information for example, iMRI, navigation, videos from microscope and endoscope camera, pathological images, and patient's monitoring information enable operating surgeons and supporting staff to approach to the best decision making by sharing patient's status via visible information. Though these intraoperative information are useful for the high quality of therapy, operating surgeons in operating field can not manipulate these information by themselves because they are wearing sterilized groves or touch any devices (computer mouse and keyboard etc.). This fact brings stress to the operating surgeons and they feel dilemma by asking circulating staff to manipulate the information. Opect is a commercially available interface which enables sterilized operating staff to manipulate intraoperative information without wearing any sensors or markers [1]. This interface has been contributing in more than 160 cases for neurosurgery and respiratory surgery. However, as the Opect experienced many cases, the requirement to observe vessels through multi angle three-dimensionally has arisen. The research aim is implementing touchless dynamic manipulatable interface (Opect 3D) for three-dimensional arteries models.

Methods

To implement the Opect 3D, Kinect for Windows v2 sensor (Microsoft Corporation) was utilized and three-dimensional models were constructed with uncompressed DICOM files through three-dimensional volume rendering. Because Kinect for Windows v2 sensor has a built-in high resolution infrared and RGB camera and is capable to identify shapes of our hands (rock, paper, and scissors) precisely, these shapes were assigned to the function of three-dimensional model manipulations. The model was rotated by the rock, stopped by the paper, parallel translated by the scissors shaped hand's motion, and enlarged/reduced by closing a hand to the Kinect. Operators were able to manipulate the model with their single hand as shown in Fig. 1.

Fig. 1 Operator manipulating the model

We evaluated user experience for the Opect 3D by employing seven volunteers. The verification was focused on intuitiveness and maneuvering based on the concept of "Natural User Interface (NUI)" which aims operators to get used to the system without instruction. The volunteers were asked to start manipulating the model without having any instruction in advance. They were simply asked to accomplish the task "find the simulated colored tumor in the model and manipulate the model as the tumor comes to the center of the display". Each of volunteers repeated the task twice. The time for taking to achieve the task was measured.

Results

Figure 2 shows the time for accomplishing the task and each manipulations (rotation, translating, stop, and others) rate were described as breakdown. The average time for the first trial was 146.87 ± 131.85 s (the fastest: 17.42 s and slowest: 440.85 s). The rates in each of motions for rotation, translation, stop, and others were 27.07, 14.88, 3.99, 54.96 % (Fig. 2a). Since the volunteers were not taught how to maneuver the model, generally they performed the task with little confused. Some of them were struggled and even jumped for maneuvering. However, after they found actions to control and got used to manipulate the model, they did not take long for achieving the task. Therefore, in the second time, the average time was reduced to less than half of the first trial, 57.34 ± 62.42 s (the fastest: 12.88 s and slowest: 206.24 s) and the manipulating rates were 42.09, 44.96, 12.95, 0 % (Fig. 2b). In the second result, it's notable that there were no volunteer who moved their hand in "others". Instead of wasting time for "others", they concentrated for translating (Fig. 2b). This result means that the concept of the NUI was realized in this implementation because all volunteers clearly figured out manipulations with only two times experiences.

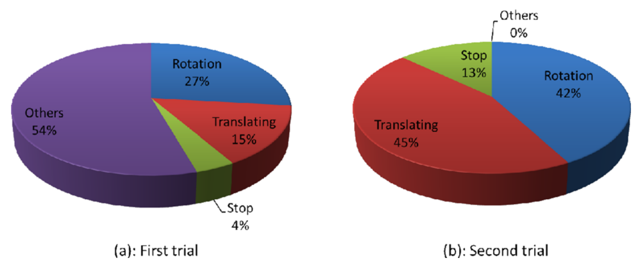

Fig. 2 Time for accomplishing the task and each manipulation

Conclusions

We proposed Opect 3D which enables operating surgeons to manipulate three-dimensional arteries models to observe from multi angle dynamically during clinical case for the best decision making and implement the first version of the interface. From the results of the user experience based on the concept of NUI, this presented work shows promising results and potential for being adapted as part of Information/precision guided surgery. Next future works start with heightening the image and visual quality of three-dimensional models to the optimized level which satisfy the clinical use through verification in clinical experiences and continual discussions with surgeons.

References

[1] Yoshimitsu, K., Muragaki, Y., Maruyama, T., Yamato, M. & Iseki, H. Development and Initial Clinical Testing of" OPECT": An Innovative Device for Fully Intangible Control of the Intraoperative Image Displaying Monitor by the Surgeon. Neurosurgery. (2014) Mar;10 Suppl 1:46–50.

An image-guidance system for vascular malformation treatment: concept, design and evaluation on a patient-specific phantom

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Keywords IGS · EM tracking · Vascular malformation · Rapid prototyping

Purpose

Minimally-invasive endovascular procedures have become the standard treatment for vascular malformations, such as arterio-venous information for example, iMRI, navigation, videos from microscope and endoscope camera, pathological images, and patient's monitoring information enable operating surgeons and supporting staff to approach to the best decision making by sharing patient's status via visible information. Though these intraoperative information are useful for the high quality of therapy, operating surgeons in operating field can not manipulate these information by themselves because they are wearing sterilized groves or touch any devices (computer mouse and keyboard etc.). This fact brings stress to the operating surgeons and they feel dilemma by asking circulating staff to manipulate the information. Opect is a commercially available interface which enables sterilized operating staff to manipulate intraoperative information without wearing any sensors or markers [1]. This interface has been contributing in more than 160 cases for neurosurgery and respiratory surgery. However, as the Opect experienced many cases, the requirement to observe vessels through multi angle three-dimensionally has arisen. The research aim is implementing touchless dynamic manipulatable interface (Opect 3D) for three-dimensional arteries models.

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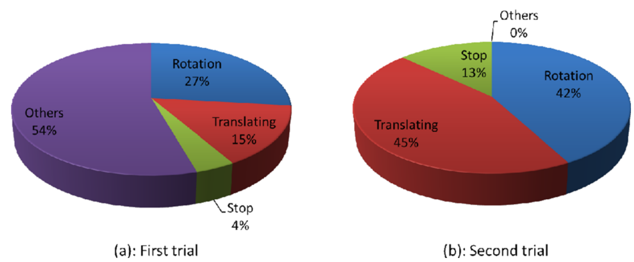

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