Obstructive sleep apnea is a common disorder with major consequences\(^1\). Although CPAP is the treatment of choice for OSA, many patients are non-adherent with therapy or refuse diagnosis as they would prefer to avoid this treatment\(^2\). As a result, efforts are being focused on potential alternative therapies\(^3\). Mandibular advancement splints (MAS) have been gaining popularity as they represent a reasonable alternative to CPAP therapy\(^4\). In randomized trials, although CPAP has better efficacy than MAS, the effectiveness of these therapies is often comparable as MAS may have improved adherence over CPAP\(^5\). Because MAS requires a series of visits to a dentist over time, some have suggested that the ability to anticipate response to therapy may be helpful\(^6\). In theory, some patients who are likely to have an excellent response to treatment with MAS could be selected for this form of therapy whereas those patients likely to have a poor response could be directed to surgical treatment or other alternatives\(^7\). As a result, we and others have been working at methods to guide potential stratification regarding optimal therapeutic response in OSA. Recognizing that OSA is likely a multifactorial disease\(^8,9\), we reasoned that identifying indices of anatomical compromise may help to determine which patients would be most likely to benefit from anatomical manipulations.

Using cephalometrics, we have recently defined anatomical tongue metrics which have predictive value from standpoint of MAS response\(^10\). These data suggest that cephalometrics may be useful to separate which patients may be highly responsive to MAS therapy from those patients who may be less responsive. In particular, patients with a large tongue relative to the oral cavity size had a robust response to MAS. Such an approach may be a useful method to stratify the response to MAS therapy prior to a series of dental visits to titrate therapy. Spirometry has also been shown to have some predictive value, with the ratio of expiratory to inspiratory flow correlating with the response to oral appliance therapy in some but not all studies\(^6\). As a result of these prior publications, we have investigated the potential role of acoustic pharyngometry to predict the response to MAS therapy\(^11,12\).

On the basis of the above logic, we sought to test the following hypothesis: Acoustic pharyngometry could be used to predict the response to oral appliance therapy. Those individuals who show an improvement in airway caliber with mandibular repositioning should have considerable improvement with MAS therapy.

Methods:

We assessed a convenience sample of individuals who had undergone upper airway assessment prior to MAS therapy. Individuals who showed improvement in pharyngeal caliber with mandibular repositioning were provided with MAS therapy (Respire Blue Series Appliance – Respire Medical, NY), whereas those without improvement were not given MAS and thus were not enrolled. We used acoustic pharyngometry to assess possible improvement in airway caliber with mandibular repositioning.
Twenty (n=25) patients were enrolled in whom inclusion criteria were met and pre and post sleep studies were available for assessment. Subjects had a range of different (Respire) MAS devices provided.

Sleep studies were performed before and after therapy. Change in AHI was the primary outcome measure. Paired t tests were used to compare individuals’ changes in AHI. The observed improvements were compared to historical controls who had undergone MAS in a recent randomized trial13.

Results

Pre vs. Post AHI are compared in Figure 1. The line of identity is shown on the figure. Values below the line represent improvement whereas values above the line would be indicative of deterioration. As can be seen in the figure, individuals with mild to moderate OSA improved considerably following MAS therapy, whereas patients with severe apnea had a more variable response. On average for all patients, the AHI improved from 29.0 ±21.2/h to 10.0±13.2/h (p <0.0001) with an average follow-up of ~3months. Although such results would perhaps be anticipated with MAS therapy, these results compare favorably with historical data published previously by our colleagues [30.1±26.6/h to 20.0±12.7/h]13 at 3 months.

Discussion and Conclusion:
These data suggest that acoustic pharyngometry can be used to anticipate response to MAS therapy. We observed a robust improvement in AHI particularly among patients with mild to moderate OSA. The observed improvement is better than what we might anticipate from historical controls, suggesting that this approach can be used to guide therapy.

OSA is known to have multiple underlying mechanisms9, with ongoing efforts focused on methods to define the factors causing apnea in a given individual. In some individuals, control of breathing abnormalities are likely the critical factor, and interventions which stabilize ventilatory control may well be beneficial in such individuals14. Other individuals may have velopharyngeal compromise and may well respond to focused interventions such as uvulopalatopharyngoplasty7. Oral appliance therapy may well be beneficial to patients with retroglossal compromise or with individuals who have good coupling between the tongue and soft palate from standpoint of protrusion maneuvers. As such, we believe our data support the notion that anatomical assessments can be used to predict response to MAS therapy. Further research will be useful to compare head-to-head tailored therapy versus empirical therapy for treatments including MAS.
Figure 1: Pre AHI vs. Post AHI

The graph shows a scatter plot with the x-axis representing Pre AHI (events/hr) and the y-axis representing Post AHI (events/hr). The line of identity is also marked on the graph.
References