THE ROLE OF FUNCTIONAL RESPIRATORY IMAGING IN THE PREDICTION OF TREATMENT OUTCOME WITH FIXED MANDIBULAR ADVANCEMENT IN OSA PATIENTS

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Introduction

Previous work did demonstrate that the severity of obstructive sleep apnea (OSA) correlates with the morphology of the patient’s upper airway (UA) lumen and skull [CurrOpinAllergyClinImmunol. 2010;26-33; JBiomech. 2007;2207–2213].

It was also demonstrated that changes in upper airway lumen and bony structures do correlate with changes in OSA severity [JBiomech. 2007;3708-14], but that these treatment response are influenced by gender, baseline OSA severity and UA collapsibility [JBiomech. 2011;442-449].

In spite of such correlations until now no single parameter was reported that predicts the outcome of a given treatment. This work aims to develop and test a binomial linear model to predict treatment response to mandibular advancement in a large population of OSA patients.

Methods

A prospective observation clinical trial was performed in 100 OSA patients (83% male; 47.4±11.5 years; BMI: 26.9±3.3 kg/m²; AHI: 21.0±11.2 events/hour). Patients started oral appliance treatment with mandibular advancement (OAm) in a fixed mandibular protrusion of 75% of the individual maximal advancement. 77 patients had both functional CT scan analysis (FRI) without and with OAm, and polysomnography at baseline and with OAm.

From the polysomnography data baseline OSA severity (AHI and oxygen desaturation index) was used for the analysis. From the FRI analysis upper airway collapsibility (collapse without or with MRA), lumen (change in UA volume and resistance) and skeletal response (movements of the mandible and hyoid bone) were analyzed. Treatment was considered positive (response=1) when the AHI decreased with at least 50%, or if the post-OAm AHI was below 5 (with a baseline AHI of at least 5). 30 photographic lumen geometry (left), contours of pressure on the lumen wall during exhalation (right). Statistical analysis was performed in R. A binomial generalized linear (bglm) model predicting response by all aforementioned parameters and the patient’s gender was constructed using a bidirectional stepwise approach considering each parameter separately and the interaction between each parameter and the baseline AHI. Fitted response values of at least 0.5 were considered to result in a positive response.

Results

The success rate in terms of AHI of the OAm treatment in the 77 patients used for model building was 47%. The fitted bglm model was significantly (p<0.05) better predicting treatment outcome as compared to no prediction. The model has a positive predictive value=0.82; negative predictive value=0.81; accuracy=0.82; sensitivity=0.78 and specificity=0.85.

Conclusion

A combination of OSA severity, gender, UA collapsibility, and the lumen and skeletal response to mandibular advancement can be used to predict the outcome of OAm treatment with an accuracy above 80%. The validity of the predictive model can now be further validated in clinical practice.