# Oral tongue squamous cell carcinoma evaluated by PROPELLER and echoplanar diffusion-weighted imaging

**C-J. Juan[1], H-C. Chang[2,3], C-Y. Chen[1], H-W. Kao[1], C-J. Hsueh[1], C-W. Wang[1], C-C. Cheng[1,3], S-C. Chiu[1,3], H-W. Chung[1,3], and G-S. Huang[1]**

[1]Department of Radiology, Tri-Service General Hospital, Taipei, Taiwan, [2]Applied Science Laboratory, GE Healthcare Taiwan, Taipei, Taiwan, [3]Institute of Biomedical Electronics and Bioinformatics, National Taiwan University, Taipei, Taiwan

## Introduction:

Echoplanar diffusion-weighted images (EP-DWI) have been widely applied to evaluate head and neck cancers [1]. However, it has not been used to evaluate oral tongue cancer (OTC) yet. The reasons might be due to severe magnetic susceptibility artifact in there oral cavity, which contains abundant air and sometimes metallic dental devices. Recently, Juan, et al. have shown that DWI using periodically rotated overlapping parallel lines with enhanced reconstruction (PROP-DWI) is superior to EP-DWI by providing distortion-free DWI in head and neck [2]. In this study we aimed to qualitatively evaluate the imaging quality of DWI specifically in the oral cavity and to quantitatively analyze the apparent diffusion coefficient (ADC) of OTC using EP-DWI and PROP-DWI.

## Material & Method:

This study enrolled 33 patients (28 men and 5 women; 52.0 ± 9.0 years) with pathological proven squamous cell carcinoma of oral tongue (OTSCC). All MR scans were performed at a 1.5 T whole-body scanner (GE Healthcare, Signa HDx, US) (maximum gradient of 50mT/m; 8NV head and neck array coil). Axial fast spin-echo (FSE) T1-weighted images (T1WI) (TR/TE/Nex/ETL: 750ms/11ms/1/4) with injection of 0.1 mmol/kg of gadolinium-DTPA and T2-weighted images (T2WI) (3150ms/87ms/2/22) were acquired with field of view (FOV) of 240 × 240 mm, matrix size of 128 × 128, slice thickness of 5 mm and slice spacing of 1.0 mm. DW-MRI were obtained with motion-probing diffusion gradient (b = 0 and 1000 s/mm$^2$) being applied on each of three orthogonal directions. The geometry, FOV, matrix size, slice thickness and slice spacing were identical to that used with the FSE T1WI/T2WI. For PROPELLER-DWI, FSE sequences (7000ms/122 ms/1.8/24) were undergone with fat saturation. For EP-DWI, single-shot spin-echo echo-planar acquisition (7000/73.3/4) was performed without acceleration. ADC maps were generated on personal computer by using a pixel-by-pixel computation according to the logarithmic equation: $ADC = \ln[SI_0/SI_{1000}]/(b_{1000}-b_0)$, where $SI_0$ and $SI_{1000}$ was the signal intensity of DW images corresponding to the b value of 0 and 1000 s/mm$^2$, respectively. Morphologic analysis to compare image distortion between DWI ($b$ = 0 sec/mm$^2$) and T2-weighted MR images was performed for qualitative comparison. For statistical analysis, one neuroradiologist with 8 years experience in head and neck image interpretation evaluated DWI distortion by using a four-point scoring system (Fig 1): A score of 0 indicated severe distortion—that is, distortion involving the entire oral cavity. A score of 1 indicated moderate distortion—that is, distortion involving two-third of the oral cavity. A score of 2 indicated mild distortion—that is, distortion involving one-third of the oral cavity. A score of 3 indicated no distortion involving the oral cavity. For quantitative analysis, the ADC of OTC and contralateral tongue in patients and tongue of volunteers were analyzed using a region of interest (ROI) method. Statistical analyses were performed by using SPSS 13.0 (SPSS, Chicago, Ill). Normality of the perfusion parameters was examined using Q-Q plots and Kolmogorov-Smirnov tests. Student t test was used for group comparisons of ADC. A $P$ value of less than .05 was considered as statistically significant.

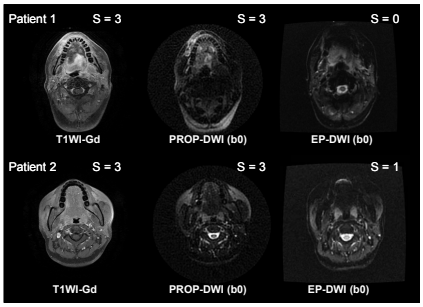


**Fig. 1.** Illustration of imaging distortion on contrast-enhanced T1-weighted image, PROP-DWI (b = 0 s/mm$^2$) and EP-DWI (b = 0 s/mm$^2$).

## Results:

FSE-PROP-DWI provided non-distorted or mild distorted images, while EP-DWI showed moderate to severe distortion ($P$ < 0.005). The ADC of the OTSCC was 1.12 ± 0.16 × 10$^{-3}$ mm$^2$/s, which was similar with SCC in other sites [3] but significantly higher than the contralateral normal appearing tongue. ($P$ < 0.005)**.**

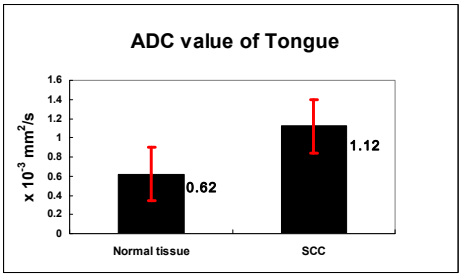


**Fig. 2.** ADC value of OTSCC and normal tissue ($P$ < 0.005).

## Discussion & Conclusion:

Our study shows that EP-DWI is not feasible for measurement of OTSCC due to severe magnetic susceptibility artifacts from dental device and air in the oral cavity as demonstrated on a prior study [2]. FSE-PROP-DWI provides a non-distorted to mild distorted DWI for assessing the ADC of OTSCC. In conclusion, FSE-PROP-DWI is superior to EP-DWI in evaluating OTSCC.

## Reference:

1. Eida S. et al. AJNR 2007; 28:116–121.
2. Juan CJ, et al. Radiology 2009, 253: 144-152.
3. Juan CJ, et al. ISMRM 2009, #3481