq$ 50%, (2) treatment apnea-hypopnea index < 5 events/h, and (3) $\geq$ 10% increase in apnea-hypopnea index compared with baseline (treatment deterioration).

Results: A complete dataset was obtained in 65 patients. After adjusting for baseline apnea-hypopnea index, body mass index, and supine dependency, the position of the soft palate (odds ratio, 4.0; 95% confidence interval, 1.3-11.8; P = .013) and crowding of the oropharynx (odds ratio, 7.7; 95% confidence interval, 1.4-41.4; P = .017) were related to treatment deterioration. Addition of both features significantly (P = .031) improved the accuracy of baseline models based on clinical measurements alone. Moreover, with the MAD in situ, a posteriorly located soft palate (odds ratio, 9.8; 95% confidence interval, 1.7-56.3; P = .010) and a posteriorly located tongue base (odds ratio, 7.4; 95% confidence interval, 1.5-35.9; P = .013) were associated with treatment deterioration.

Conclusions: Awake nasopharyngoscopy might be a valuable office-based examination to exclude the risk of treatment deterioration and improve patient selection for MAD treatment.

==EADSM== comment:
Interesting new predictors for the deterioration of OSA with MAD. A previously somewhat unexamined topic about factors that relate to a worsened outcome with MAD therapy.