Ease of use in accessing electronic dental records with a touchless interface compared with a conventional mouse

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Why Is This Important?

Dental offices have traditionally used paper records to document patient files. However, there has been a shift in medical record keeping. An increasing number of practices are implementing electronic health records (EHR). Frequent access to EHR for clinical notes and viewing diagnostic images requires touching the mouse and keyboard, often with contaminated gloves, during a procedure. It is difficult to disinfect computer units, increasing the chance of cross-contamination when working in clinical environments. A hands-free computer interface driven by motion-sensing technology addresses this challenge, but few data exist regarding the efficacy of this technology in the clinical setting. As shown in the graphical abstract, dental clinicians manipulated patient EHR using the Leap Motion (Ultraleap) controller with no significant reduction in speed compared with the conventional mouse (CM). The controller was found to be practical and easy to learn. Furthermore, a probable reduction in glove use may present an environmentally friendlier option. The authors show that the Leap Motion controller contactless computer interface has similar efficiency to the CM and reduces physical contact with the hardware. Motion-sensing technology accounts for the disadvantages of CM systems and may be a viable alternative in the future.

Introduction

Because of advantages such as time efficiency and accuracy,\textsuperscript{1} the use of digital records in dentistry has grown, and the ubiquity of electronic health records (EHR) is approaching. However, dependence on technology has posed new challenges. Physically interacting with a computer requires physical contact, which increases the risk of cross-contamination.\textsuperscript{2}

Motion-sensing cameras for computer control offer a potential solution. There are few data regarding the effectiveness of hands-free controllers in either dentistry or medicine. Studies have investigated Xbox Kinect (XK) (Microsoft) as a potential interface. For computer control during vascular surgeries\textsuperscript{3} and radiographic image manipulation,\textsuperscript{4} XK has been shown to be better than directing an assistant. XK has also been used successfully for computer control during removing malignant kidney neoplasms.\textsuperscript{5}

Key Words. Leap Motion controller; conventional mouse; electronic health records; hands-free controller; waste reduction; aseptic technique.
However, this system has disadvantages that would limit its use in the dental setting. XK requires a large working distance and total body movements. This is practical in a larger operating room but unrealistic in a confined space. 3

A practical control system for the dental operator must be compact and require gestures from a single hand. A device that meets these needs is the Leap Motion controller (LM) (Ultraleap). Few studies have examined using the LM for computer control in health care. One study assessing the efficiency of the LM for manipulating angiographic images found that procedural time when using the LM was considerably less than when clinicians directed a technician to control the computer. 6 Although the LM has been found effective in the dental setting, researchers failed to describe their methods, and corresponding results may be difficult to reproduce. 7

We conducted a proof-of-concept study aimed to compare touchless control of EHR and medical imaging software with the conventional mouse (CM). The relative efficiencies, perceived asepsis, learning curve, and practicality of the LM and CM were evaluated. The efficacy of the touchless interface in the dental setting was also determined.

Methods

The computer used was a Dell Latitude E7440 Ultrabook powered by Windows 7 (Microsoft). The respective software for the LM and CM was Leap Motion Software (Ultraleap) and Mudra Mouse (Ultraleap). The dental EHR software used was axiUm (Exan Software).

The LM was introduced to 3 endodontists for approximately 20 minutes of orientation. The participants practiced with the LM for 30 minutes, after which a sequence of tasks was assigned on the EHR. As a proof-of-concept study, a test case was used. No protected health information was accessed.

The program axiUm was open at the start time. The sequence of tasks was repeated 3 times: open schedule, select patient, view EHR notes, view radiographs, and manipulate a radiograph. The 3 clinicians completed the same tasks with the CM and the LM. Then, 2 glove changes were added to the CM protocol, and 3 more task sequences were timed.

Finally, each provider completed a root canal treatment using the LM for computer manipulation. Clinicians then completed a 5-point Likert scale survey, ranging from 1 through 5 in which 1 represented “strongly disagree” and 5 represented “strongly agree,” to score questions about perception of asepsis, learning curve, and practicality. No microbiological assessment was performed. A sample survey is provided in the Appendix.

Results

Three clinicians completed the task sequence using the CM without glove changes in less than 20 seconds (mean, 18.7 seconds). The CM with 2 glove changes took a mean of 52.6 seconds, and the LM took a mean of 42.2 seconds.

The CM without glove changes was significantly faster than the LM and the CM with 2 glove changes. No time difference was perceived between the LM and the CM with 2 glove changes.

In the postprocedural survey, the 3 participants expressed that the LM effectively maintained perceived asepsis and agreed it was practical with a realistic and short learning curve.

Discussion

Invasive intraoral procedures require field asepsis for successful outcomes. Computers are difficult to disinfect and become contaminated with various pathogens. 8 The colonization rate for a mouse and keyboard is higher than for other user interfaces in a clinical setting. 9 Using the LM, we developed a system that allowed endodontists to control EHR without physical contact, thus possibly preventing cross-contamination. The CM without glove changes was significantly faster than the LM and the CM with 2 glove changes. No time difference was perceived between the LM and the CM with glove changes. These data were significant for endodontic procedures, and we infer that motion-sensing technology can be implemented in other dental fields in which the aseptic technique is required.

Time trials in this study showed that the CM with glove changes is comparable with the hands-free system. The LM’s perceived ability to maintain asepsis was because it reduced physical contact, and 3 clinicians agreed that the LM was practical with a realistic and short learning curve. The LM may also be advantageous because of a probable reduction in glove use. The LM may offer a safer and more sustainable alternative for EHR entry in the future.

Forthcoming studies should aim to pair voice-recognition software with the LM for dictation and develop software for the LM designed for interacting with clinical records. As a control, microbial assessment studies should also be considered to document contamination reduction. This study showed that clinicians could use the LM controller with no reduction in speed compared with their current practice of using a CM. The participants reported that the LM was practical and had a short learning curve, indicating that transitioning from the CM to a hands-free system was not challenging and could be an alternative for dental practices.

Conclusions

This proof-of-concept study showed that a motion-based controller for electronic health records showed no compromise in speed or practicality and offered reduced physical contact compared with a CM.
Evaluation of a touchless interface for EHR access

Supplemental Data

Supplemental data related to this article can be found at: https://doi.org/10.1016/j.jfscie.2023.100024.

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