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Literature Review

The Role of Artificial Intelligence in Plastic Surgery: Opportunities, Limitations and Governance

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Abstract

Artificial intelligence (AI) is increasingly being incorporated into plastic surgery, influencing various stages of patient care. AI-generated tools offer potential benefits for both surgeons and patients; however, concerns persist regarding safety, ethics and governance. This paper critically examines the clinical potential of AI in plastic surgery as well as its associated challenges. Reported benefits include improved efficiency, training, enhanced patient education and extended postoperative monitoring. Conversely, limitations include risks of inaccuracies, overreliance, bias, unclear accountability, and concerns regarding patient privacy and informed consent, which may consequently harm doctor-patient relationships. By analysing both aspects, effective strategies for AI integration are discussed to minimise risks while maximising benefits. The successful integration of AI in plastic surgery involves establishing clear legal guidelines, maintaining human oversight and providing clinicians with comprehensive education. These measures ensure that AI functions as a supportive tool, not a replacement for clinicians. Such an approach is essential for a future in which AI and humans coexist.

Keywords: artificial intelligence, plastic surgery, ethics, clinical integration, decision-making, human oversight

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Introduction

Artificial intelligence (AI) has rapidly emerged as a transformative technology in healthcare, including within plastic surgery. Especially in plastic surgery, it is utilised to support a range of non-clinical and clinical functions, such as clinical documentation (Abdelhady and Davis, 2023) and diagnostic support (Kiwan et al., 2024). This review focuses primarily on widely accessible generative AI systems currently discussed in the plastic surgery literature, rather than institution-specific proprietary AI platforms. It has the potential to support patient care, communication and education. However, the integration of AI into plastic surgery also raises important clinical, ethical, and regulatory considerations. Accuracy (Yibulayimu et al., 2022), transparency (Kiwan et al., 2024), accountability (Kenig, Monton Echeverria and Rubi, 2024) and patient autonomy (Kiwan et al., 2024) remain unclear, which can harm the doctor-patient relationship. To ensure the quality of patient care, effective strategies are needed to mitigate these limitations while preserving the benefits. Understanding how AI can be implemented safely and responsibly is, therefore, essential to ensuring that technological innovation aligns with the core values of plastic surgery. The literature included in this review reflects international perspectives on AI integration in plastic surgery across diverse healthcare settings.

AI-Operated Clinical Documentation: Efficiency Gains and Associated Risks

AI-operated clinical notes can be time-saving and efficient for surgeons; however, they also pose risks, including a lack of personalisation, overreliance and unclear responsibility. Operative notes generated by AI for plastic surgery are efficient and can serve as a valuable supporting tool for surgeons. A study suggested that ChatGPT-4 generated operative notes approximately 84 times faster than human-written notes, and these notes were completely guideline-adherent. Additionally, more than 80% of patients and surgeons are satisfied with the generated notes (Abdelhady and Davis, 2023). DALLE-E, another AI tool produced by OpenAI, can create hyper-realistic images of surgical incisions by entering text prompts of ideal photos, which is utilised as a visual aid in notes (Abdelhady and Davis, 2023). It implies that AI tools have significant potential to enable surgeons to save time on clinical documentation and reviewing existing medical records, thereby reallocating more time to interacting with patients.

However, there are several drawbacks that users need to be aware of. ChatGPT-generated notes rely solely on the input provided during the chat. If ChatGPT does not have full access to patients' file notes and data, such as their previous medical history, treatment and details of surgical procedures, operative notes can be produced based on general knowledge to fill the information gap, which lacks personalisation (Abdelhady and Davis, 2023). Those notes can contain incorrect information about patients, which may lead surgeons to provide inappropriate treatment (Patel and Lam, 2023). Therefore, it is essential that surgeons manually check the generated notes before submission (Patel and Lam,

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2023). Additionally, as AI develops, surgeons may overly rely on its benefits, which can diminish their clinical skills if not properly managed. Farid et al. (2024) found that 35% of the plastic surgeons who participated in the research raised concerns regarding overreliance on AI, even though some of them believe that whether AI poses a threat or offers benefits depends on the type of AI technology and how it is implemented. Thus, healthcare systems need to control the extent to which AI becomes a part of the field by assessing the optimal levels of AI integration to achieve the most beneficial outcomes. It is also argued that accountability remains unclear in the situation where harms occur in AI-assisted clinical practice. It remains unclear who would be responsible for errors resulting from AI, whether AI developers, healthcare providers or legal entities, as there is no concrete guideline regarding AI regulation (Kenig, Monton Echeverria and Rubi, 2024). Utilisation of AI without adequate consideration of accountability may compromise the quality of patient care.

AI-Assisted Surgical Training: Benefits and Limitations of Objective Feedback

AI is increasingly utilised in surgical training to provide accurate, scalable and objective feedback; however, users must also consider potential model bias and over-standardisation. In surgical training contexts, this objectivity is achieved through the analysis of quantifiable performance metrics, allowing trainees' skills to be assessed in a standardised and reproducible manner. An AI system designed for microsurgery training objectively assesses trainees' skills and workload in real time by tracking their eye, hand and instrument motions (Kiew et al., 2025). Moreover, in liposuction training, AI can distinguish between experienced surgeons and novices by assessing measurable data, including their speed, force, consistency and precision, with an accuracy of 89-94% (Yibulayimu et al., 2022). Furthermore, a video-based laparoscopic training system that utilises AI to assess surgical performance has been developed, producing expert-independent and scalable feedback even in resource-limited environments (Ryder et al., 2024). Though traditional feedback is often considered subjective (Yibulayimu et al., 2022), these findings suggest that AI could represent a significant advancement in surgical training.

However, there are some drawbacks to using AI in surgical training. Feedback produced by AI can include biases. Models might be trained on non-diverse datasets, ignoring minority population groups, such as women, ethnic minorities and socioeconomically disadvantaged individuals (d'Elia et al., 2022). The skewed outcomes lead to situations where AI is better fitted for one group, thereby contributing to inequalities in patient care (d'Elia et al., 2022). Similarly, generative AI systems used for educational feedback, such as ChatGPT, may produce overly standardised responses, and sometimes those include inaccurate or outdated references. Sng et al. (2023) found that ChatGPT generates accurate and easily comprehensible responses to general knowledge questions; however, when specific

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scenarios are presented to ChatGPT, the response is inaccurate, and additional prompts are required to generate personalised and accurate responses. To produce more accurate and personalised responses, ChatGPT has currently implemented several measures to monitor the accuracy of generated content (Li et al., 2024). The quality of such responses is expected to improve over time; however, they are unlikely to be completely free from inaccuracies. If surgeons omit the step of verifying accuracy when AI-assisted feedback informs clinical communication, this may lead to misinterpretation of treatment during care and potentially undermine trust between the surgeon and the patient.

Clinical Applications of AI in Plastic Surgery: Benefits and Ethical Concerns

AI is integrated into several aspects of clinical procedures, including diagnosis, planning and the post-operative phase; however, concerns exist regarding informed consent, patient privacy, data security and potential damage to doctor-patient relationships. During the diagnosis phase, deep learning aids in classifying patients' conditions by analysing images (Kiwan et al., 2024). Although some AI diagnostic systems demonstrate lower specificity than sensitivity in detecting skin cancer, there is no significant difference between AI and clinician diagnostic performance (Manolakos et al., 2024). This technique enables surgeons to objectively assess whether a patient is suitable for surgery (Li et al., 2025). In surgical planning, the use of three-dimensional (3D) printing is becoming increasingly prevalent (Lynn et al., 2021), and AI can streamline the workflow, improving the quality of the 3D models (Ma et al., 2023). By automating key pre-printing steps such as image segmentation, digital model refinement and support structure generation, AI can improve the efficiency and scalability of 3D printing in plastic surgery (Ma et al., 2023). Once printed, those models are customised to individual patients (De La Peña et al., 2018). Showing patients their CT or MRI scans, a traditional approach in patient education, is often insufficient because it is difficult for patients to interpret two-dimensional image representations of three-dimensional anatomy (Aimar, Palermo and Innocenti, 2019). In contrast, 3D printing helps patients comprehend structure more effectively, which can minimise misunderstandings and potentially contribute to postoperative satisfaction (Aimar, Palermo and Innocenti, 2019). Although AI's contribution is indirect, these applications ultimately confer measurable benefits for patients. In the postoperative phase, continuous patient monitoring is necessary to prevent complications. Bajwa et al. (2021) stated that an AI tool is used to continuously monitor patient vitals and notify the responsible clinical staff as soon as any abnormality is detected. This helps minimise postoperative complications (Bajwa et al., 2021) and enables prompt intervention even if the patients are away from the clinic, which extends access to postoperative care beyond the hospital setting. Additionally, advanced AI tools can measure patient satisfaction using facial emotion recognition systems. Changes in facial action units and muscle activity can be correlated with the perception of emotions, such as happiness and negativity

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(Boonipat et al., 2022). This system detects subtle facial changes that even surgeons are unable to recognise (Li et al., 2020).

However, several drawbacks need to be recognised, concerning informed consent, patient privacy, data security and the doctor-patient relationship. In the process of AI training, large datasets containing sensitive patient information are required, which poses a potential risk for data breaches and misuse (Kavian et al., 2023). Protecting patient privacy and ensuring data security are essential for maintaining ethical standards and patient confidence in AI-assisted care. However, an increasingly digitised and algorithmized medical environment may threaten the quality of patient-doctor relationships (Kenig, Monton Echeverria and Rubi, 2024). Currently, as AI models lack sufficient transparency, patients and surgeons often lack clear insights into decision-making processes, which prevents patients from providing informed consent (Kiwan et al., 2024). Addressing these concerns is essential to ensure that AI integration enhances, rather than undermines, patient-centred plastic surgery.

Mitigating the Risks of AI Integration: Regulation, Human Oversight, and Education

The limitations of AI integration may be mitigated through several key strategies, including the establishment of clear legal frameworks, mandatory manual verification by surgeons and education to improve clinicians' understanding of AI-assisted decision-making. Legal frameworks about AI integration should clearly state that AI should be used only as a supporting tool, rather than a replacement for human clinicians (Farid et al., 2024). Such structures should also specify the extent to which AI may be integrated into the process of patient care to minimise risks of overreliance and clinician deskilling. Strict standards are required to handle patient-sensitive information, including data storage, access and privacy protection (Farid et al., 2024). In addition, regulations should clarify the information that must be disclosed to patients to ensure meaningful informed consent, including the role of AI, its limitations and associated risks. Finally, accountability frameworks must be clearly defined (Kenig, Monton Echeverria and Rubi, 2024) by outlining responsibility across various scenarios of AI use to prevent uncertainty when errors or adverse outcomes arise. Alongside legal regulation, surgeons should not rely solely on AI-generated content. It is necessary to acknowledge that AI may produce inaccurate, outdated and contextually inappropriate information. When AI is used for clinical documentation, it should be limited to the first drafting process, with manual checks by clinicians before its completion (Patel and Lam, 2023). Any AI output must be cross-checked with reliable sources, such as peer-reviewed articles (Li et al., 2024). Surgeons also need to acknowledge that AI output is not always personalised, and to consider individual patient characteristics, such as age, sex, gender, ethnicity and anatomical variation. Additionally, providing clinicians with targeted education can enhance their understanding of AI applications in plastic surgery (Kenig, Monton Echeverria and Rubi,

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2024), including how these systems function, their appropriate use and their limitation in clinical decision-making. Improved AI literacy among surgeons may support clearer communication regarding the capabilities and limitations of AI-assisted decision-making.

Conclusion

AI has demonstrated substantial potential to support plastic surgery by enhancing efficiency, objectivity and accessibility across various steps of patient care. AI-assisted systems can help surgeons save time, enhance performance assessment, and improve the quality and satisfaction of patient care. However, essential limitations must be considered: risks of hallucinations, inaccuracies, overreliance, algorithmic bias and ethical concerns surrounding privacy, informed consent and accountability, which can worsen doctor-patient relationships. Clear legal and regulatory frameworks that define accountability, protect patient data and ensure transparency are necessary to ensure safe and effective integration. Additionally, AI should be used strictly as a supportive tool, not as a replacement for human clinicians. Mandatory manual verification of AI-generated outputs, careful consideration of individual patient characteristics, and improved AI literacy among surgeons are also essential. Addressing these challenges is crucial to safeguard patient trust and quality of care in plastic surgery while reaping the benefits of AI integration.

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References

Abdelhady, A. M. and Davis, C. R. (2023) 'Plastic surgery and artificial intelligence: how ChatGPT improved operation note accuracy, time, and education', *Mayo Clinic Proceedings: Digital Health*, 1(3), pp. 299–308. Available at: https://doi.org/10.1016/j.mcpdig.2023.06.002

Aimar, A., Palermo, A. and Innocenti, B. (2019) 'The role of 3D printing in medical applications: a state of the art', *Journal of Healthcare Engineering*, 2019(1), pp. 5340616. Available at: https://doi.org/10.1155/2019/5340616

Bajwa, J., Munir, U., Nori, A. and Williams, B. (2021) 'Artificial intelligence in healthcare: transforming the practice of medicine', *Future Healthcare Journal*, 8(2), pp. e188–e194. Available at: https://doi.org/10.7861/fhj.2021-0095

Boonipat, T., Hebel, N., Zhu, A., Lin, J. and Shapiro, D. (2022) 'Using artificial intelligence to analyze emotion and facial action units following facial rejuvenation surgery', *Journal of Plastic, Reconstructive & Aesthetic Surgery*, 75(9), pp. 3628–3651. Available at: https://doi.org/10.1016/j.bjps.2022.08.007

De La Peña, A., De La Peña-Brambila, J., Pérez-De La Torre, J., Ochoa, M. and Gallardo, G. J. (2018) 'Low-cost customized cranioplasty using a 3D digital printing model: a case report', *3D Printing in Medicine*, 4(4). Available at: https://doi.org/10.1186/s41205-018-0026-7

d'Elia, A., Gabbay, M., Rodgers, S., Kierans, C., Jones, E., Durrani, I., Thomas, A. and Frith, L. (2022) 'Artificial intelligence and health inequities in primary care: a systematic scoping review and framework', F*amily Medicine and Community Health*, 10(1), e100573. Available at: http://dx.doi.org/10.1136/fmch-2022-001670

Farid, Y., Botero Gutierrez, L. F., Ortiz, S., Gallego, S., Zambrano, J. C., Uribe Morrelli, H. and Patron, A. (2024) 'Artificial intelligence in plastic surgery: Insights from plastic surgeons, education integration, ChatGPT's survey predictions, and the path forward', *Plastic and Reconstructive Surgery — Global Open*, 12(1), e5515. Available at: https://doi.org/10.1097/GOX.0000000000005515

Kavian, J. A., Wilkey, H. L., Patel, P. A. and Boyd, C. J. (2023) 'Harvesting the power of artificial intelligence for surgery: uses, implications, and ethical considerations', *The American Surgeon*, 89(12). Available at: https://doi.org/10.1177/00031348231175454

Kenig, N., Monton Echeverria, J. and Rubi, C. (2024) 'Ethics for AI in plastic surgery: Guidelines and review', *Aesthetic Plastic Surgery*, 48, pp. 2204–2209. Available at: https://doi.org/10.1007/s00266-024-03932-3

Kiew, C. Y. K., Shah, A., Hadjiandreou, M. and Pafitanis, G. (2025) 'Artificial intelligence in microsurgery and supermicrosurgery training within plastic surgery: A systematic review', *JPRAS Open*, 46, pp. 154–168. Available at: https://doi.org/10.1016/j.jpra.2025.07.010

Kiwan, O., Al-Kalbani, M., Rafie, A. and Hijazi, Y. (2024) 'Artificial intelligence in plastic surgery, where do we stand?', *JPRAS Open*, 42, pp. 234–243. Available at: https://doi.org/10.1016/j.jpra.2024.09.003

DOI: 10.19164/nusaj.v2i2.1871
ISSN: 3033-4217

Li, C.-W., Wang, C.-C., Chou, C.-Y. and Lin, C.-S. (2020) 'Customized precision facial assessment: An AI-assisted analysis of facial microexpressions for advanced aesthetic treatment', *Plastic and Reconstructive Surgery — Global Open*, 8(3), e2688. Available at: https://doi.org/10.1097/GOX.0000000000002688

Li, R., Zheng, J., Xu, L., Han, W., Zhen, Y., Ji, S. and An, Y. (2025) 'An artificial intelligence tool used for patient selection in cosmetic surgery', *Aesthetic Plastic Surgery*, 49, pp. 5631–5638. Available at: https://doi.org/10.1007/s00266-025-04876-y

Li, W., Chen, J., Chen, F., Liang, J. and Yu, H. (2024) 'Exploring the potential of ChatGPT-4 in responding to common questions about abdominoplasty: An AI-based case study of a plastic surgery consultation', *Aesthetic Plastic Surgery*, 48, pp. 1571–1583. Available at: https://doi.org/10.1007/s00266-023-03660-0

Lynn, A. Q., Pflibsen, L. R., Smith, A. A., Rebecca, A. M. and Teven, C. M. (2021) 'Three-dimensional printing in plastic surgery: current applications, future directions, and ethical implications', *Plastic and Reconstructive Surgery — Global Open*, 9(3), e3465. Available at: https://doi.org/10.1097/GOX.0000000000003465

Ma, L., Yu, S., Xu, X., Amadi, S. M., Zhang, J. and Wang, Z. (2023) 'Application of artificial intelligence in 3D printing physical organ models', *Materials Today Bio*, 23, pp. 100792. Available at: https://doi.org/10.1016/j.mtbio.2023.100792

Manolakos, D., Patrick, G., Geisse, J. K., Rabinovitz, H., Buchanan, K., Hoang, P., Rodriguez-Diaz, E., Bigio, I. J. and Cognetta, A. B. (2024) 'Use of an elastic-scattering spectroscopy and artificial intelligence device in the assessment of lesions suggestive of skin cancer: a comparative effectiveness study', *JAAD international*, 14, pp. 52–58. Available at: https://doi.org/10.1016/j.jdin.2023.08.019

Patel, S. B. and Lam, K. (2023) 'ChatGPT: the future of discharge summaries?', *The Lancet Digital Health*, 5(3), pp. e107–e108. Available at: https://doi.org/10.1016/S2589-7500(23)00021-3

Ryder, C. Y., Mott, N. M., Gross, C. L., Anidi, C., Shigut, L., Bidwell, S. S., Kim, E., Zhao, Y., Ngam, B. N., Snell, M. J., Yu, B. J., Forczmanski, P., Rooney, D. M., Jeffcoach, D.R. and Kim, G. J. (2024) 'Using artificial intelligence to gauge competency on a novel laparoscopic training system', *Journal of Surgical Education*, 81(2), pp. 267–274. Available at: https://doi.org/10.1016/j.jsurg.2023.10.007

Sng, G. G. R., Tung, J. Y. M., Lim, D. Y. Z. and Bee, Y. M. (2023) 'Potential and pitfalls of ChatGPT and natural-language artificial intelligence models for diabetes education', *Diabetes Care*, 46(5), pp. e103–e105. Available at: https://doi.org/10.2337/dc23-0197

Yibulayimu, S., Wang, Y., Liu, Y., Sun, Z., Wang, Y., Jiang, H. and Li, F. (2022) 'An explainable machine learning method for assessing surgical skill in liposuction surgery', *International Journal of Computer Assisted Radiology and Surgery*, 17, pp. 2325–2336. Available at: https://doi.org/10.1007/s11548-022-02739-4

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