Think Before Sinking Your Teeth into Oral Appliance Therapy

Commentary on Pliska et al. Obstructive sleep apnea and mandibular advancement splints: occlusal effects and progression of changes associated with a decade of treatment.


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The treatment of obstructive sleep apnea (OSA) has been undergoing a steady shift over the last decade. Whereas continuous positive airway pressure (CPAP) was more or less the sole effective treatment for many years, the landscape is changing with a growing number of treatment alternatives of varying efficacy, and a move toward personalized care. Oral appliance therapy is increasingly recognized as a viable treatment alternative for OSA. Mandibular advancement splints (MAS) are the most common form of oral appliance used in clinical practice and are currently indicated for treatment of mild to moderate OSA patients and severe OSA patients who are intolerant or refuse CPAP therapy. This clinical shift toward increasing usage of MAS is underpinned by a growing evidence base that has identified good treatment efficacy for patients across the spectrum of mild to severe OSA and higher patient preference for this form of treatment. While this augers well for enhancing treatment adherence and treatment outcomes, some unease exists among clinicians and patients about long term side effects.

A number of studies have demonstrated the appearance of minor, usually subclinical, changes in the dentition over time. The details surrounding the appearance and time course of these changes have been poorly understood. Hence, the paper by Pliska and colleagues in this issue of JCSM is a welcome addition to the literature. This landmark longitudinal study, representing the longest follow-up published to date, documented clinically significant changes in occlusion that were progressive over an average of 11 years of MAS use, based on dental study cast analysis. 77 patients (62 males, mean BMI 29 kg/m²) including snorers and patients with a broad spectrum of OSA severity were evaluated and found to have significant decreases in overbite (2.3 ± 1.6 mm), overjet (1.9 ± 1.9 mm) and mandibular intercanine (0.7 ± 1.5 mm) and intermolar widths (1.1 ± 1.4 mm) were found. Half of the patients developed a posterior openbite, defined as a loss of occlusal contact on at least 2 posterior teeth. Moreover, 62% (48/77) of the group also developed an anterior crossbite of at least one tooth with an average of 4 teeth being observed.

This study builds on previous work by these authors and others. The magnitude of overbite (2.3 mm) and overjet (1.9 mm) changes described in this study associated with over a decade of MAS use is greater than previous long term (> 5 years) studies.

However, in contrast to previous studies, this study highlights that discernible changes in dental side effects do not plateau or reach a discernible end-point but are ongoing with MAS use. Progressive changes in dental occlusion were observed with overbite and mandibular intermolar distance decreasing less with time, while overjet, mandibular intercanine distance and lower arch crowding all decreasing at a constant rate.

Like CPAP therapy, MAS effectiveness is impacted by adherence. The motivation to use a MAS represents a delicate balance between a patient’s perception of therapeutic efficacy, comfort and side effects. Although this study highlights dental occlusal changes that are progressive with MAS use, the impact of a patient’s perception of bite changes on long term adherence was not specifically addressed. The high proportion of posterior openbites described, and magnitude of overbite/overjet changes are speculated to influence functional occlusion, aesthetics and speech but this is poorly understood and warrants further research. Despite its poorer efficacy when compared to CPAP therapy, it is thought that patients generally are more receptive to MAS treatment due to its ease of use, non-invasiveness and portability. In support of this belief, a recent study using an objective compliance monitor reported greater compliance (82% at 3 month follow up) and daily use (mean 6.6 ± 1.3 h/day) with MAS therapy when compared to CPAP treatment. Thus, like a double edged sword, poorer MAS compliance may be caused by bite alteration effects and better compliance and increased MAS usage may be plagued with progressive and ongoing bite changes.

In the Pliska et al. study, the total change in overjet was significantly, albeit weakly, correlated to initial AHI (r = 0.28) suggesting that this may relate to a greater degree of mandibular advancement with increasing OSA severity. Numerous studies have documented improved therapeutic efficacy of MAS therapy with increasing mandibular advancement. However, it is generally thought that a greater degree of mandibular protrusion may lead to increased side effects and poorer MAS compliance. This is not surprising as a near linear relationship with increasing forces has been reported by Cohen-Levy and colleagues who recorded forces of 1.5 N/mm with increasing mandibular protrusion. Nevertheless, the degree of mandibular advancement required for optimal treatment outcomes is controversial and a wide variability exists. Recent advances with
a remote controlled mandibular positioner during sleep have however prospectively identified favorable candidates for MAS therapy with the added ability to define an effective target protractive position. This development may prove to be the key to better patient selection, enhanced longer term MAS compliance, and a reduced risk of bite change.

The Pliska et al. study dealt exclusively with one thermoplastic type of MAS, and the authors suggest the observed dental changes are likely to be generalizable to all MAS devices. However, it seems likely that in the same way that device design influences treatment efficacy and compliance, it would also influence the likelihood of bite change. For example, it has been proposed that using a hybrid orthodontic MAS that realigns the dentition may preemptively counteract the adverse bite changes expected to occur. In support of this hypothesis, this study also proposes the notion that the specific expected occlusal changes may be predicted based on the patient’s baseline dentition. Nevertheless, to avoid dental side effects, the use of skeletal anchorage with orthodontic mini-implants for mandibular advancement has been proposed. However, the role of craniofacial morphology on MAS dental changes is still unclear and future research may uncover if specific craniofacial phenotypes are predisposed to more dental changes.

In conclusion, a complex relationship between the perceived therapeutic benefits of MAS therapy, dental side effects and the level of mandibular protrusion exists, which may ultimately affect MAS treatment outcomes and longer term MAS adherence. The findings of progressive and ongoing dental changes with MAS use emphasize the need for better patient education, informed consent and systematic protocols for the longer term management of MAS patients as part of a chronic disease management model of care. It underpins the key role of the dentist with adequate training in dental sleep medicine, who is committed to the long term management of MAS side effects, as part of a multidisciplinary team. Personalized dental sleep care in the future will involve a greater understanding of the specific craniofacial and dental phenotypes and genotypes that are more susceptible to adverse bite changes. Further research focused on identifying suitable candidates for MAS therapy, the required level of mandibular protrusion for optimal therapeutic efficacy, and risk of bite change is warranted and the collaborative efforts of the ORANGE Network offers hope that answers will be forthcoming in the not too distant future.