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EDITORIAL • GENERAL ORTHOPAEDICS - MICROSURGERY

Reconstructive microsurgery

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The history of microsurgery spans across most of the last century, with the introduction of vascular end-to-end or end-to-side anastomosis and autogenous vein grafts by Carrel, Guthrie and Eck between 1800 and 1900. In the 1960s, Jacobson and Suarez demonstrated that with the use of the operating microscope and refined techniques, the fine work necessary to facilitate the anastomosis of small vessels less than 1 mm in diameter was possible. The use of magnification along with micro-instruments and micro-sutures opened a new era in surgery, with the establishment a new discipline called microsurgery [1]. This marked the end of conventional surgery for cases of major trauma of the upper and lower extremities, such as complete or incomplete nonviable amputations, where a team consisting of both orthopaedic and vascular surgeons was required. Thus, it is with the introduction of the operating microscope along with micro-instruments and micro-sutures, the three "Ms" of microsurgery, that orthopaedic surgeons were able to achieve successful anastomoses of digital arteries in incomplete digital amputations [1, 2].

The introduction of the operating microscope by Jacobson and Suarez in the 1960s led to the revolution in microsurgery, making it an integral part of orthopaedic reconstructive and trauma surgery. As microsurgical techniques were perfected, a notable increase in success was seen with replantation surgery, artery and nerve repairs [3, 4]. While the application of microsurgical techniques to secondary reconstructive procedures is a relatively more recent development, it gave orthopaedic surgeons the ability to better manage secondarily various complications associated with conventional orthopaedic surgery, using techniques such as toe-to-hand transfer, vascularized bone grafts, free tissue flaps, nerve grafts and much more.

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Across the last few decades, microsurgery in orthopaedics has made sweeping contributions to trauma and has shown a rapid growth into complicated reconstructive procedures for severe defects secondary to traumatic injury, as well as for congenital malformations. In the 1970s, microsurgical composite tissue transfer became a reality, with functioning free muscle transfers, vascularized bone grafts, toe-to-hand transfers and so on [5]. Because of technological advances, as well as a better understanding of the micro-anatomy, reconstructive microsurgery has reached the stage, today, where anastomosis of vessels as small as 0.3 mm is feasible. This type of microsurgery, referred to as "supermicrosurgery" is now applied for perforator flaps, complex digital replantations, lymphatic anastomosis, etc. Among the recent milestones in the history of microsurgery has been the advancement of composite tissue allotransplantation [6]. Today, microsurgical techniques have become an integral part of orthopaedics, hand surgery, plastic surgery, neurosurgery, as well as most primary surgical disciplines.

While today both orthopaedic surgeons and plastic surgeons sub-specialize in microsurgery, microsurgery is a specialty with significant overlap that plays a critical role in the advancement and improvement of surgical outcomes. This overlap has been referred to as "orthoplasty" [7, 8].

Even though the concept of skills, competency and expertise is widely embraced, it remains poorly defined in surgery. The development of each surgeon's microsurgical skills is an ongoing process of refining surgical technique based on experience. The broad gamma of topics covered in this issue by international experts, underscores the importance of training young surgeons by keeping them aware of the advances in the field of microsurgery [9, 10]. As Buncke said, "The age of the self taught microsurgeon is over". While fellowship training can be a means of pursuit of excellence in skills that few have, performing more cases, and/or additional training in specific types of microsurgical procedures, recent reports have shown an increasing level of dissatisfaction and burnout ranging from 28 to 42% among surgeons who focus on performing demanding microsurgical reconstructive procedures [11–15]. Surgeons that focus

primarily on microsurgical reconstruction are also associated with higher rates of emotional exhaustion, and there are several significant stressors that may decrease motivation for performing microsurgical reconstructions. These may contribute, in part, to surgeons moving away from practices that weigh heavily in microsurgical reconstructive to shorter, less stressful cases [11, 16]. Nonetheless, as both trauma and cancer remain on high on the medical forefront, experienced and well-versed reconstructive microsurgeons remain in high in-demand. As such, special issues such as this, which highlights some of the recent advances in microsurgery, are imperative for the advancement of state-of-the-art knowledge and experience. This special issue focuses on what is new in microsurgery and addresses various aspects including advances in microsurgical techniques, the influence of this progress in other fields related to microsurgical practice and current topics in research. With this respect, we are grateful to all of the authors and surgeons who have shared their experience over a wide range of current topics.

Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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