# 舌體運動的觀測：超音波與非超音波研究綜論

# Observation of tongue movement: ultrasonic versus non-ultrasonic methods

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## 摘要

舌體的大小或運動模式，因爲解剖位置的關係，很難作正確的檢查及評估。過去對於舌體運動功能的檢查，往往只侷限於臨床間接的觀察。隨著科學的進步，許多種方法被發展出來用以評估及研究舌體的大小、位置及功能。例如：動態放射線攝影術(cineradiography)、螢光影片法(videofluoroscopy)、活性碳腭圖法(palatography)或活性碳舌圖法(linguography)、腭電圖(electropalatography)、電腦斷層掃描(computerized tomography)、核磁共振造影(magnetic resonance imaging)及超音波(ultrasonography)法有其優缺點及臨床應用或研究的限制。在眾多的方法中，超音波儀器應用在口腔舌體生理病理的研究上，具有操作簡單、能顯示二度平面圖像即時(real-time)動態、影像可重覆取得(reproducible)、沒有生物傷害性及相對儀器價格較便宜等特點。本文回顧文獻中各種有關評估及研究舌體的方法，並分超音波與非超音波的研究方式來討論，同時簡介口腔防震式超音波的研究方式。

## Abstract

Tongue is an important organ both in speech production and swallowing, yet the most difficult is to obtain a direct view. Previously, cineradiography was used almost exclusively for evaluating tongue movement. Owing to considerable x-ray exposures, the use of this technique has become limited for ethical reasons. The same limitation applies to the usage of computerize tomography (CT). Palatography is a well-known traditional method of obtaining articulatory data. However, different absorbency to the marking medium among speakers adds measurement error. Electropalatography (EPG) utilizes an artificial palate to measure tongue-palate contact during function. The involved artificial palate has to be designed individually and is expensive. The carriage of pseudo-palate during tongue movements, to some degree, is not physiological. In the case of eletromagnetic articulography (EMA) or electromagnetic midsagittal articulometer (EMMA), considerable preparation time is needed, and the procedure and subsequent

signal processing is complicated. Magnetic resonance imaging (MRI) technique permits observation of vocal tract features from any angle and makes possible three-dimensional reconstruction of the entire vocal tract. However, image acquisition rates are currently still too slow by an order of magnitude to capture dynamic motion. Also the accompanied noise is disturbing. Ultrasound has the advantage of allowing visualization of the actual soft tissues of the tongue and floor of the mouth. Over the past years, an increasing number of ultrasonography examinations of tongue tumor have been carried out in an effort to improve preoperative staging and to help the surgeon to define an adequate resection margins. Many researchers used this technique to observe tongue functions, such as speaking or swallowing. However, these previous ultrasound studies are subject to potential artifacts caused by varying transducer-skin contact surfaces of the submental area due to movements during function. Additional movements also occurred readily since the ultrasound transducers in previous studies were handheld by either the examinee or the examiner. Consequently, the images depicted were misinterpreted. A dynamic tongue imaging technique, the cushion-scanning technique (CST), was developed to overcome these problems. The purpose of this study is to introduce this technique, with a brief review of other associated techniques, in the research of tongue movement.