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EDITORIAL

# Time to Evolve Plastic Surgery Education? Integrating Robotic Techniques and Artificial Intelligence into Training Curricula

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We, as plastic and reconstructive surgeons, have long prided ourselves on our intricate skill, precision, and manual dexterity. Using simple magnification with microscopes, we have successfully performed delicate procedures such as anastomosing lymphatic vessels as minuscule as 0.2 mm, using hand-held microsurgical instruments. However, as technology continues to advance, we are faced with the question of how far we can push the boundaries of surgical innovation, relying solely on traditional magnification and manual instruments.

Other surgical specialties stand further in their uptake of new-age technology, such as robotic surgical techniques in urology and general surgery,[1] artificial intelligence (AI) in orthopedics and neurosurgery,[2,3] and virtual reality across various disciplines. Although some may argue that plastic surgery, dealing primarily with the external surface of the human body, does not necessitate such technological adjuncts, the rapid adoption of these innovations by other specialties raises important questions about the future of our field. Purists may argue that the essence of plastic surgery lies in the artistic finesse and subjective judgment of the surgeon, rather than the precise calculations of machine-driven precision. Indeed, much of our craft is based on aesthetic principles and the surgeon's intuitive sense of form and proportion. However, dismissing robotic and AI development outright overlooks the potential benefits they may offer in enhancing surgical outcomes, efficiency, and patient care. It may further put us at a disadvantage compared with other specialties, which enjoy a higher integration of robotic technology and AI.

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It is our opinion that true change and uptake can only come from training and increased exposure during the surgeon's formative years. Exposure, in turn, can lead to new innovations and indications for robotic surgery and AI. The earlier this happens in our career, the more scope and motivation there is for innovation, research, and development. This forms the basis of the argument to consider integrating robotics and AI in our training curricula.

Nonetheless, to effectuate any form of change, it is wise to determine whether as a specialty we are ready for this, and whether our young colleagues even want to learn about robotic surgery and AI, especially as indications currently seem limited. As the landscape of surgical innovation continues to evolve, the question arises: should plastic surgery residency programs incorporate training in robotic surgery skills and AI?

To this aim, a national survey was done to gauge awareness, interest, and future perspectives of Belgian residents on robotic plastic surgery. A 30-point questionnaire was designed by the national resident organization in cooperation with the Organization of Robotics and Surgical Innovation Young Professionals Board. Questions were designed as Likert scales from 1 to 5 (low to high). This was sent to all Belgian residents by e-mail in February 2022, followed by a reminder 1 and 2 weeks later. Of the 60 residents, 40 (67%) with an average age of 29 years replied to the questionnaire. Responses were received across all training years and from all training programs. Only one in five residents had witnessed robotic procedures during their plastic surgery residency, most of which were for robotic DIEP flap harvest, with none having used AI. The average rating (out of 5 on Likert scales) for current utility in robotic surgery was 2.4, and for cost effectiveness, 1.6. When asked about future utility, this rose to 3.3 ($P = 0.007$ when compared with current utility), and for future cost-efficiency, to 3 ($P < 0.0001$ when compared with current cost-efficiency). Robotic training as an added value for residency was rated highly (4 or above) by 66% of residents with an average rating of 3.6. Residents rated their current knowledge on robotic surgery as 2.2. Interest in learning more about robotics in plastic surgery was rated 4 and 4.4 for AI and virtual reality.

This shows that robotic surgery and AI enjoy limited exposure in plastic surgery, with only 20% having seen at

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least one procedure performed with a robot and none having used AI for clinical indications. Current utility and cost efficiency are rated averagely; however, there is a significant increase when questioned on the future. This, coupled with a high interest in learning about robotics and AI, shows that residents look favorably at the evolution of robotic plastic surgery. Indeed, although current perceptions may vary, there is a consensus among residents that the future of robotic-assisted procedures and AI hold promise. Increased exposure at an early stage during the formative years can help in expanding knowledge and surgical skills, allowing plastic surgeons to remain at the forefront of surgical innovation.

From this, we can conclude that there is awareness of robotic surgery and AI among young plastic surgeons with a genuine motivation to learn. As such, we should aim to proactively integrate robotic surgery training and AI into plastic surgery residency curricula to ensure that future plastic surgeons can fully benefit from this technology. However, this can present several challenges and considerations. Firstly, there is a need for identification of relevant robotic and AI training protocols, specific for plastic surgeons. This may involve a task force with collaboration of industry partners, simulation centers, engineers, and even experienced robotic surgeons from other specialties to design tailored training endpoints that meet the specific needs of young plastic surgeons.

In the end, the integration of robotic surgical techniques, could augment the capabilities of plastic surgeons by providing greater precision and maneuverability in complex reconstructive procedures.[4] Similarly, AI algorithms may assist in preoperative planning and decision-making, flap monitoring, optimizing surgical approaches, and minimizing risks by outcome prediction.[5] Moreover, virtual reality simulations could offer invaluable training opportunities, allowing surgeons to refine their skills and explore innovative techniques in a controlled, risk-free environment.

Ultimately, the question of whether we should integrate technological advancements in training is not one of abandoning our traditional strengths, but rather of leveraging these tools to complement and enhance our specialty. By embracing innovation at an early stage in training, we can equip future plastic surgeons to transcend the boundaries of what is possible in plastic surgery, advancing both the artistry and the science of our field. As we continue to explore the potential of new technologies, we must remain vigilant in maintaining the core values of patient-centered care, ethical practice, and artistic finesse that define our specialty. In doing so, we can ensure that plastic surgery remains at the forefront of surgical innovation, delivering the highest standard of care to our patients while honoring the rich tradition of craftsmanship that has defined our discipline for decades.

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## REFERENCES

1. Sheetz KH, Claflin J, Dimick JB. Trends in the adoption of robotic surgery for common surgical procedures. *JAMA Netw Open*. 2020;3:e1918911–e1918911.
2. Buchlak QD, Esmaili N, Leveque JC, et al. Machine learning applications to clinical decision support in neurosurgery: an artificial intelligence augmented systematic review. *Neurosurg Rev*. 2020;43:1235–1253.
3. Kurmis AP, Ianunzio JR. Artificial intelligence in orthopedic surgery: evolution, current state and future directions. *Arthroplasty*. 2022;4:1–10.
4. Henn D, Trotsyuk AA, Barrera JA, et al. Robotics in plastic surgery: it's here. *Plast Reconstr Surg*. 2023;152:239–249.
5. Kooi K, Martinez ET, Freundt L, et al. From data to decisions: how AI is revolutionizing clinical prediction models in plastic surgery. *Plast Reconstr Surg*. 2024. [E-pub ahead of print.]