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Short Communication

# Artificial intelligence in plastic surgery: Implications and limitations of text-to-image models for clinical practice

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Artificial intelligence (AI) has rapidly advanced across healthcare including plastic surgery. Among these innovations, text-to-image models represent a significant leap, promising to transform some aspects of clinical practice. Text-to-image models generally consist of two main components: a large language model (LLM) that converts the input text into a latent representation, and a generative image model that creates an image based on this representation.[1] Due to their capability of producing increasingly realistic and detailed visuals, they have a vast potential as an innovative tool in plastic surgery.[2] However, there are notable limitations and ethical considerations that must be addressed before these technologies can be fully integrated into clinical practice.

Text-to-image models involve the use of advanced algorithms to convert textual descriptions into detailed images. These models are trained on extensive datasets comprising images and corresponding textual annotations. By learning the intricate relationships between text and visuals, these algorithms

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can generate images that closely match the input descriptions.[1] Leading companies in this field include OpenAI, Google DeepMind, and Adobe, which have developed sophisticated models like DALL-E, Imagen, and Adobe Firefly, respectively. These technologies have shown impressive capabilities in creating realistic images from simple text prompts, making them attractive tools for various applications in plastic surgery.[2]

The potential use cases in plastic surgery for text-to-image models are diverse. Current implementations that surgeons can readily adopt include marketing and advertising, where text-to-image models can generate compelling and sophisticated images for promotional materials, websites, and social media. This allows plastic surgery practices to curate their online presence effectively, and attract new patients using low-cost approaches. For example, AI-generated images can help design unique and appealing logos and visual content for branding purposes, enhancing the overall professional image of a practice at a fraction of the cost of traditional creative designers.

While these applications offer immediate benefits for plastic surgery practices, future advancements in these models could extend the use of text-to-image models to more complex areas such as patient education and preoperative planning. For instance, detailed visual aids created by AI could explain surgical procedures and outcomes more effectively, improving patient understanding and informed consent. AI-generated personalized images based on patient data could help tailor surgical plans to individual anatomies and aesthetic goals. Surgeons could use AI to generate realistic images of potential outcomes, aiding in surgical planning and improving patient confidence in the procedure. In addition, text-to-image model might eventually be used to create scientific diagrams for publications, as well as tables and figures, ensuring high-quality, accurate visual representations of research findings.

Despite the promising applications, text-to-image models currently face significant limitations, especially concerning their use in generating anatomic images for clinical purposes. These AI models are not yet equipped to handle the complexity and precision required for accurate anatomical representations (Figure 1).[2] Relying on such technology prematurely could lead to adverse consequences in clinical settings, underscoring the need for regulatory oversight and validation before clinical implementation.[3]

Moreover, ethical considerations play a crucial role in the adoption of AI technologies in healthcare. One major concern is patient privacy. Text-to-image models must ensure that patient information is not shared or used without consent, including for model training, maintaining strict confidentiality and adhering to data protection regulations. Another critical issue is that most AI models are trained on datasets that may not represent diverse populations accurately, leading to biases that can propagate misinformation and misrepresentation. For instance, biased datasets could misidentify the race or gender of individuals, and have already been shown to affect the reliability and fairness of the AI-generated images.[4] This is particularly concerning in plastic surgery, where visual accuracy and representation are paramount.

To harness the full potential of text-to-image models in plastic surgery, future developments must focus on improving the accuracy and reliability of anatomic images. This involves expanding and diversifying training datasets with clinical plastic-surgery data. The development of more advanced algorithms suited for clinical use should undergo a rigorous regulatory and validation processes like any other medical device or software.[3] Additionally, regulatory bodies should establish clear guidelines and standards for the clinical use of AI-generated images, ensuring they meet the necessary safety and ethical requirements for surgeons in practice.[5] It is also essential for future studies to systematically evaluate the effectiveness of these models in real-world clinical applications. By addressing these issues and advancing the technology, text-to-image models could eventually become valuable tools for reducing costs, improving patient care, enhancing education and research, and achieving better surgical outcomes.

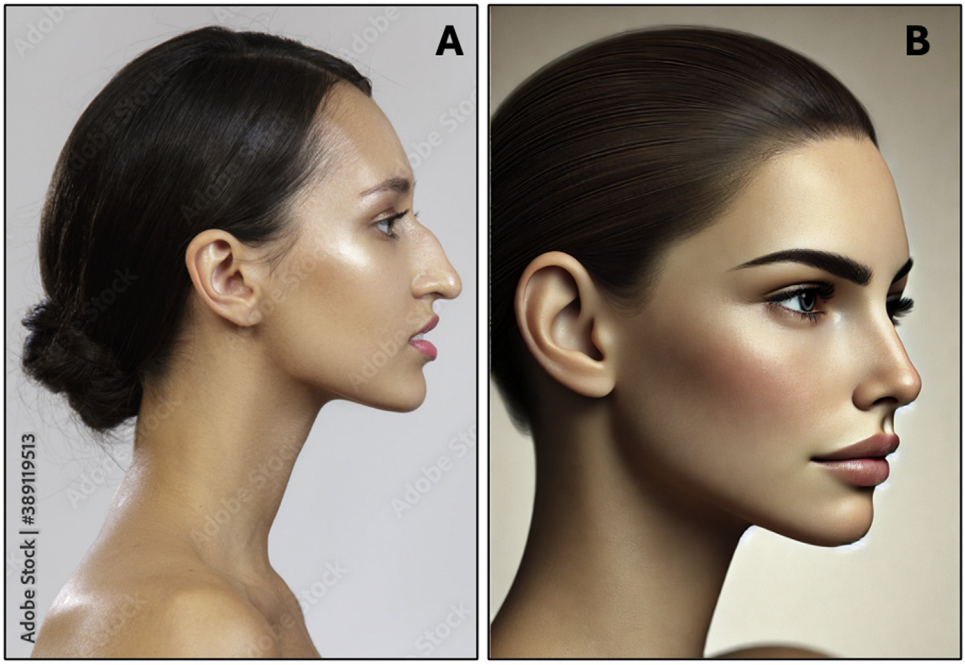


**Figure 1.** Post-surgical rhinoplasty simulation from DALL·E 3, a leading text-to-image AI model. Image A of Figure 1 is an Adobe Stock image (#389119513) of an individual with a prominent dorsal nasal hump, used under a standard license from Adobe, Inc. Image A was input into the web version of DALL·E 3, part of OpenAI, with the prompt: "Based on Image A, render the same individual in a lateral view (B) after rhinoplastic correction of the dorsal nasal hump, showing a single photorealistic post-surgical image. The image should showcase a refined and slightly upturned nose and otherwise the same facial features. Background and lighting should be consistent with Image A." In Image B, while the dorsal nasal hump has been successfully removed, the post-rhinoplasty simulation does not entirely comply with the prompt. First, Image B lacks the slightly upturned nose as instructed. Second, the facial structure, hair, and eye color of the individual, as well as the shape and color of the eyebrows have significantly changed compared to Image A, essentially portraying a different individual. Third, the background color and lighting are inconsistent with Image A. Finally, Image B has an artificial and animated appearance, lacking the realistic consistency of Image A.

## Ethical approval

Not required.

## Declaration of AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT-4o for language editing. After using this tool, the authors reviewed and edited the content as needed, and take full responsibility for the content of the publication.

## Declaration of competing interest

Ravi Dhawan (R.D.) reports owning stock/equity in Microsoft Corporation and Adobe Inc. The authors report no other financial, commercial, or research-related conflicts of interest.

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