Articles of the Month – June 2022

MAD

Sleep Med Rev. 2022 May 6;64:101644. doi: 10.1016/j.smrv.2022.101644. Online ahead of print.
Link: Comparison of the phenotypic characteristics between responders and non-responders to obstructive sleep apnea treatment using mandibular advancement devices in adult patients: Systematic review and meta-analysis - ScienceDirect

Comparison of the phenotypic characteristics between responders and non-responders to obstructive sleep apnea treatment using mandibular advancement devices in adult patients: Systematic review and meta-analysis

Sara Camañes-Gonzalvo[1], Carlos Bellot-Arcís[2], Rocío Marco-Pitarch[1], Jose M Montiel-Company[3], Marina García-Selva[1], Rubén Agustín-Panadero[1], Vanessa Paredes-Gallardo[3], Francisco J Puertas-Cuesta[4]

Mandibular advancement device (MAD) therapy is the most commonly used second-line treatment for obstructive sleep apnea (OSA), but MAD may be ineffective in a subgroup of patients. The aim of this systematic review is to identify predictors of the efficacy of oral appliance (OA) therapy for OSA in adult patients. This review focuses on performing the quantitative analysis by subgroups based on the response criteria used in the literature and based on the type of device. PubMed, EMBASE, Scopus, Web of Science and Cochrane databases was conducted to identify potentially relevant studies published until Dec 2021. The search identified 1343 preliminary references. A total of 99 studies met the eligibility criteria and were included in the review, and 60 in the meta-analysis. The quality of studies was assessed using the Newcastle-Ottawa scale and the Cochrane scale. Based on meta-analysis, and considering a low to moderate evidence profile according to the GRADE scale, responders are younger patients, with smaller neck circumference, lower body mass index. Responders have shorter maxillary length, lower anterior and posterior facial height, a shorter distance from the hyoid bone to the third cervical vertebra, a shorter airway length, a smaller minimum airway cross-sectional area and a higher minimum oxygen saturation during sleep. Responders needed a lower optimal continuous positive airway pressure than non-responders. The type of device has not affected the results of the meta-analysis. The criterion "AHI <10 and reduction AHI >50%" is the one that provides the "weight" of significance for several variables. This criterion should be taken into consideration for future studies to predict OSA treatment by OA.

EADSM comment: Meta-analysis confirming many previous detected predictors of MAD success. The suggested definition of treatment success does only, however, consider AHI and not other suggested factors that might influence the results as well as symptomatic effects and the influence of sleep position on the results.

J Clin Sleep Med. 2022 Mar 1;18(3):911-919.
doi: 10.5664/jcsm.9758.

Link: In-home mandibular repositioning during sleep using MATRx plus predicts outcome and efficacious positioning for oral appliance treatment of obstructive sleep apnea | Journal of Clinical Sleep Medicine (aasm.org)

In-home mandibular repositioning during sleep using MATRx plus predicts outcome and efficacious positioning for oral appliance treatment of obstructive sleep apnea

Erin V Mosca[1], Sabina Bruehlmann[1], Shaelynn M Zouboules[1], Alexandra E Chiew[1], Curtis Westersund[2], Dillon A Hambrook[1], Seyed A Zareian Jahromi[1,3], Joshua Grosse[1], Zbigniew L Topor[1,3], Shouresh Charkhandeh[1], John E Remmers[1,3]

Study objectives: Oral appliance therapy is not commonly used to treat obstructive sleep apnea due to inconsistent efficacy and lack of established configuration procedures. Both problems may be overcome by information gathered while repositioning the mandible during sleep. The purpose of this investigation was to determine if an unattended sleep study with a mandibular positioner can predict therapeutic success and efficacious mandibular position, assess the contribution of artificial intelligence analytics to such a system, and evaluate symptom resolution using an objective titration approach.

Methods: Fifty-eight individuals with obstructive sleep apnea underwent an unattended sleep study with an auto-adjusting mandibular positioner followed by fitting of a custom oral appliance. Therapeutic outcome was assessed by the 4% oxygen desaturation index with therapeutic success defined as oxygen desaturation index < 10 h^{-1}. Outcome was prospectively predicted by an artificial intelligence system and a heuristic, rule-based method. An efficacious mandibular position was also prospectively predicted by the test. Data on obstructive sleep apnea symptom resolution were collected 6 months following initiation of oral appliance therapy.

Results: The artificial intelligence method had significantly higher predictive accuracy (sensitivity: 0.91, specificity: 1.00) than the heuristic method (P = .016). The predicted efficacious mandibular position was associated with therapeutic success in 83% of responders. Appliances titrated based on oxygen desaturation index effectively resolved obstructive sleep apnea symptoms.

Conclusions: The MATRx plus device provides an accurate means for predicting outcome to oral appliance therapy in the home environment and offers a replacement to blind titration of oral appliances.

EADSM comment: Important step forward to define the optimal mandibular positioning and treatment success.

J Sleep Res. 2022 Jun 22;e13673.
doi: 10.1111/jsr.13673. Online ahead of print.

Link: https://onlinelibrary.wiley.com/doi/epdf/10.1111/jsr.13673

Multimodal phenotypic labelling using drug-induced sleep endoscopy, awake nasendoscopy and computational fluid dynamics for the prediction of mandibular advancement device treatment outcome: a prospective study

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Mandibular advancement device (MAD) treatment outcome for obstructive sleep apnea (OSA) is variable and patient dependent. A global, clinically applicable predictive model is lacking. Our aim was to combine characteristics obtained during drug-induced sleep endoscopy (DISE), awake nasendoscopy, and computed tomography scan-based computational fluid dynamic (CFD) measurements in one multifactorial model, to explain MAD treatment outcome. A total of 100 patients with OSA were prospectively recruited and treated with a MAD at fixed 75% protrusion. In all, 72 underwent CFD analysis, DISE, and awake nasendoscopy at baseline in a blinded fashion and completed a 3-month follow-up polysomnography with a MAD. Treatment response was defined as a reduction in the apnea-hypopnea index (AHI) of ≥50% and deterioration as an increase of ≥10% during MAD treatment. To cope with missing data, multiple imputation with predictive mean matching was used. Multivariate logistic regression, adjusting for body mass index and baseline AHI, was used to combine all potential predictor variables. The strongest impact concerning odds ratios (ORs) was present for complete concentric palatal collapse (CCCp) during DISE on deterioration (OR 28.88, 95% confidence interval [CI] 1.18-704.35; p = 0.0391), followed by a C-shape versus an oval shape of the soft palate during wakefulness (OR 8.54, 95% CI 1.09-67.23; p = 0.0416) and tongue base collapse during DISE on response (OR 3.29, 95% CI 1.02-10.64; p = 0.0464). Both logistic regression models exhibited excellent and fair predictive accuracy. Our findings suggest DISE to be the most robust examination associated with MAD treatment outcome, with tongue base collapse as a predictor for successful MAD treatment and CCCp as an adverse DISE phenotype.

EADSM comment: Study highlighting the excellent predictive value of DISE.

Other oral devices

Int J Environ Res Public Health. 2022 May 31;19(11):6714.doi: 10.3390/ijerph19116714.

Link: [IJERPH | Free Full-Text | Effect of Different Maxillary Oral Appliance Designs on Respiratory Variables during Sleep (mdpi.com)]

Effect of Different Maxillary Oral Appliance Designs on Respiratory Variables during Sleep

Kay Thwe Ye Min Soe[1], Hiroyuki Ishiyama[1], Akira Nishiyama[2], Masahiko Shimada[3], Shigeru Maeda[3]

This study aimed to analyze the efficacy of maxillary oral appliance (MOA) designs on respiratory variables during sleep. At baseline, 23 participants underwent a sleep test with a portable device for two nights and were categorized as participants with mild obstructive sleep apnea (mild-OSA) (*n* = 13) and without OSA (w/o-OSA) (*n* = 10). Three types of MOAs, standard-OA (S-OA), palatal covering-OA (PC-OA), and vertically increasing-OA (VI-OA), were each worn for three nights, and sleep tests with each MOA were performed with a portable device for two nights. Based on the average of the respiratory event index (REI) values for the two nights for each MOA, w/o-OSA participants with an REI ≥ 5.0 were defined as the exacerbation group and those with an REI < 5.0 as the non-exacerbation group. In mild-OSA participants, an REI ≥ 15.0 or REI ≥ baseline REI × 1.5 were defined as the exacerbation group and those with an REI < 15.0 and REI < baseline REI × 1.5 were defined as the non-exacerbation group. The percentage of the exacerbation and non-exacerbation groups with MOA was evaluated in the w/o-OSA and mild-OSA participants. The maxillary and mandibular dental-arch dimension was compared by dentition model analysis. The exacerbation group in w/o-OSA participants (*n* = 10) comprised 10.0% participants (*n* = 1) with S-OA, 40.0% (*n* = 4) with PC-OA, and 30.0% (*n* = 3) with VI-OA. The exacerbation group in the mild-OSA participants (*n* = 13) comprised 15.4% subjects (*n* = 2) with S-OA, 23.1% (*n* = 3) with PC-OA, and 23.1% (*n* = 3) in VI-OA. In the model analysis for w/o-OSA, the posterior dental arch width was significantly greater in the exacerbation group than in the non-exacerbation group wearing S-OA (*p* < 0.05). In addition, the ratio of the maxillary to mandibular dental arch width (anterior dental arch width) was significantly greater in the exacerbation group than in the non-exacerbation group for both PC-OA and VI-OA (*p* < 0.05). In mild-OSA, the maxillary and mandibular dental arch lengths and the ratio of maxillary to mandibular dental arch width (posterior dental arch width) were significantly smaller in the exacerbation group than in the non-exacerbation group for S-OA (*p* < 0.05). This study confirmed that wearing an MOA by w/o-OSA and mild-OSA participants may increase the REI during sleep and that PC-OA and VI-OA may increase the REI more than S-OA. The maxillary and mandibular dental-arch dimensions may affect the REI when using an MOA.

EADSM comment: Insertion of material into the mouth in terms of various maxillary devices might influence the risk for sleep disordered breathing. More studies are needed to define these risks in the dental practice.

OSA

Review

ERJ Open Res. 2022 Jun 27;8(2):00126-2022.

doi: 10.1183/23120541.00126-2022. eCollection 2022 Apr.

Link: Current and novel treatment options for obstructive sleep apnoea | European Respiratory Society (ersjournals.com)

Current and novel treatment options for obstructive sleep apnoea

Winfried Randerath[1], Jan de Lange[2], Jan Hedner[3], Jean Pierre T F Ho[2], Marie Marklund[4], Sofia Schiza[5], Jörg Steier[6], Johan Verbraecken[7]

Obstructive sleep apnoea is a challenging medical problem due to its prevalence, its impact on quality of life and performance in school and professionally, the implications for risk of accidents, and comorbidities and mortality. Current research has carved out a broad spectrum of clinical phenotypes and defined major pathophysiological components. These findings point to the concept of personalised therapy, oriented on both the distinct clinical presentation and the most relevant pathophysiology in the individual patient. This leads to questions of whether sufficient therapeutic options other than positive airway pressure (PAP) alone are available, for which patients they may be useful, if there are specific indications for single or combined treatment, and whether there is solid scientific evidence for recommendations. This review describes our knowledge on PAP and non-PAP therapies to address upper airway collapsibility, muscle responsiveness, arousability and respiratory drive. The spectrum is broad and heterogeneous, including technical and pharmaceutical options already in clinical use or at an advanced experimental stage. Although there is an obvious need for more research on single or combined therapies, the available data demonstrate the variety of effective options, which should replace the unidirectional focus on PAP therapy.

EADSM comment: Up-to-date overview about the state-of-the-art regarding of various OSA treatments.

Meta-Analysis J Hypertens. 2022 Jun 1;40(6):1071-1084.
doi: 10.1097/HJH.0000000000003131.

Link:https://journals.lww.com/jhypertension/Fulltext/2022/06000/Effect_of_different_treatments_for_obstructive.3.aspx

Effect of different treatments for obstructive sleep apnoea on blood pressure

Chengkun Kou[1], Xu Zhao, Xin Lin, Xin Fan, Qiongying Wang, Jing Yu

Objective: Obstructive sleep apnoea (OSA) is a common cause of secondary hypertension. This network meta-analysis (NMA) assessed the effect of different OSA treatments on lowering blood pressure.

Methods: PubMed, EMBASE, Web of Science, and Cochrane Library databases were searched for relevant randomized controlled trials. The search strategies included the concepts of OSA, blood pressure, hypertension, and blood pressure-reducing treatments without language or data restriction (from inception to 1 June 2021). The outcomes included office SBP, office DBP, daytime SBP (dSBP) and DBP (dDBP), and night-time SBP (nSBP) and DBP (nDBP). A Bayesian network meta-analysis was performed, and mean differences with 95% credibility intervals were calculated.

Results: We reviewed 49 randomized controlled trials involving 4893 patients and the following interventions: continuous positive-airway pressure (CPAP), mandibular advancement devices, nocturnal supplemental oxygen, surgery, β-blocker, angiotensin-converting enzyme inhibitors (ACEIs)/angiotensin receptor blockers (ARBs), renal sympathetic denervation (RDN), mineralocorticoid receptor antagonists (MRAs), calcium channel blockers. MRAs were significantly associated with blood pressure reduction followed by ACEI/ARB. RDN could reduce office SBP, office DBP, 24-h SBP, 24-h DBP, dSBP, and dDBP. CPAP also demonstrated modest blood pressure lowering.

Conclusion: MRAs and ACEIs/ARBs can reduce blood pressure effectively in patients with OSA. RDN is a novel hypertension treatment that lowered blood pressure in such patients. CPAP was associated with mild but stable blood pressure reduction, and it might be helpful as an adjunctive therapy in OSA patients with hypertension.

EADSM comment: Meta-analysis showing the best effect on blood pressure from medication in patients with OSA and hypertension, while CPAP, but not MAD, was regarded as an adjunctive therapy. Although, few studies exist so far regarding MAD therapy.

CPAP

Hypertens Res. 2022 Jun 14.
doi: 10.1038/s41440-022-00954-9. Online ahead of print.

Benefits of continuous positive airway pressure on blood pressure in patients with hypertension and obstructive sleep apnea: a meta-analysis

Wenli Shang[1], Yingying Zhang[2], Lu Liu[1], Fenfen Chen[3], Guizuo Wang[1], Dong Han[4]

This meta-analysis was performed to determine the effects of continuous positive airway pressure (CPAP) on blood pressure (BP) in patients with systemic hypertension and obstructive sleep apnea (OSA). A systematic search was conducted using PubMed, Embase, Web of Science, Cochrane Library, and clinicaltrials.gov, without language restrictions. Randomized controlled trials on the treatment of hypertension and OSA with CPAP, compared with sham CPAP or no CPAP, were reviewed. Studies were pooled to obtain weighted mean differences (WMDs) with 95% confidence intervals (CIs). Nineteen trials (enrolling 1904 participants) met the inclusion criteria. CPAP had significant effects on 24-h systolic blood pressure (SBP) (WMD -5.01 mmHg, 95% CI -6.94 to -3.08; P < 0.00001), 24-h diastolic blood pressure (DBP) (WMD -3.30 mmHg, 95% CI -4.32 to -2.28; P < 0.00001), daytime SBP (WMD -4.34 mmHg, 95% CI -6.27 to -2.40; P < 0.0001), daytime DBP (WMD -2.97 mmHg, 95% CI -3.99 to -1.95; P < 0.00001), nighttime SBP (WMD -3.55 mmHg, 95% CI -5.08 to -2.03; P < 0.00001), nighttime DBP (WMD -2.33 mmHg, 95% CI -3.27 to -1.40; P < 0.00001), office SBP (WMD -3.67 mmHg, 95% CI -5.76 to -1.58; P = 0.0006), office DBP (WMD -2.61 mmHg, 95% CI -4.25 to -0.97; P = 0.002), and heart rate (WMD -2.79 beats/min, 95% CI -4.88 to -0.71; P = 0.009). CPAP treatment was associated with BP reduction in patients with systemic hypertension and OSA, except when the follow-up period was shorter than 3 months.

EADSM comment: Important observation that the effect from CPAP on blood-pressure was undetected before 3 months, which might have implications also for studies of MAD on blood pressure.

Pediatric OSA

Int J Pediatr Otorhinolaryngol. 2022 Jun 2;159:111194.
doi: 10.1016/j.ijporl.2022.111194. Online ahead of print.

Link: https://www.sciencedirect.com/science/article/pii/S0165587622001550?via%3Dihub

The effects of obstructive sleep apnea-hypopnea syndrome (OSAHS) on learn and memory function of 6-12 years old children

Hui Li[1], Luqiu Chen[2], Xinhao Wu[3], Fangyuan Zhu[1], Xin Bing[3], Lei Shi[1], Xiaoming Li[1], Wenwen Qi[4], Ming Xia[4], Xiang Zhang[5], Xuening Zhao[6]

Background: Obstructive sleep apnea-hypopnea syndrome (OSAHS) is a sleep disorder causing cognitive impairments.

Aims: We use the auditory verbal learning test (AVLT), clock drawing test (CDT), Wechsler intelligence scale for children (WISC) and Montreal cognitive assessment (MoCA) to evaluate the memory and spatial impairments of OSHAS in 6-12 years old children patients with different severity.

Material and methods: A total of 137 children of snoring were enrolled following the inclusion criteria of this study. According to the apnea-hypopnea indices (AHI), they were divided into three groups. The AVLT, CDT, WISC and MoCA tests were executed by physicians. The self-rating depression scale (SDS) test was performed for depression screening.

Results: Compared with the children in the primary snoring group, the other two groups had higher body mass index (BMI), longer periods of snoring and older age. The AHI, oxygen desaturation index (ODI) and 90% oxygen saturation (TS90%) showed increasing trends whereas the lowest blood oxygen saturation ($LSaO_2$) showed a decreasing trend. Besides, compared with the primary snoring group, the two groups had lower immediate recall scores in AVLT.

Conclusion: AVLT had clinical values for evaluation of impaired memory function in OSAHS children, suggesting a correlation between cognitive impairments and nocturnal hypoxia.

EADSM comment: Study highlighting the neglected children who should probably more often be treated for OSA.