

Articles of the Month – February 2021

Mandibular advancement device therapy

Sleep Medicine 80 (2021):294-300. doi: 10.1016/j.sleep.2021.01.059. Online ahead of print.
Link:<https://www.sciencedirect.com/science/article/pii/S1389945721000769?via%3Dihub>

Comparative effects of CPAP and mandibular advancement splint therapy on blood pressure variability in moderate to severe obstructive sleep apnoea

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Background: Obstructive sleep apnoea (OSA) is associated with increased blood pressure variability (BPV) and are risk factors for cardiovascular disease. We aimed to assess the comparative effects of two OSA therapies, continuous positive airway pressure (CPAP) and mandibular advancement splint (MAS), on BPV.

Methods: This is a secondary analysis of data collected as part of a previously published randomised crossover trial of one month each of CPAP and MAS therapy. BPV was determined from 24-h-ambulatory blood pressure recordings in 92 patients with moderate to severe OSA at baseline and after one month of optimised treatment with each modality. BPV was assessed by three measures: Standard deviation of the mean (SD), Coefficient of variation (CoV), and the Average Real Variability (ARV) index.

Results: Neither CPAP nor MAS therapy improved BPV, with no difference between treatments. BPV did not change in hypertensive OSA patients, however, there was a reduction in ARV of diastolic blood pressure in the effectively treated compared to ineffectively treated CPAP patients, Δ ARV 24-h-DBP (mmHg), -0.72 ± 2.14 , 0.34 ± 1.52 , $P = 0.02$, respectively. There was no difference between effective versus ineffective MAS treatment, Δ ARV 24-h-DBP (mmHg), -0.04 ± 2.4 , 0.02 ± 1.9 , $P = 1.00$, respectively.

Conclusions: One month of optimised CPAP or MAS therapy did not improve short term BPV in patients with moderate to severe OSA. The subgroup of patients on effective CPAP showed some improvement in BPV with CPAP but not MAS. Further work on the effect of OSA therapy on BPV following long-term therapy is needed.

EADSM comment:

Interesting new methodology; blood pressure variability, to look at beneficial effects from OSA treatments.

Review Sleep Med Rev. 2020 Nov 29;56:101407.

doi: 10.1016/j.smrv.2020.101407. Online ahead of print.

Link: <https://www.sciencedirect.com/science/article/pii/S1087079220301507?via%3Dihub>

Use of mandibular advancement devices for the treatment of primary snoring with or without obstructive sleep apnea (OSA): A systematic review

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The aim of this review was to systematically evaluate the available scientific evidence on the benefit of mandibular advancement devices (MADs) in the treatment of primary snoring (PS). From 905 initially identified articles, 18 were selected. Papers that provided indirect information regarding obstructive sleep apnea syndrome (OSAS) and/or sleep breathing disorders (SBD) were included. Information was obtained on monoblock and duoblock appliances from the selected studies. The devices were most commonly able to achieve 50%-70% of the maximum mandibular protrusion. The frequently used outcome measurements were the apnea-hypopnea index, Epworth sleepiness scale, and oxygen desaturation index, which all yielded positive post-treatment results. The most common side effects were temporomandibular joint pain and excessive salivation, which improved with time. Our findings indicated that the use of MADs, even with varying designs, improved outcomes in all the reported patient populations (PS, OSAS, and SBD). Despite the lack of studies on PS, the available evidence supports the use of MADs for treatment of PS. Snoring should be treated from a preventive and psychosocial perspective to avoid progression to more severe diseases that could have a significant medical and economic impact.

EADSM comment: Important review about a somewhat neglected area that, however, is of great interest for patients; effects of oral appliances on snoring.

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Link: <https://www.sciencedirect.com/science/article/pii/S0021929021000786?via%3Dihub>

A finite element analysis for evaluating mandibular advancement devices

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Obstructive sleep apnoea (OSA) is a disorder characterised by complete or partial occlusion of the upper airway during sleep. Muscles relax during sleeping and collapse into the airway, closing the throat and prohibiting air flowing into the lungs. Different solutions have been adopted to manage the pathology to improve the life quality of affected patients.

Mandibular advancement devices (MADs) are proven to be a compliant and successful therapy in the forward repositioning of the mandible to increase the upper airway volume. However, this method has some long-term adverse events that may affect the teeth and periodontal ligaments. This paper presents a finite element model to evaluate the MADs effects (displacement and stress) on teeth and periodontal ligaments, by varying the design, the point of application of the force and the material. The modelled bodies have been reconstructed through a Reverse Engineering approach and computer-aided design tools starting from tomographic images of anatomic bodies and from laser scans of a physical MAD. The results suggest that a central connection mechanism could affect mostly the anterior teeth. In contrast, a lateral connection mechanism provides a more uniform distribution of the load on teeth.

EADSM comment: Important study about the influence of appliance design on the forces of the device on the teeth and following tooth movements. Lateral mechanisms and hard material produce less forces on the upper incisors, which is often of main interest to avoid disturbing bite changes during longer term OA treatment.

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Link: <https://link.springer.com/article/10.1007/s00784-021-03865-0>

Predicting treatment response to mandibular advancement therapy using a titratable thermoplastic device

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Objectives: 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. We describe the use of a trial of a titratable thermoplastic MAD to predict treatment outcomes with a custom-made MAD.

Materials and methods: Patients treated with a thermoplastic MAD as a trial before custom-made MAD manufacturing were included in the study. Sleep recordings and clinical outcomes assessed after 6 months of treatment with each device were compared. Predictive utility of thermoplastic MAD to identify custom-made MAD treatment success defined as a reduction greater than 50% and final apnea-hypopnea index (AHI) less than 10 events/h was evaluated.

Results: Thermoplastic MADs were installed in 111 patients, but only 36 patients were finally treated with both devices and were included in the analysis. A significant correlation was observed between the impact of the two devices on the AHI ($r=0.85$, $p<0.0001$), oxygen desaturation index ($r=0.73$, $p<0.0001$), snoring index ($r=0.85$, $p<0.0001$), and Epworth sleepiness scale ($r=0.77$, $p<0.0001$). A high positive predictive value (86%) but a low negative predictive value (46%) was observed regarding AHI decrease.

Conclusions: Similar impacts of both MADs were observed on major OSA severity markers and symptoms. The ability of thermoplastic MAD to indicate likelihood of success with custom-made MAD will require further controlled studies.

Clinical relevance: Thermoplastic MADs could represent a useful and easily implemented tool to predict the likelihood of success of a custom-made MAD as treatment for OSA.

EADSM comment: Test devices in order to predict treatment response with oral appliances for sleep apnea seems attractive. This study provide some knowledge, although suffer from many drop-outs.

CPAP

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Link: <https://www.sciencedirect.com/science/article/pii/S2352396421000414?via%3Dihub>

Long-term continuous positive airway pressure treatment ameliorates biological clock disruptions in obstructive sleep apnea

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Background: Obstructive Sleep Apnea (OSA) is a highly prevalent and underdiagnosed sleep disorder. Recent studies suggest that OSA might disrupt the biological clock, potentially causing or worsening OSA-associated comorbidities. However, the effect of OSA treatment on clock disruption is not fully understood.

Methods: The impact of OSA and short- (four months) and long-term (two years) OSA treatment, with Continuous Positive Airway Pressure (CPAP), on the biological clock was investigated at four time points within 24 h, in OSA patients relative to controls subjects (no OSA) of the same sex and age group, in a case-control study. Plasma melatonin and cortisol, body temperature and the expression levels and rhythmicity of eleven clock genes in peripheral blood mononuclear cells (PBMCs) were assessed. Additional computational tools were used for a detailed data analysis.

Findings: OSA impacts on clock outputs and on the expression of several clock genes in PBMCs. Neither short- nor long-term treatment fully reverted OSA-induced alterations in the expression of clock genes. However, long-term treatment was able to re-establish levels of plasma melatonin and cortisol and body temperature. Machine learning methods could discriminate controls from untreated OSA patients. Following long-term treatment, the distinction between controls and patients disappeared, suggesting a closer similarity of the phenotypes.

Interpretation: OSA alters biological clock-related characteristics that differentially respond to short- and long-term CPAP treatment. Long-term CPAP was more efficient in counteracting OSA impact on the clock, but the obtained results suggest that it is not fully effective. A better understanding of the impact of OSA and OSA treatment on the clock may open new avenues to OSA diagnosis, monitoring and treatment.

EADSM comment: Exciting new beneficial results about the effects of CPAP on the circadian system.