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Accuracy Evaluation of an Estimation System for Dental Treatment Sites by Using Image Recognition

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Abstract. In dentistry, misidentification of the treatment site may occur an adverse event with irreversible consequences. Among these, the left-right tooth error is the second most common site misidentification. In this study, we developed a treatment site estimation system using image recognition, and the accuracy rate of the left and right teeth was more than 85%. The results suggest that this system can be used to prevent the misidentification of the left and right teeth.

Keywords. Dentistry, Medical safety, Identification, Treatment site

1. Introduction

Misidentification of the treatment site is a serious medical safety issue in the field of dentistry. Although reminders have been issued in the past, individual reminders in busy clinical settings are limited, and misidentification of the treatment site is repeated.

In recent years, AI-based systems have been developed in a variety of fields, and systems such as automobile collision damage mitigation systems have been put to practical use [1]. In dentistry as well, the use of AI for image recognition, etc., has the potential to create a human error prevention system that does not depend on individual attention.

2. Methods

Eight subjects were divided into two groups, one for training and the other for evaluation, and videos were captured with an iPhone 12 Pro (Apple, California) for each, assumed dental treatment. Five hundred and 200 annotated images were created from the videos in the learning group and evaluation group using labelImg [2]. YOLOv4 [3] was used for training and evaluation to determine facial landmarks, from which an estimation system for dental treatment sites was built. To evaluate the accuracy of the developed

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system, the location of dental treatment instruments was estimated for another three subjects.

3. Results

Site accuracy is the highest at lower right (61.9%), and the lowest at upper left (42.9%). Left/right accuracy is all over 85%, in particularly left side is more than 95%. Upper/lower accuracy is the highest at lower right (76.2%), and the lowest at upper left (42.9%).

4. Discussion

In this study, we constracted a dental treatment site estimation system using image recognition. As a result, we confirmed that this system can estimate the left and right treatment sites with high accuracy. In our dental hospital, the number of misidentification of the treatment site per year is less than five cases. Therefore, we believe that this system can prevent misidentification of the treatment site. Among them, wrong tooth extractions can lead to particularly serious consequences and it is reported that the most common error in the wrong tooth extractions is two of adjacent teeth, followed by the tooth on the left and right sides [4]. In actual clinical practice, misidentification of treatment site occur most frequently between the adjecent second molars and impacted wisdom teeth [4]. Improving the accuracy of this system by identifying the tooth type based on tooth morphology, it may be possible to prevent the mistake between adjacent teeth.

5. Conclusions

By using image recognition to detect facial landmarks and instruments, the left and right treatment sites could be estimated with high accuracy. It was suggested that this system can prevent left-right site errors..

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