

Magnetic Resonance Imaging of Dynamical Upper Airway Structural Changes in OSA patients during Negative Oral Pressure Treatment

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Objective: The innovated iNAP system creates a negative pressure in oral cavity by applying a suction power through the soft mouth bite. Theoretically, the tongue and soft palate are pushed forward by the pressure differences between upper airway and oral cavity and keep airway potent. This study applied dynamical magnetic resonance imaging (MRI) to explore the effect of the negative pressure on the upper airway structure and the relationship between the structural changes of the upper airway and the effectiveness of treatment for OSA patients.

Methods: After consent form was signed, the subject underwent dynamical and 3 dimensional MRI scan with and without iNAP. Then, the subject was asked to sleep and the same MRI procedure repeated while the iNAP was turned off or on. The volume and area of different segments of the upper airway were calculated from the MRI images by a commercial program. The differences in the upper airway volume and area between iNAP on and off or between the subject with and without mouth bite were analyzed. In addition, the subjects were subdivided into responder and non-responder by whether the AHI can decrease 50% and lower than 20 after treatment.

The characteristics of the upper airway in responder and non-responder were compared.

Results: Totally 10 subjects were recruited and aged 36.9 ± 6.04 years. The BMI was 27.8 ± 4.37 and the baseline AHI was 40.72 ± 22 . There were 7 subjects respond to the treatment and the AHI was significantly decreased after treatment (14.1 ± 10.82 ; $P=0.0009$). The volume of the upper airway was significantly increased when iNAP was turned on during both awake ($P=0.005$) and sleep ($P=0.001$). The maximal and minimal areas of upper airway were also significantly increased when iNAP was on during both awake ($P=0.0002$ and $P=0.0042$ respectively) and sleep ($P=0.0068$ and $p=0.0161$ respectively). The characteristics of the upper airway showed no differences between responder and nonresponder.

Conclusion: The severity of AHI can be significantly ameliorated in most of the patients by iNAP. The effect of the treatment can be mainly attributed to the increased the upper airway area and volume during both awake and sleep. A larger group of the nonresponder warranted for further study to understand the limitation of the treatment and improve patient selection.

中文題目：利用磁振造影評估睡眠呼吸中止症病人對於負壓治療的變化

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