Journal of Plastic, Reconstructive & Aesthetic Surgery (2014) 67, 967–972

JPRAS
An International Journal of Surgical Reconstruction
www.JPRASurg.com

Assessment of three-dimensional high-definition visualization technology to perform microvascular anastomosis

Alex K. Wong [a,*,c], Gabrielle B. Davis [a,c], T. JoAnna Nguyen [a], Kenneth J.W.S. Hui [a], Brian H. Hwang [a], Linda S. Chan [b], Zhao Zhou [a], Wesley G. Schooler [a], Bala S. Chandrasekhar [a], Mark M. Urata [a]

[a] *Division of Plastic and Reconstructive Surgery, Keck School of Medicine, University of Southern California, 1510 San Pablo St., Suite 415, Los Angeles, CA 90033, USA*
[b] *Department of Surgery, Keck School of Medicine, University of Southern California, 1510 San Pablo St., Suite 415, Los Angeles, CA 90033, USA*

Received 20 December 2013; accepted 1 April 2014

KEYWORDS
Microsurgery;
Three-dimensional;
Visualization;
Ergonomics

Summary *Background and aim:* Traditional visualization techniques in microsurgery require strict positioning in order to maintain the field of visualization. However, static posturing over time may lead to musculoskeletal strain and injury. Three-dimensional high-definition (3DHD) visualization technology may be a useful adjunct to limiting static posturing and improving ergonomics in microsurgery. In this study, we aimed to investigate the benefits of using the 3DHD technology over traditional techniques.
Methods: A total of 14 volunteers consisting of novice and experienced microsurgeons performed femoral anastomoses on male Sprague-Dawley retired breeder rats using traditional techniques as well as the 3DHD technology and compared the two techniques. Participants subsequently completed a questionnaire regarding their preference in terms of operational parameters, ergonomics, overall quality, and educational benefits. Efficiency was also evaluated by mean times to complete the anastomosis with each technique.
Results: A total of 27 anastomoses were performed, 14 of 14 using the traditional microscope and 13 of 14 using the 3DHD technology. Preference toward the traditional modality was noted with respect to the parameters of precision, field adjustments, zoom and focus, depth perception, and overall quality. The 3DHD technique was preferred for improved stamina and less back and eye strain. Participants believed that the 3DHD technique was the better method

* Corresponding author. Division of Plastic and Reconstructive Surgery, Department of Surgery, University of Southern California, Keck School of Medicine, 1510 San Pablo Street, Suite 415, Los Angeles, CA 90033, USA. Tel.: +1 323 442 7920.
E-mail address: Alex.Wong@med.usc.edu (A.K. Wong).

[c] These two authors contributed equally to the work.

http://dx.doi.org/10.1016/j.bjps.2014.04.001
1748-6815/© 2014 British Association of Plastic, Reconstructive and Aesthetic Surgeons. Published by Elsevier Ltd. All rights reserved.

for learning microsurgery. Longer mean time of anastomosis completion was noted in participants utilizing the 3DHD technique.

Conclusions: The 3DHD technology may prove to be valuable in improving proper ergonomics in microsurgery. In addition, it may be useful in medical education when applied to the learning of new microsurgical skills. More studies are warranted to determine its efficacy and safety in a clinical setting.

© 2014 British Association of Plastic, Reconstructive and Aesthetic Surgeons. Published by Elsevier Ltd. All rights reserved.

Introduction

Microsurgery is a unique surgical discipline, as it requires high levels of technical expertise, fine motor movements, and prolonged durations of static posturing. Microsurgical training emphasizes proper ergonomics focusing on neutral body positioning, appropriate posturing with parallel positioning of the legs to the floor, suitable limb support to reduce tremor, and vertical alignment of the microscope with the head and neck to prevent neck flexion.[1] However, when improper techniques are adapted, they can result in fatigue and strain. In severe cases, suboptimal ergonomics can lead to career-limiting injuries. It has been reported that over 70% of plastic surgeons reported musculoskeletal symptoms with an increased predominance of cervical and thoracic pain with microscope use.[2] Therefore, novel strategies warrant investigation to enhance proper ergonomics and comfort in microsurgery.

Currently, traditional methods of visualization include magnifying loupes, head-mounted microscopes, and the standard operating microscope, all of which require the operator to look strictly through the lens in order to maintain the field of vision. In reference to the usage of loupes, it has been reported that they lead to increased incidence in neck flexion in a myriad of surgical displines.[3,4] It has been well established that neck flexion >15–20 degrees produces significant fatigue of the musculature in the neck.[5] The United States Department of Labor, Bureau of Labor Statics reports a strong correlation of static posturing to the development of neck and shoulder musculoskeletal disorders.[6] 3DHD visualization technology, which projects a three-dimensional (3D) image onto a large flat screen display, may prevent excessive neck flexion and static neck posturing as the head can move freely during the operation without losing the field of vision. We hypothesized that the 3DHD system could reduce excessive strain and static posturing, thus improving ergonomics in microsurgery.

The aim of this study was to compare the 3DHD microsurgery technology to the traditional operating microscope with respect to operational parameters, musculoskeletal strain, and overall quality outcome and preference based on a survey of attending surgeons, residents, and medical students. In addition, we aimed to evaluate the utility of the 3DHD system as a surgical teaching aide.

Materials and methods

A total of 14 voluntary participants were recruited in the study; four were attending plastic surgeons, six were plastic surgery residents, one was a general surgery resident, and three were medical students at the Keck School of Medicine of University of Southern California (USC). Experienced participants were those who had previously taken a formal course in microsurgery, which included the four attending surgeons and three plastic surgery residents. Novice participants were considered those who had never taken a formal microsurgery course and included three plastic surgery residents, one general surgery resident, and three medical students. The experienced participants were compared to the novice participants. Each participant performed a microsurgical end-to-end anastomosis of the femoral artery in male Sprague-Dawley retired breeder rats. One anastomosis was performed using the Zeiss Opmi-MD (Carl Zeiss Meditech, Jena, Germany) traditional microscope and the other with the 3DHD (TrueVisions Systems, Santa Barbara, CA, USA) camera mounted onto the oculars of the same microscope. Prior to the operation, each participant was randomized to determine which visualization technique was to be used first, making sure that there were equal numbers of participants in each group. All participants were assisted by an attending microsurgeon to ensure patency of the anastomosis.

Male retired breeder Sprague-Dawley rats, weighing from 500 to 900 g, were housed at the vivarium at the USC under standard conditions. All procedures were performed according to guidelines of the Institutional Animal Care and Use Committee at the USC. The animals were anesthetized using pentobarbital for induction and a ketamine/xylazine mixture for maintenance. The femoral artery was then isolated using standard techniques[7] and transected midway between the inguinal ligament and the superficial epigastric branch. Either a standard microscope or the TrueVision 3D camera was attached to the beam splitter of the Zeiss Opmi-MD in preparation for the vascular anastomoses. The image from the 3DHD camera was projected onto two 46” JVC flat panel 3D screens (Yokohama, Japan), which were placed behind the surgeon so that it was visible to each surgeon. Real-time adjustments were made to the TrueVision camera and screen placement in order to optimize the image obtained. The interrupted, end-to-end vascular anastomosis was performed using 10/0 monofilament nylon suture. The proximal and distal clamps were removed and patency was determined by direct visualization of pulsatile flow. The rats were monitored for 1 week to access for vessel patency via direct visualization of the limbs prior to being euthanized.

Background information was obtained regarding the participants' level of training, prior microsurgery experience, general comfort with microvascular surgery, and the

Download English Version:

https://daneshyari.com/en/article/4117651

Download Persian Version:

https://daneshyari.com/article/4117651

Daneshyari.com