Purpose: Xerostomia (dry mouth), resulting from radiation damage to the parotid glands, is one of the most common and distressing side effects of head-and-neck cancer radiotherapy. We have developed a family of sonographic texture features to evaluate the morphologic and microstructural integrity of the parotid glands, and investigate the feasibility of quantitative evaluation of radiotherapy-induced parotid-gland injury.

Methods: In this pilot study, 12 post-radiotherapy head-and-neck cancer patients and 7 healthy volunteers were enrolled. Each participant underwent one ultrasound study, and longitudinal (vertical) ultrasound scans were performed of the bilateral parotids. The averaged follow-up time for the post-radiotherapy patients was 17.2 months and the median radiation dose was 32.3 Gy. Eight grey level co-occurrence matrix (GLCM) features were derived from the B-mode images. The associated parameters for texture features can be summarized as follows: 1. Inverse differential moment (IDM): local homogeneity; 2. Contrast: difference of gray-scale through continuous pixels of the image; 3. Angular second moment (ASM): homogenous texture; 4. Entropy: disorder of the image. 5. Variance: heterogeneity; 6. Correlation: linear relationship between the gray-scale of pixel pairs; 7. Cluster shade and 8. Cluster prominence: the perceptual concepts of uniformity and proximity.

Results: Significant differences ($p<0.05$) were observed in 8 sonographic features, between normal and irradiated parotid glands. IDM value decreased from 7.88Â±1.14E-2 (normal) to 6.93Â±1.54E-2 (irradiated); Contrast value increased from 3.41Â±1.11E+2 to 8.45Â±3.46E+2; ASM value decreased from 6.06Â±1.72E-4 to 3.02Â±0.87E-4; Entropy value increased from 7.66Â±0.34 to 8.47Â±0.23; Variance value increased from 2.84Â±1.01E+2 to 9.30Â±3.53E+2; Correlation value decreased from 1.35Â±0.45E-3 to 6.22Â±2.09E-4; Cluster shade value increased from 1.20Â±1.24E+4 to 1.51Â±1.27E+5; Cluster prominence value increased from 3.11Â±2.50E+6 to 3.74Â±3.11E+7.

Conclusions: This work has demonstrated the feasibility of ultrasonic texture evaluations of the parotid glands, and the sonographic features may serve as imaging signatures to assess radiation-induced parotid damage.