

Up-to-Date Use of Computer Technology in Orthopedic Surgery and Future Revolutions

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Editorial

Musculoskeletal diseases are the most common cause of long term disability and mechanical pain in industrialized societies. The importance of musculoskeletal disorders, is not only concerned with individual health and mobility, but also social functionality is critical for productivity and economic growth [1,2].

With the widespread use of differential imaging methods and improvements in analytical and navigation areas, computer-assisted orthopedic surgery (CAOS) was introduced as a new field about 20 years ago. This description refers to approaches using computer-aided monitoring systems or robotic devices to improve the visibility of the surgical field and to increase the accuracy of application in various surgical fields.

In orthopedic surgical treatment, insertion of an implant member for fixation of fractures, ligament reconstruction, and surgical steps such as tumor resection and cutting or drilling bones, as far as possible, are carried out perfectly. In addition, surgeons often face with difficulties with a limited visibility of surgical field, and there is a growing trend towards minimally invasive surgery recently. As a global positioning system (GPS) based on car navigation displays the vehicle on a map, and the driver gives a visual instruction; computer assisted orthopedic surgery (CAOS) module provides the surgeons to receive real-time feedback like GPS. The surgeon performs surgical operations using information transmitted from a virtual scene of the situs presented on an imaging device. Active or semi-active surgical robots are used in parallel with the CAA module in order to potentially improve the results of surgical procedure [3].

There are two different types of robots in the literature. The nominal active robots perform an autonomous task without additional support from the surgeon. Such a system has been applied for total joint replacement, but their clinical benefits have been questioned frequently [4].

Unlike active robotic devices, passive or semi-active robots do not carry out a part of the operation independently. They guide or assist the surgeon in locating surgical instruments [5].

Despite its superior advantages such as reduced patient exposure to radiation and greater accuracy in most cases, surgical navigation has yet to be generally accepted among orthopedic surgeons. In a recent study [6], it was noted that the obstacles faced by surgeons in adopting surgical navigation were not due to a difficult learning curve or lack of training opportunities. Barriers to the adoption of navigation, disappointments about unreliable accuracy, intra-operative registration and doubts associated with the line of sight. These findings indicate that significant advances in technology are needed to speed up the adoption of surgical navigation.

As a result, about twenty years have passed since the introduction of the first robot and navigation systems for CAOS. Today, this technology has emerged from the laboratory and is routinely used in the operating room and may be about to become the latest technology for some orthopedic procedures. Existing techniques are systematically optimized and new techniques will be constantly integrated into the existing systems. Hybrid CAOS systems are being developed and the surgery will be able to create virtual object information in the future [3].

The focus of the research should be on alternative monitoring technologies that remove the disadvantages of existing devices. This will encourage the development of less or even non-invasive recording methods and reference tools. Force sensing devices and real-time computational models, going beyond pure kinematic control of surgical action may permit the establishment of a new generation of CAOS system.

Eventually, the acceptance of robotic or navigational orthopedic surgeon can contribute to the evidence of better long-term outcomes of the intervention.

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