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Researchers identify improved avenues to train plastic surgeons in microsurgery

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Microsurgery is an intricate and challenging surgical technique that involves using miniature instruments and sutures as fine as a hair strand aided by sophisticated microscopes. In plastic surgery, microsurgery is used to repair small damaged vessels and nerves following trauma, or in reconstructive procedures by moving a component of living tissue from one place of the body to another and reconnecting its vascular supply to this new region to keep its blood supply.

Repetitive and intensive training is necessary to develop the required fine motor skills and competencies for residents to become proficient in microsurgery. Historically, surgical training has employed a "see one, do one, teach one," approach, though there has been an increased interest in using simulation for training in recent years, in particular with respect to microsurgery, where there is little room for error. The majority of simulation training in microsurgery currently uses both live and cadaveric animal models. However, several financial, practical, ethical, and accessibility issues persist with animal model use, particularly in low-resource settings.

Proposing a move to non-biological models for simulation training

A recent study, published in the journal *Plastic and Reconstructive Surgery* led by Dr. Stephanie Thibaudeau, Assistant Professor of Surgery at McGill University, and Division of Plastic and Reconstructive Surgery

Program Director at the McGill University Health Centre, puts forward the notion that non-biologic simulators could prove to be a better alternative when it comes to training future surgeons.

"Our paper provides a comprehensive summary of all non-biologic simulators in use for microsurgery training in plastic surgery, and reports on the demonstrated efficacy of non-biologic simulators for the acquisition and retention of microsurgical skills," explains Jad Abi-Rafeh, a medical student at McGill and the paper's first author.

"In contrast to animal model training, which requires expensive labs, the advantages of non-biologic simulators include increased availability, ease of set-up, flexibility (accommodating interrupted practice), low cost, low maintenance, lack of biological hazards, portability, potential for repeated use, and easy storage. It also reduces animal use and is overall more ethical."

The researchers showed that using basic sewing needles led to a 48 percent decrease in the number of animals needed for microsurgery training, resulting in an equivalent performance on animal models compared with animal model training alone. Supplementing an animal-based training course with practice card exercises led to a 50 percent reduction in costs associated with microsurgical training, decreased animal use and death, and improved performance on animal models later on.

Silicone tubing yielded equivalent outcomes as animal model training on rat anastomosis assessment exercises, and skills learned were retained over the next four months.

Moving towards implementation

"The findings of our study bring us one step closer towards a new

standardized, ethical, accessible, and objectively measurable microsurgery training curriculum to train the modern-day surgical resident in the practice of microsurgery," the authors claim. "The next steps would be to develop a training curriculum employing various non-biologic simulators that would leverage the use of different models of increasing complexity to teach growing microsurgical skills in a stepwise fashion. It would also leverage exciting emerging technologies to further narrow the gap between biologic and non-biologic simulators, such as the heart-like 'micro-pump', which drives pulsatile and dynamic circulation through simulated non-biologic vessels."

The researchers note that once this curriculum is developed, it would then need to be validated and compared to animal-based training models presently available, and, if demonstrated to be as effective, may considerably reduce, if not by-pass completely, animal model use in microsurgery training.

"It is such a privilege for a medical student like myself to be working with such a talented team of plastic surgery residents under the supervision of Dr. Thibaudeau," adds Jad. "All co-authors on this study have such notable experience in simulation research; Dr. Zammit and Dr. Jaberi are CIHR-funded researchers currently obtaining their masters in experimental surgery and simulation, while Dr. Al-Halabi is a Ph.D. candidate with interests in surgical education. Without their guidance and supervision, this study would not have been possible."

"Nonbiological Microsurgery Simulators in Plastic Surgery Training: A Systematic Review," by Jad Abi-Rafeh, Dino Zammit, Mehrad Jaberi, et al, was published online in *Plastic and Reconstructive Surgery* in September 2019.

More information: Jad Abi-Rafeh et al, Nonbiological Microsurgery Simulators in Plastic Surgery Training, *Plastic and Reconstructive Surgery*

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