Measurement of Tongue Movement during Vowels Production with Computer-assisted B-Mode and M-Mode Ultrasound

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Abstract

We sought to apply B- M-mode ultrasonography in combination with the cushionscanning technique (CST) in quantitative analysis of tongue movement during vowel articulation. STUDY DESIGN AND SETTING: Twenty normal persons (10 women and 10 men) were enrolled in this study. Each individual was asked to enunciate 5 vowels:/e/, /i/, /aI/, /o/, and /ju/. A noninvasive diagnostic technique, computer-assisted B-mode plus M-mode ultrasonography, was used in combination with the CST to assess their tongue movement. The sonographic signals were recorded on a video recorder and then transferred to a personal computer via a frame grabber for digital assessment. RESULTS: M-mode images show an amplitude-time diagram, whereas B-mode images reveal midsagittal tongue configuration. The ranges of tongue movement in midsagittal plane in male speakers during production of the vowels /e/, /i/, /aI/, /o/,and /ju/ were 8.29 ± 1.76, 4.00 ± 0.78, 13.82 ± 2.86, 14.05 ± 1.63, and 6.72 ± 1.66 mm, respectively; for female speakers, the averages were 7.19 ± 0.92, 3.36 ± 1.31, 12.74 ± 2.16, 12.86 ± 2.18, and 7.11 ± 2.09 mm, respectively. CONCLUSIONS: The computer-assisted B-mode plus M-mode ultrasonography in combination with the CST provides a standardized and quantifiable ultrasonographic examination for the clinical investigation of tongue movement during vowel articulation. In our study group, there was no difference in the thickness of tongue or the range of tongue movement in midsagittal plane during articulation of the selected vowels between males and females.Further exploration can be extended in the field of speech research by this valuable tool.