Quantification of Tongue Tissue Stiffness with Ultrasound Shear-Wave Elastography in Patients with Obstructive Sleep Apnea

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Objective: To evaluate the potential of tongue tissue elasticity measurement in participants with obstructive sleep apnea (OSA) and healthy controls through ultrasound (US) shear-wave elastography (SWE).

Methods: From October 2017 to September 2018, transcutaneous submental SWE was performed in 46 participants (20 healthy controls and 26 patients with OSA; 14 women and 32 men; aged 24–69 years) using a US system. Tongue tissue elasticity quantification with shear modulus of 0–200 kPa was recorded during normal breathing and during the Müeller maneuver (MM). Polysomnography (PSG) was used as the reference standard.

Results: Mid-sagittal tongue tissue elasticity was significantly higher in awake patients with OSA than in controls during normal breathing and the MM (normal breathing: 36.58 kPa vs. 21.12 kPa; MM: 37.30 kPa vs. 21.74 kPa, respectively; $P < .0001$). The posterior third of the tongue in patients with OSA had the highest value of shear modulus during the MM ($P < .001$). Shear modulus values of the posterior third of the tongue were significantly higher in mid-sagittal scanning than in coronal section in all participants during normal breathing and the MM. With cutoffs of 27.6 and 35.2 kPa for the whole tongue and posterior third during the MM, respectively, the sensitivity obtained was 69.2% (18 of 26) and 76.9% (20 of 26), and specificity was 85% (17 of 20) and 95% (19 of 20) respectively, for detecting OSA. The corresponding areas under the receiver operating characteristic curve were 0.82 and 0.88, respectively.

Conclusion: US SWE demonstrated that tongue tissues are stiffer in patients with OSA than in controls, especially in the posterior third of the tongue during the MM. US SWE is a feasible imaging modality for noninvasive tongue tissue elasticity measurement in OSA.

中文題目：以超音波剪向波彈性影像檢查量化阻塞性睡眠呼吸中止症病患的舌部組織硬度

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