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COMMENTARY

Predicting a Successful Response to Oral Appliance Therapy: Advancing Knowledge One Model at a Time

Comment on Sutherland et al. Awake multimodal phenotyping for prediction of oral appliance treatment outcome. *J Clin Sleep Med*. 2018;14(11):1879–1887.

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When prescribing an oral appliance (OA) for the treatment of obstructive sleep apnea (OSA), the American Academy of Sleep Medicine (AASM) and American Academy of Dental Sleep Medicine (AADSM) guidelines recommend providers use a custom-made OA, fabricated by a licensed dentist.[1] The device and the dental appointments associated with fabrication and titration are expensive, there are logistical challenges with reimbursement, and treatment delays while the device is being titrated. A recent review estimated that OAs provide a complete response (apnea-hypopnea index [AHI] < 5 events/h) only 48% of the time.[2] Ideally, sleep medicine providers would have a method for identifying those who would be sucessfully treated with an OA prior to fabrication, so that the monetary and time costs could be avoided when treatment is unlikely to be effective.

The clinical practice guideline published by the AASM and AADSM recommends OA treatment for patients who prefer an OA or are intolerant of positive airway pressure (PAP) therapy.[1] In clinical practice, the sleep medicine provider should also consider polysomnography data, clinical variables, patient occupation, physical examination findings, and likelihood of PAP adherence. Incidentally, some of the predictors for low PAP adherence—younger age, lower body mass index (BMI) and AHI[3]—are also associated with OA success.

That said, predicting OA response is difficult. Individual variables associated with success include AHI, BMI, Mallampati score, nasopharyngoscopy, spirometry, and craniofacial photography, among others.[1,2] As is often the case, no one variable performs well enough to impact clinical decision making, so investigators have turned to integrating multiple variables via statistical modeling to improve performance. Identifying the optimal model is not easy. The existing literature consists of multiple derivation studies without successful validation in an external patient sample. These studies lack consistency in the definition used to define OA response. They rarely include overlapping variables, so we often cannot tell whether a given predictor improves the performance of those previously identified. Authors of a recent systematic review attempted to synthesize the existing data, but of the 17 studies they analyzed, only two used the same index test, methodology, and diagnostic thresholds.[4] In short, the derivation studies rarely include the same predictors (independent variables) or outcome definition (dependent variable), and we do not have external validation. This makes choosing the right model, and improving on what we know, hard to do.

Enter the study by Sutherland et al., published in this issue of the *Journal of Clinical Sleep Medicine*.[5] The authors hypothesized that combining multiple, awake assessments of upper airway function would produce an optimized model for predicting OA response. The "multimodal phenotyping assessments" they studied were nasopharyngoscopy, spirometry, and craniofacial photography. They also assessed the effects that age, BMI, sex, AHI, and waist and neck circumference have on model performance. They included three separate definitions for OA response and created a separate model for each. They concluded that awake multimodal phenotyping assessments do not improve predictive accuracy when added to models based on clinical variables alone. Therefore, there is no reason to use nasopharyngoscopy, spirometry, or craniofacial photography when deciding whether to prescribe an OA.

Because it is negative, this study is unlikely to change clinical practice. However, that is precisely why it is important. The assessments they studied performed well. The authors could have stopped there, submitted for publication, and attempted to convince us that the awake assessments they did should be considered in clinical practice. This would be very misleading, but we would not necessarily know that. We would have no way of judging their model against the others that exist, and clinical practice guidelines would continue to limit their recommendations given the poor quality of existing evidence.

Instead, they took the additional step of testing whether awake multimodal phenotyping improves on what we already know, by adding each variable one at a time to a model with clinical predictors. They made sure to include several definitions for OA response as the dependent variable for their models. Instead of finding that awake multimodal phenotyping predicts OA response by one specific definition, the authors proved these tests add nothing to standard clinical variables,

no matter how OA response is defined. Moving forward, investigators can switch their focus away from nasopharyngoscopy, spirometry, and craniofacial photography.

We still do not know which model to use, and all models lack external validation. However, the authors, and the editors at the *Journal of Clinical Sleep Medicine*, deserve credit for publishing a negative study. Unfortunately, far too often we search for significance at the expense of value and accuracy.[6,7] With modeling, attaining significance is easy to do, as there is no shortage of adjustments and manipulations to be made. Although standards for reporting exist,[8] they are rarely followed, so it is challenging to judge whether the investigators were biased in their search for significance. It is refreshing to read a study that moves us closer to our goal, even though it is negative.

CITATION

Holley AB, Dombrowsky JW. Predicting a successful response to oral appliance therapy: advancing knowledge one model at a time. *J Clin Sleep Med*. 2018;14(11):1837–1838.

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