Prototyping MR Clinical Support System for Dentists

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1. Introduction

Modern advancement of medical technologies forces clinicians to renew their knowledge about materials and devices continuously. As dental treatment handles innumerable devices and materials, dentists and dental technicians have high demands to check their knowledge about correct ways of treating each item as well as conditions of a patient under treatment during dental treatment. However, to check conventional manuals or patient records, clinicians need to halt clinical process. In order to avoid interfere smooth clinical process with frequent consultation with clinical information, new display suitable for dental process is required.

This paper proposes and prototypes dental information display based on mixed reality technology.

2. Foregoing Researches

After an official notice from ministry of health and welfare of Japan to permit to use electric patient record (EPR) gave on April 22, 1998, many clinical sites, especially gigantic hospitals, start introducing advanced hospital information systems (HIS) including EPR. Most of HIS are designed to support clinical activities by producing innumerable clinical information, such as EPR, attached documents of medicine, or manuals of medical equipments. Clinicians refer them on usual PC terminals or PDA terminals in daily clinical activities. However, users need stop their treatments to handle a keyboard or a mouse to search and to look into required information.

Several foregoing researches including the authors [1] are proposed to utilize a head mounted display (HMD) (Fig.1). Although a HMD can be a best solution to overlay additional information to target area, such as surgical field [2], to wear HMD throughout clinical process may disturb clinical process itself as well as may give displeased feeling for patients. Only otolaryngologists, who always wear fiberscopes or head mirrors, may accept wearing HMD throughout their clinical processes.

Figure 1: HMD-based dental support system
Projector-based MR is another way to visualize clinical information within target area as shown in figure 2[3]. This approach enables clinicians to browse required information without wearing any additional devices.

Figure 2: Projector-based tele-instruction system for an ultrasound probe operation

3. Prototyping and Results

In ordinal clinical setup, dentists sits behind head of patient laying down on a dental chair and uses both hands to treat the patient’s mouth. A patient wears a bib to keep their cloth clean even when he/she rinses his/her mouth. When supporting information projected onto the bib, the dentists may browse the information within his field of vision without taking off his/her view from the patient’s mouth.

The authors developed projector-based information support system for dental process as shown in figure 3. The developed prototype displays information via projector mounted on dental pole to mount dental lights.

Figure 3: the prototype and projected image

Dental specialists evaluated the developed prototype under pseudo clinical session of composite resin (CR) filling. Although CR filling is one of the most popular dental care, conditions of a patient may force a dentist to use unfamiliar CR. Then dentists need to refer proper way and timing to prepare it. With the prototype, a dental assistant to support dentist visualize manual of resin using near field communication device (NFC) to select proper step of manual.

The developed prototype clearly smoothened whole dental process. The dentists could understand the given information through the projected image, and the dentists and the patients didn’t claim any disturbance given by the projected light.

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