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Predicting Oral Appliance Therapy Outcome Using an Auto-Adjusting Mandibular Positioner in the Home

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Introduction: Selecting patients with obstructive sleep apnea for oral appliance therapy (OAT) can enhance its efficacy. We have recently described a test that predicts OAT outcome using a mandibular positioner under technician remote control in a polysomnographic setting. The present study evaluated the accuracy of a comparable prediction test using a computer-controlled positioner in an unattended setting.

Methods: Patients (n=118) with OSA (mean AHI=24.1±12.5hr-1; mean BMI=29.8±5.0kg/m2) were studied for two or three nights at home using a temporary dental appliance attached to a computer-controlled actuator. Respiratory airflow and oxygen saturation were recorded, and the mandible was moved in response to detected apneas (A) and hypopneas (H). A first night study involved continuous interaction between respiratory events and the controlling algorithm. This data was analyzed using mandibular position in relation to residual AHI (residual AHI=A+H for remaining protrusion ÷ time for remaining protrusion). In a second night confirmatory study, the mandible was held at a derived efficacious position and protruded when the AHI exceeded 10hr-1. When the two nights yielded discrepant outcome predictions, a third night's study, similar to night 2, was performed. Using prospectively established a priori rules, each patient was assigned an OAT outcome prediction and an effective target protrusive position (predicted successes) or a sham value (70% maximal protrusion, for predicted failures), and each received a custom appliance (G2, Somnomed) which was set to target within 3 weeks. Baseline and outcome AHI values were obtained from two nights each of home sleep testing, and therapeutic success was defined as outcome AHI<10hr-1 & 50% of baseline AHI.

Results: The therapeutic success rate was 75%. Using the a priori prediction rules, sensitivity/specificity and positive/negative predictive values (P/NPV) were 0.83/0.76 and 0.91/0.59, respectively, and the overall incorrect prediction rate was 19%. A retrospective classification tree analysis (195 variables) identified two predictors and reduced the incorrect rate to 12%. Imposing a trunk branch criterion of 16.7hr-1 for baseline AHI (see Figure) reduced this rate to 10% and provided values for sensitivity/specificity and P/NPV of 0.94/0.76 and 0.92/0.81.

Conclusions: We have developed an auto-adjusting oral appliance titration system suitable for home use and having a high accuracy in selecting patients suitable for OAT. A retrospective classification tree analysis that treats mild OSA separately increases the overall predictive accuracy. This promising prediction method requires prospective confirmation.