

Training Artificial Intelligence with Surgical Entry Data for Enhanced Furcation Involvement Detection

Stephanie Hoang¹, Dr. Jennifer Chang¹, Lauren Garcia¹, Dr. Celine Sheng¹, and Dr. Robin Weltman²

1. UTHealth Houston School of Dentistry, Houston, TX, USA
2. University of Nevada, Las Vegas School of Dental Medicine, Las Vegas, NV, USA

Objectives: Furcation involvement is one of the clinical parameters used for diagnosing periodontal disease, but it can be difficult to detect. Several studies involving the application of AI to radiographic bone loss have been conducted, but none have directly addressed furcation involvement. The aim of this research is to develop an AI model for furcation detection to assist the clinician in making a diagnosis and enable the clinician to determine the optimal treatment.

Experimental Methods: Radiographs from a total of 150 patients at UTSD and UNLV from 1/10/2011 to 4/19/2023 with surgical entry results revealing furcation involvement were included in this retrospective study. Prior to the application of deep machine learning, the radiographic images were pre-processed via annotations using Computer Vision Annotation Tool, marking the area of interest, labeled with associated surgical codes, and teeth were individually segregated via bounding boxes. The processed images were flipped for data augmentation. A U-Net model was developed for deep machine learning in which the images were inputted, and the output was which type of furcation involvement was present.

Results: The U-Net model detected 159 teeth having buccal furcation, 53 with lingual furcation, and 100 teeth with proximal furcation involvement. Accuracy of buccal and lingual furcation detection combined was 89%, and proximal furcation detection was 85%.

Conclusion: The detection of buccal and lingual furcation involvement was associated with higher accuracy than proximal detection most likely due to radiographic distortions since the boundaries of proximal areas of teeth on radiographs can be more difficult to define. This study can be improved by expansion of the clinical data to be more representative. Successful development of an AI model would serve as a clinical aid in diagnosing periodontitis. Future improvement of the model to provide treatment suggestions to the provider would improve its usefulness as a clinical aid.

This study was supported by the UTSD Student Research Program.