Robotic-assisted Micro- and Supermicrosurgery

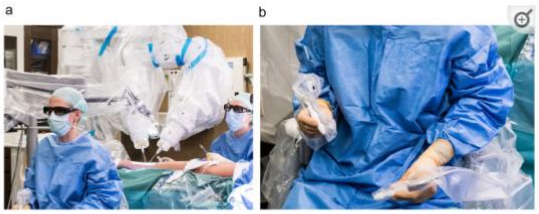
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Abstract (300 word limit)

Statement of the Problem: Robotic microsurgery has emerged as a new technology with potential benefits for plastic and reconstructive surgery. Further development may advance the field by allowing for microsurgical reconstructions of even smaller structures or in otherwise hard to reach areas. Methodology & Theoretical Orientation: We report our more than 2 year experience using the Symani® Surgical System to perform micro- and supermicrosurgical (< 0.8 mm) anastomoses in lymphatic and reconstructive surgery. The system consists of two robotic arms that can be positioned to facilitate microsurgical procedures. It is combined with a console, that is composed of an ergonomic chair, a footswitch controller and forceps-like joysticks. Motion scaling can be set to 7-20x. Visualization can be achieved with a 3D visualisation system (exoscope) or an optical microscope. Findings: Despite a longer time to perform the first robotic anastomoses, we observed a marked decline in suture time over time. Among the advantages of the system were a high accuracy in placing the stitches. The challenges encountered included the lack of a touch sensation and the necessity to develop a "see-feel". The systems has shown to be very beneficial in performing microsurgical anastomoses in small cavities or deep within the body, e.g. for central lymphatic surgery of the thoracic duct. Conclusion & Significance: Robotic-assisted surgery may open up new frontiers in reconstructive microsurgery, e.g. reliable anastomoses on even smaller blood vessels (e.g. smaller perforator free flaps) and lymphatic vessels or on structures that lie deeper in the body cavities. It may allow surgeons to push the boundaries of reconstruction in anatomic areas previously considered too small and remote to operate on in the future. Ongoing research will have to validate the used techniques in larger clinical studies and future challenges include cost reduction and technical optimization of the robotic systems themselves. However, they have emerged as one of the most useful and innovative tools in recent times.

Image

Figure 1



(a) Intraoperative set up of the Symani Surgical System® using a 3D exoscopic visualization system. (b) The surgeon controls the robotic system with two sterile manipulators and foot pedals. Hand movements are converted, and motion is scaled (7-20x) into movements of the robotic arms.

From: Barbon C, Grünherz L, Uyulmaz S, Giovanoli P, Lindenblatt N (2022) Exploring the learning curve of a new robotic microsurgical system for microsurgery. JPRAS Open 34:126-133.

Recent Publications (minimum 5)

1. Weinzierl A, Barbon C, Gousopoulos E, von Reibnitz D, Giovanoli P, Grünherz L, Lindenblatt N (2023) Benefits of robotic-assisted lymphatic microsurgery in deep anatomical planes. JPRAS Open 37:145-154.
2. Grünherz L, Gousopoulos E, Barbon C, Uyulmaz S, Giovanoli P, Lindenblatt N (2023) Robotics in plastic surgery. Chirurgie (Heidelb) 94:325-329.
3. Grünherz L, Lindenblatt N (2023) Central Lymphatic Surgery. Plast Aesthet Res 10:20. doi: 10.20517/2347-9264.2023.24
4. Barbon C, Grünherz L, Uyulmaz S, Giovanoli P, Lindenblatt N (2022) Exploring the learning curve of a new robotic microsurgical system for microsurgery.JPRAS Open 34:126-133.
5. Lindenblatt N, Grünherz L, Wang A, Gousopoulos E, Barbon C, Uyulmaz S, Giovanoli P (2022) Early experience using a new robotic microsurgical system for lymphatic surgery.Plast Reconstr Surg Glob Open 10:e4013

Photograph



Biography (150 word limit)

Prof. Dr. med. Nicole Lindenblatt currently holds the position of Deputy Director in the Department of Plastic and Hand Surgery at the University Hospital Zurich, Switzerland. In this function she leads the Plastic and Reconstructive Surgery Team and the Burns Unit and is the Director of the Zurich Lymphatic Network of Excellence. In addition to her roles at the hospital, she is an Adjunct Professor at the University of Zurich. Prof. Lindenblatt`s primary focus is on Peripheral and Central Lymphatic Surgery, Robotic Microsurgery, Reconstructive and Aesthetic Facial and Breast Surgery, and Facial Paralysis. She performed the first thoracic duct reconstruction in 2018 in Switzerland/Europe and receives referrals for Central Lymphatic Surgery from all over Europe. In 2021, Prof. Lindenblatt performed the first lymphatic reconstruction in a child in Switzerland and the first robotic-assisted lymphatic surgery case worldwide using the Symani® Surgical System.

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Notes/Comments: