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REVIEW

Application and exploration of interprofessional education in the teaching of plastic and reconstructive surgery: a narrative review

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Abstract

The growing discussion on "interdisciplinary integration" brings attention to the "interprofessional education" (IPE) in the field of plastic surgery. IPE not only improves the precision and effectiveness of plastic and reconstructive surgery but also plays an important role in personalized treatment. Whereas, the implementation of IPE in plastic and reconstructive surgery field faces huge difficulties such as technology combination, standard making, and lacking of qualified talents. This article individually summarizes the latest developments in the integration of plastic and reconstructive surgery with engineering, basic science, and human science. It looks forward to the future practice and innovation of IPE in the field of plastic and reconstructive surgery, analyzes the challenges in cultivating innovative professional talents, and proposes methods to overcome these difficulties in a way that invites further discussion.

Keywords Interprofessional education, Plastic and reconstructive surgery, Medical education, New Medical requirements

Background: new medical requirements lead to IPE

Medical science is a practical discipline that involves the interaction of multiple disciplines, advocating for a patient-centered approach based on multi-disciplinary team work.

In 1978, the World Health Organization (WHO) first introduced the concept of interprofessional education (IPE) in its "Health for All by the Year 2000" program [1]. Subsequently, in 1987, the UK Centre for the Advancement of Interprofessional Education (CAIPE) refined the definition of IPE, emphasizing the mutual learning and collaboration between different professional fields (such as nursing, clinical, health-related disciplines, and social work) to enhance service quality and improve mutual understanding. By 2010, WHO further elaborated on the definition of IPE, indicating that it involves the mutual understanding, learning, and cooperation among students from different professional backgrounds to jointly promote effective collaboration and enhance healthcare service [2, 3].

The talent shortage in the healthcare industry has become a global issue [4]. With the rapid development of technology, fields such as artificial intelligence, extended reality, and surgical robotics are making significant achievements. The development of cutting-edge

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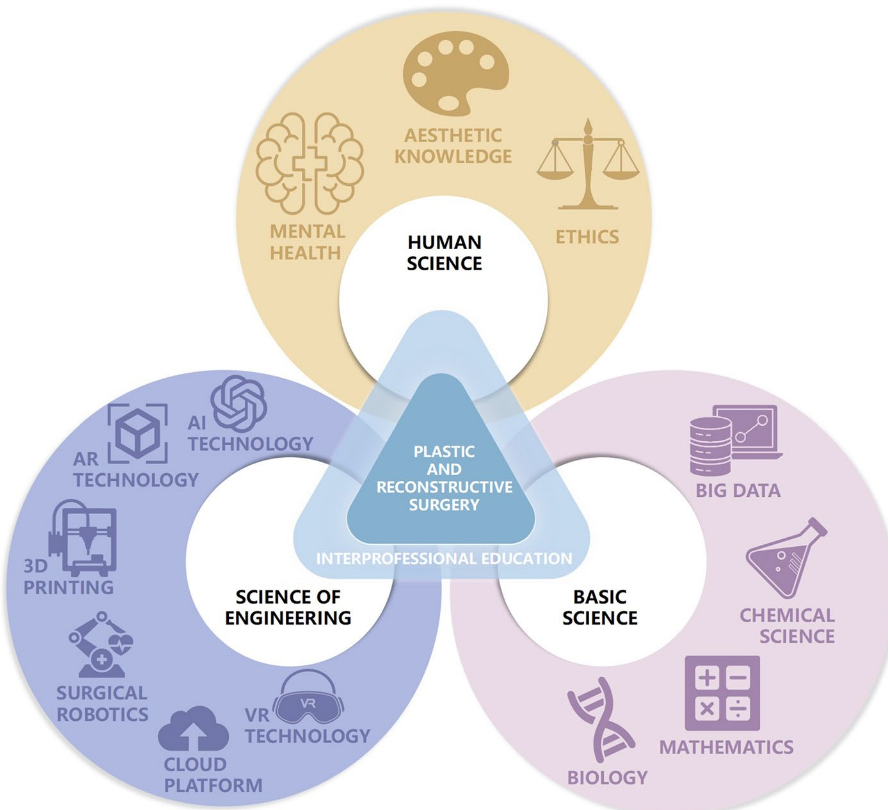

Scheme 1 Most of the interdisciplinary subjects are mentioned in the included reviews

technology has made it possible to realize what was once imagination. Technology integration can synchronize the latest medical research globally, improve teaching efficiency, and reduce regional disparities. This places higher demands on the skillset of medical students. Previous interdisciplinary learning mainly focuses within the medical field, while current IPE in medical education has a wider range of intersections crossing multiple fields of study [5]. In recent years, the prevalence of international academic exchange programs has provided an important platform for the sharing and inheritance of medical knowledge and related research achievements. Through interprofessional education, experiential medical knowledge is presented in more vivid forms such as images, data, and models, making them easier to understand and more applicable.

As economic grows and technology develops, people's expectations for medical care are also increasing [6, 7]. Compared to the previous focus on disease treatment, patients now have higher expectations for humanistic care and the medical environment. Some hospitals in the United States have already implemented patient satisfaction scoring systems to enhance the quality of medical services. Nowadays, great research achievement has been developed in related fields of study such as science of psychology, family medicine, and rehabilitation. There is an urgent need for systematic training so as to combine knowledge in different fields [3].

To address these needs, experts worldwide have been advocating for promoting interdisciplinary integration and collaboration. The main goal is to build a highly integrated medical education system so as to converge knowledge and skills from different disciplines. Such a system not only covers traditional areas such as life and health, clinical diagnosis and treatment, biosafety, drug innovation, and vaccine development, but also includes interdisciplinary integration with science of engineering such as artificial intelligence, material science, and bioinformatics, as well as basic science like biology and chemistry. This interdisciplinary educational model aims to cultivate medical professionals who have an international perspective and can contribute to innovation. This model not only enhances the comprehensive quality of students but also drives the overall development of the medical field to be prepared for potential challenges (Scheme 1).

Methods

Study design

This narrative review aimed to explore the application and exploration of interprofessional education (IPE) in the teaching of plastic and reconstructive surgery. The review was conducted following a systematic approach to synthesize the latest developments in the integration of plastic and reconstructive surgery with engineering, basic science, and human science.

Aims

This narrative review aims to collate and summarize the current state of Interprofessional Education (IPE) in the field of plastic and reconstructive surgery, an area that has not been fully developed in terms of its potential and challenges. Given this review's comprehensive objectives and broad scope, it was imperative to conduct an in-depth analysis encompassing an extensive and multifaceted corpus of scholarly literature. Consequently, two research questions were meticulously formulated to specifically address the central inquiry posed by the review.

Research questions

1. What is the current status of Interprofessional Education (IPE) in the field of plastic and reconstructive surgery, and how have recent technological advancements influenced its integration and implementation?
2. What challenges and opportunities does the integration of IPE present in the context of plastic and reconstructive surgery education, and how can these be addressed to foster innovative professional development?

Eligibility criteria

Data sources and search strategy

A comprehensive literature search was conducted in PubMed, Web of Science, Scopus, and Google Scholar databases. The search terms included "interprofessional education," "plastic surgery," "medical engineering," "basic science," "human science," and "interdisciplinary integration", as shown in Table 1. The search was last updated on [insert date] and included articles published from the inception of each database.

Inclusion criteria

The study's scope was not limited by time, focusing on undergraduate medical students, graduate students, residents, and qualified clinical physicians. The research included articles from medical schools worldwide, accepting content from all countries. The criteria included only full-text articles in English published in peer-reviewed journals.

Exclusion criteria

The study excluded individuals outside the medical student demographic, such as those in other health fields (e.g., public health professionals). There was no age limit imposed on the participants. The research specifically focused on articles within medical schools, excluding those from other settings. It only considered full-text articles in English-language peer-reviewed journals. Letters or commentary articles were excluded, and the study did not limit itself to a particular type of research.

Information sources

Two electronic databases (Pubmed & Web of science) were utilized for literature search. These included: PubMed and Web of Science. The databases were selected from various fields based on relevant topics, such as education, academic evaluation and assessment, medical education, science of engineering, basic science, and human Science. In addition to these, the reference lists from articles identified through Google Scholar were used to uncover further relevant literature.

Search strategy

This review commenced with a database search. Two electronic databases were utilized to retrieve literature. Specific keywords and terms were employed in the search, yielding a total of 206,447 articles. After the exclusion of duplicates, letters, and comments, this number was reduced to 75,279. The exclusion of non-medical related articles further narrowed down the count to 6,838. Subsequent inclusion of articles related to surgical procedures brought the number to 560. Duplicates were removed using EndNote, and after screening for articles that met the criteria of this paper, 63 articles were selected. Following an assessment by two reviewers, 39 articles were chosen for review. Strategies for identifying research through databases and registries are presented in supporting information Table 1. The search keywords are as follows:

Keywords

Interprofessional Education (IPE), Plastic and Reconstructive Surgery, Medical Engineering, Basic Science, Artificial Intelligence(AI), Human Science, Extended Reality, 3D Printing, Virtual Reality (VR), Augmented Reality (AR), Robotics, Data Analysis, Biomedical Engineering, Material Science, Surgical Robotics, education.

Table 1 Literature search and selection process for the review

Keywords	AND	Web of Science	web of science records after excluding literature types	web of science records exclude non-medical	web of science Included surgery
Interprofessional education (IPE)	medical engineering	1,199	854	79	5
	basic science	406	340	143	14
	medical science	12,010	10,226	2084	132
	human science	11,737	10,204	1892	135
	medical humanities	25	22	73	2
	3D printing	689	536	1	1
	Extended Reality(ER)	12	7	4	1
	virtual reality (VR)	264	196	47	11
	augmented reality (AR)	143	119	12	2
	surgical robotic	421	299	6	5
	Artificial Intelligence (AI)	348	122	26	2
	chemical science	1,574	1,411	11	1
	big data	113	93	17	1
	biology	6,120	4,562	1072	84
	mental health	440	373	444	14
	aesthetic	11,096	10,335	3	3
		46597	39699	5914	413
	AND	Pubmed	Pubmed records after excluding literature types	Pubmed records exclude non-medical	Pubmed Included surgery
interprofessional education (IPE)	medical engineering	6,176	964	28	3
	basic science	1,823	454	18	2
	medical science	103,253	22,810	730	120
	human science	2,676	320	21	2
	medical humanities	110	15	14	2
	3D printing	1,446	401	0	0
	Extended Reality(ER)	18	8	2	2
	virtual reality (VR)	270	64	2	5
	augmented reality (AR)	190	40	2	2
	surgical robotic	1,065	276	0	1
	Artificial Intelligence (AI)	1,231	177	6	1
	chemical science	595	91	1	0
	big data	258	34	5	1
	biology	5,812	1,059	22	2
	mental health	1,156	197	71	3
	aesthetic	33,771	8,670	2	1
		159850	35580	924	147
Total		206447	75279	6838	560

Selection process

A duo of independent appraisers conducted a thorough examination of each document, culminating in the compilation of pertinent reports. Throughout this evaluation phase, the appraisers evaluated each scholarly article in accordance with established inclusion criteria. Discordances in their assessments were deliberated upon and reconciled through collaborative consensus achieved during scheduled convened meetings. Should disagreements remain unresolved, a third appraiser was engaged to offer an additional perspective.In the first screening phase, EndNote is used to find duplicate entries, simplify the review of titles and abstracts, and aid in obtaining the full articles.

Characteristics and challenges of the education of plastic and reconstructive surgery

Plastic and reconstructive surgery, commonly referred to as plastic and reconstructive surgery, is a specialized branch of surgery that encompasses two main areas: reconstructive plastic and reconstructive surgery and cosmetic plastic and reconstructive surgery. As a rapidly developing interdisciplinary field, it draws upon knowledge and technology from various disciplines, including surgery, anatomy, and biomedical engineering. plastic and reconstructive surgery can be applied on skin, soft tissues, nerves, and the musculoskeletal system, as well as related internal organs. Through surgical and non-surgical methods, plastic and reconstructive surgery aims to treat congenital abnormalities and other functional deficits, as well as age-related issues and aesthetic concerns. The ultimate goal is to enhance functional recovery, improve appearance, and increase quality of life, and potentially promote mental health. This not only benefits patients but also brings well-being to the general public who's seeking beauty and health [8].

Similar to other medical disciplines, plastic and reconstructive surgery face challenges such as inadequate training, difficulties in data collection, and lack of humanistic care. IPE has the potential to address these issues by promoting collaboration and communication among different professional fields, enhancing training quality, optimizing data integration, and strengthening humanistic care to better meet patient needs and raise the level of medical services.

Why does plastic and reconstructive surgery need interdisciplinary integration with the science of engineering?

For many years, the teaching and training of plastic and reconstructive surgery have been facing numerous challenges. The proficiency of a doctor's surgical techniques relies on extensive experience accumulation, but in reality, there is often a lack of sufficient practical opportunities. At the same time, the lack of professional equipment makes it difficult for simulation practice. The high risk of surgery and the high standard of professional skills [8], coupled with insufficient practical training and lack of equipment in schools and hospitals, severely restrict students' opportunities to gain practical experience. Additionally, while the demand for interdisciplinary collaboration is increasing, the integration between different disciplines is still difficult due to the vast information gap and other issues. Education of plastic and reconstructive surgery also faces challenges such as uneven distribution of educational resources, huge pressure from rapid technological updates, and differences in medical standards and practices across countries and regions. In recent years, the rapid advancement of network transmission and technological innovation in engineering fields has brought a new perspective to the plastic and reconstructive surgery field, which makes it possible to better and efficiently face the challenges ahead of us.

Why does plastic and reconstructive surgery need interdisciplinary integration with basic science?

Facing new challenges, such as the difficulty of interdisciplinary collaboration, rapid technological advancements, and ethical regulations, plastic and reconstructive surgery teaching needs to keep up with the latest information (such as new techniques and concepts) [4]. Doctors often lack time and energy to update their knowledge while managing their busy clinical work. With the accumulation of large amounts of data and the establishment of databases, data analysis has brought the research of basic science to a whole new level, which makes the visualizing and preservation of experiential knowledge possible [9]. At the same time, the relevant clinical data and conclusions can also help AI learning [10].

Why does plastic and reconstructive surgery need interdisciplinary integration with human science?

Medical professionals in the field of plastic and reconstructive surgery need to possess not only profound medical knowledge and exquisite surgical skills but also the ability to provide humanistic care in order to make personalized and comprehensive treatment plans for patients [11]. Patients' needs for plastic and reconstructive surgery diversify. Therefore, teaching should focus on cultivating students' ability to provide personalized treatment plans based on patients' individualized needs [8]. Besides medical knowledge, practitioners should have a good understanding of aesthetics, strong empathy, and great communication skills.

In summary, besides the insufficient practical operation opportunities, traditional teaching methods lack knowledge and information about other fields of study. To improve the quality of plastic and reconstructive surgery education, it is necessary to develop new teaching methods that integrate modern technology. Through the latest technologies and concepts, new teaching methods can provide richer and more vivid resources and tools so that students can have full access to abundant professional knowledge, which will help them develop solid research capabilities and exquisite clinical skills and gain a high sense of empathy. To improve the quality of education in the field of plastic and reconstructive surgery, the international medical education community is actively exploring new educational models to develop professionals who can meet the needs of globalization. By utilizing advanced technological means and through interdisciplinary collaboration, the education and practice of plastic and reconstructive surgery will be significantly enhanced, thereby better serving patients.

Application of "Interprofessional Education" in plastic and reconstructive surgery teaching

"Interprofessional Education" (including the combination of applied engineering, basic science, and human science), plays a significant role in solving problems in the teaching of plastic and reconstructive surgery. It provides an interdisciplinary perspective and methodology for teaching, encourages the updating and optimization of teaching content, and enhances teaching effectiveness and quality. Guided by the concept of "Interprofessional Education", plastic and reconstructive surgery is undergoing a profound revolution [12]. Training professionals through "Interprofessional Education" is becoming an important trend in the medical education reformation [13, 14].

Medical engineering

Medical Engineering integrates engineering theories and technologies into plastic and reconstructive surgery education, enhancing clinical equipment and technology for simulation of surgical operation, thereby strengthening students' operational skills. For example, through the joint effort of college of engineering and college of biomedical engineering, cross-disciplinary courses covering surgery, anatomy, and biomedical engineering are designed, allowing students to systematically grasp relevant knowledge. Digital design and manufacturing technology has brought virtual surgical simulation into reality, which helps better planning and preparation before the plastic and reconstructive surgery. Medical students and professionals can utilize digital design and manufacturing technology for data collection and use digital software to develop and rehearse surgical plans, thereby optimizing the surgical procedure [15, 16].

Additionally, 3D printing technology has been widely used in plastic and reconstructive surgery teaching. It converts medical images into three-dimensional models, providing support for surgical planning and simulation. Lerner and his team have used 3D printing technology to simulate the reconstruction of the flap [17], which makes both high-fidelity and cost-effective facial models available to students, thereby making it easier for students to understand the surgical technique [18]. Moreover, the application of virtual reality technology has created highly realistic surgical simulation environments for students, providing abundant practical opportunities. In such virtual environments, students can safely practice plastic and reconstructive surgery, which helps effectively reduce the risks associated with actual operation [19, 20].

Traditional plastic and reconstructive surgery teaching relies on apprenticeship and clinical experience, but due to the protection of privacy and the consideration of surgical risk, students barely have practical opportunities. Whereas by simulating realistic surgical scenarios, VR technology, allows students to practice in a virtual environment constantly, which will rapidly fasten the speed of learning and greatly increase teaching effectiveness [21]. Anaïs's team utilized VR together with computed tomography angiography to provide preoperative planning for deep inferior epigastric perforator (DIEP) flap breast reconstruction surgery [22] (Fig. 1). This method can be used to assist students in studying of preoperative planning. Jiang's team found that the HoloLens (Microsoft) augmented reality system can accurately locate perforator vessels while transferring the flap [23], thus believing that AR technology aids in precise positioning, which can potentially improve surgical efficiency. AR technology also allows trainees to learn surgical details from an expert's perspective. Cloud platforms, such as Proximie, have been trying to facilitate global surgical collaboration and teaching which in the long run will enhance the quality and efficiency of plastic and reconstructive surgery education [24, 25].

Surgical robotics, such as the Da Vinci system, has demonstrated promising applications in fields such as oral reconstruction, flap collection, hernia repair, and microvascular anastomosis [26–29]. Taking the example of the Jimma University Medical Center in Ethiopia, through international cooperation and professional training, successful microsurgical operations, including free flap surgery, have been performed, breaking geographical academic barriers and ensuring high-quality medical services in resource-limited environments [30, 31]. Chen et al. developed an innovative training system for zygomatic implant surgery that integrates Virtual Reality (VR) with robotic force feedback devices, providing a new model capable of virtually replicating the experience of real surgery [32] (Figs. 2 and 3).

Furthermore, with the widespread attention of AI across various global fields, its application in plastic and reconstructive surgery education has shown significant potential [33, 34]. The capability of data analysis through AI has demonstrated great value in clinical monitoring. AI can analyze postoperative wound images, evaluate the progress of recovery, predict the potential risk of complications, and provide doctors with more precise monitoring and treatment plans.

For instance, McCullough et al. trained five convolutional neural network models on 800 preoperative unilateral cleft lip images, enabling accurate assessment of cleft

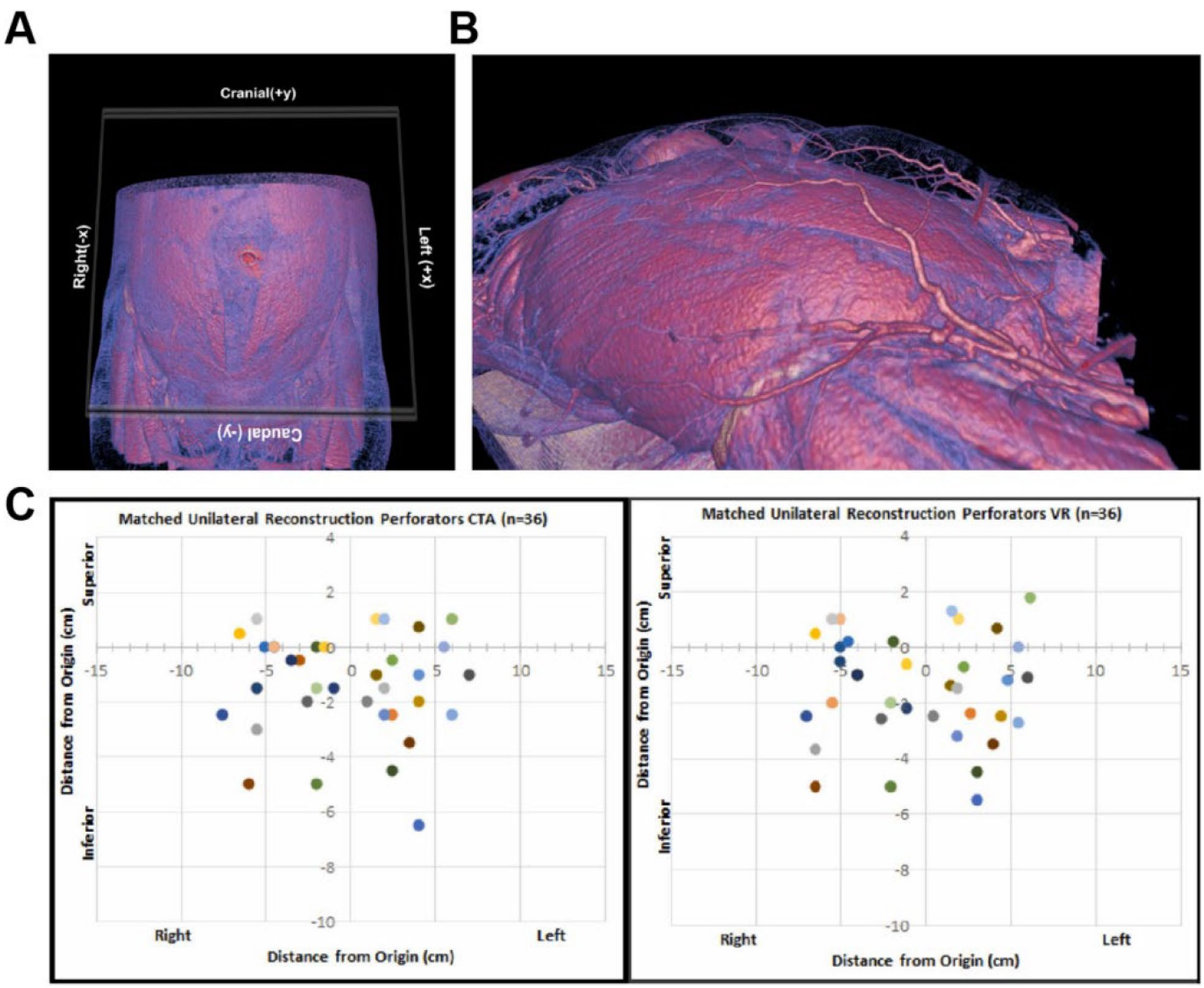

Fig. 1 Preoperative planning for deep inferior epigastric perforator (DIEP) flap breast reconstruction using virtual reality and computed tomography angiography (CTA). **A** The VR image of the lower abdomen is overlaid with a digital grid to measure the coordinates of the perforators from the umbilicus. **B** VR image of the superficial upper abdominal venous vascular system. **C** Scatter diagram showing VR and the distribution of matched unilateral perforators from CTA [22]

severity from preoperative photos and demonstrating the potential of machine learning in automated cleft severity evaluation and clinical feedback [35]. In a related study, Phillips et al. presented an AI-driven algorithm capable of detecting melanoma with an accuracy rate that matched dermatological professionals [36]. Kiyasseh et al. have developed a machine learning system that employs visual transformers and supervised contrastive learning to accurately decode intraoperative activities from robotic surgery videos, including surgical steps and movement quality, thereby offering feedback on surgical skills. This system not only aids in the refinement of surgical techniques but also advances the study of postoperative outcomes [37].

Moreover, AI has been employed to condense the material discovery process into a mere one to two years through a technique known as "closing the loop." Essentially, the algorithm identifies the optimal substance—focusing on molecular structure and solid-state compounds—once the material's desired function is defined [38]. This approach has been utilized in the design of potential drugs and the creation of novel chemical structures within molecular science [39, 40].

Additionally, AI can develop intelligent teaching assistants that provide personalized learning advice and learning path based on students' learning progress and needs, aiding them in efficient learning. The integration of AI with robotics technology in plastic and reconstructive surgery education further enhances teaching efficiency

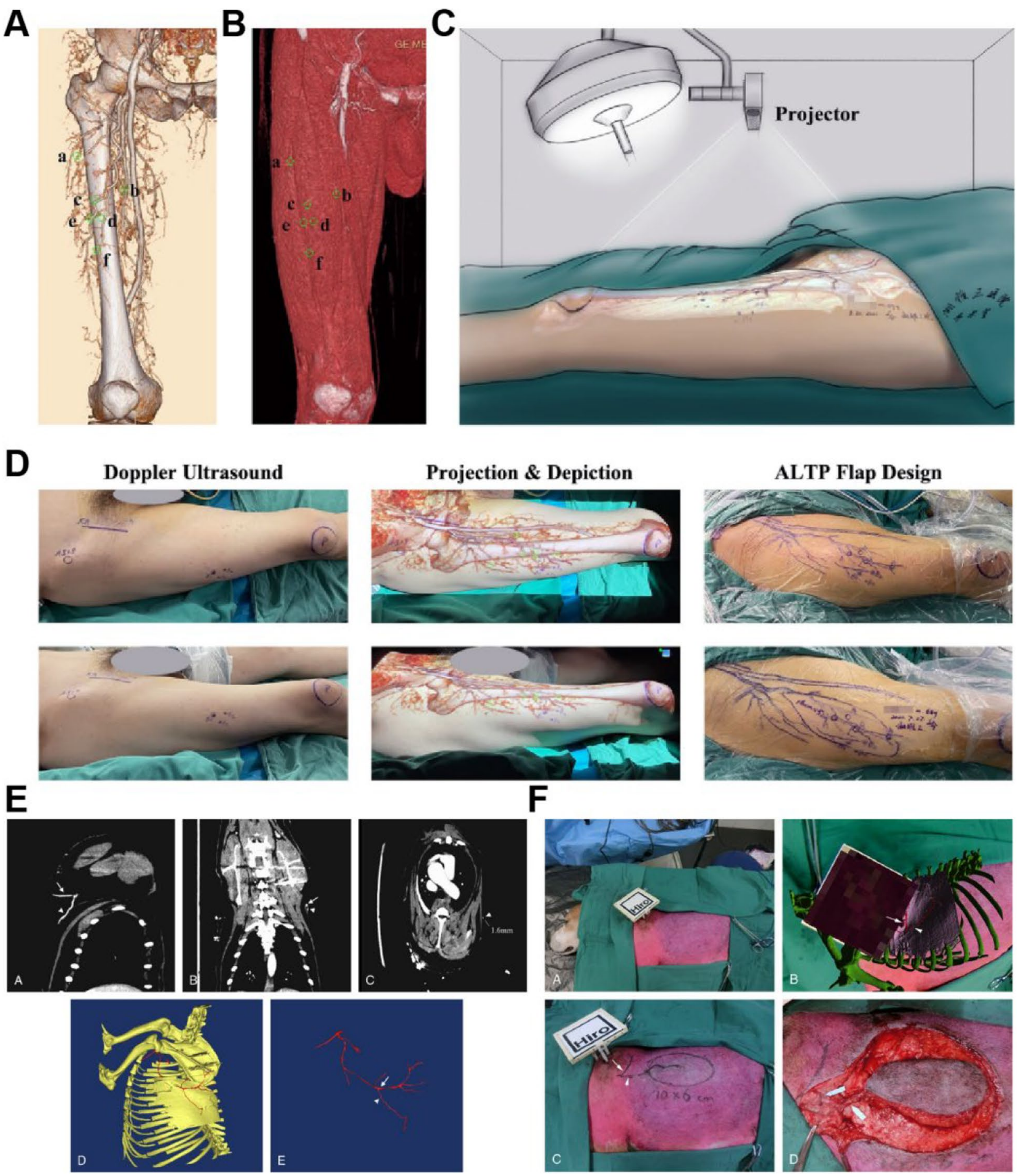

Fig. 2 Augmented reality (AR) for ALTP flap design. **A** Marking points a-f on the 3D CTA image. **B** Marking points a-f on the muscle surface. **C** Importing the marked image into a portable projector and then mapping it to the thigh surface before the operation. **D** Using Doppler ultrasound and AR to project and depict specific spots for better collection of ALTP flap [31] **E** Sagittal, coronal, and axial views of the thoracodorsal artery and its perforator arteries, reconstructing a virtual model including the thoracodorsal artery and its perforators, the latissimus dorsi muscle, and bones, as well as the reconstructed three-dimensional vascular diagram. **F** Projecting the reconstructed virtual model (including the thoracodorsal artery and its perforators, the latissimus dorsi muscle, and bones) onto the body for preoperative planning and observation of the intraoperative performance of the thoracic artery and its perforators [26]

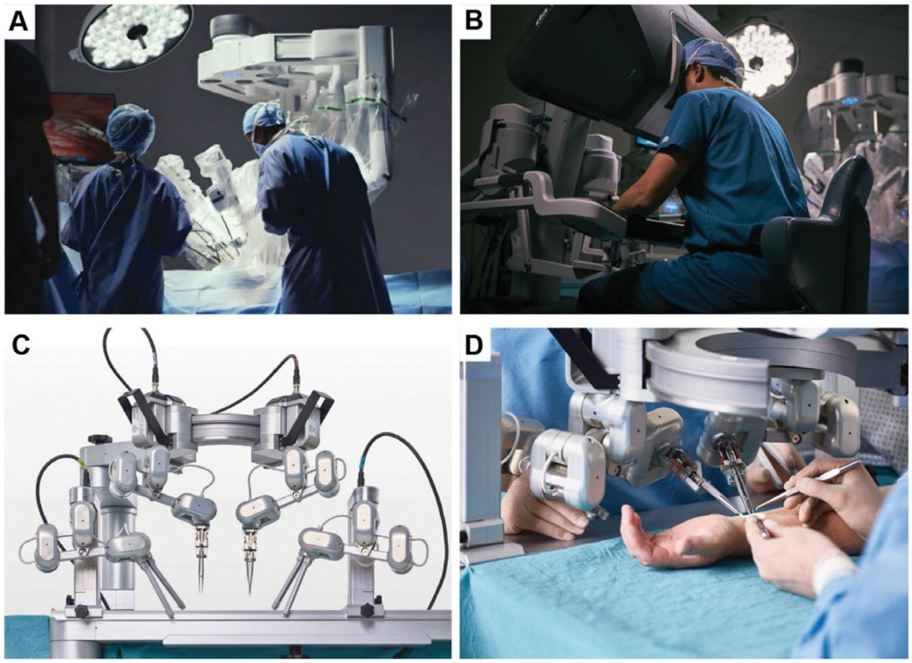

Fig. 3 The application of surgical robots in plastic and reconstructive surgery education and practice. **A** Intraoperative use of the Da Vinci surgical system. **B** Surgeons remotely (operate the Da Vinci system from a console. **C** MUSA microsurgical robot (Microsure). **D** Intraoperative use of the MUSA microsurgical robot in a hand surgery case [27]

and the learning experience. Through simulated surgical training and intraoperative assistance, AI provides medical students and resident doctors with immersive learning experiences, aiding them in mastering sophisticated surgical skills. AI also has the capacity to expedite the learning process and diminish the duration required for supplementary medical training [41]. Robot-assisted simulations provide learners with opportunities for constant practice and familiarize them with the surgical procedures, while intraoperative assistance offers precise positioning and fine manipulation to assist doctors in completing complex surgeries.

In conclusion, combining the knowledge of medical science and engineering science, the interdisciplinary teaching model provides advanced medical education and better teaching equipment and tools, which helps teachers better demonstrate medical knowledge and technique, as well as better follow up with students' learning progress, and thus lightens the teaching burden (Fig. 3).

Medical science and basic science

Plastic and reconstructive surgery encompasses a wide range of medical knowledge and techniques. The integration of medical science and theories applies the principles and methods of the physical sciences to plastic and reconstructive surgery education, aiming to help students gain a deeper understanding of the fundamental laws and mechanisms in the biomedical field. This deeper understanding can guide clinical diagnosis and provide more effective treatment, which is crucial for solving complex medical problems. Through physical models and computational simulations, the mechanical properties of muscles, bones, and skin can be studied to optimize surgical plans and enhance surgical outcomes. Chemical principles aid in selecting appropriate materials for prosthesis and implants, optimizing their biocompatibility and mechanical properties. For instance, mathematical models and computer simulations can be used for preoperative planning, simulating anatomical structures and surgical operations, aiding doctors in formulating more rational surgical plans and optimizing surgical techniques. This allows students to practice in a virtual environment, improving their surgical skills and spatial understanding [42].

Big data, as a driving force of the information age, offers students new tools and opportunities to design research and analyze data [43]. Plastic and reconstructive surgery, when combined with big data, demonstrates clear advantages in research and data analysis. Statistical applications help doctors scientifically design experiments, uncover deep patterns in data, and enhance the credibility of conclusions [44, 45]. For example, scientists could identify a pre-engineered material that is both cost-effective and time-efficient by compiling a vast database encompassing all known and theoretical materials [46]. Big data technology also allows the extraction of typical cases from a large number of clinical cases for teaching purposes, breaking geographical and temporal barriers and enabling students to access teaching resources freely [47].

Through the interdisciplinary teaching model of medical science and basic science, students are encouraged to develop interdisciplinary thinking skills and the ability to apply knowledge from different disciplines to solve practical problems. This integration method not only helps students establish deeper connections between theory and practice but also injects more vitality into the innovation and advancement of medical education.

Medical humanities

The medical model has evolved from a simple "biological" model to a "biological-psychosocial" model [48, 49]. Plastic and reconstructive surgery not only focuses on patients' physical health but also aims to enhance their quality of life and psychological well-being. Integrating human science into plastic and reconstructive surgery education aims to enhance students' knowledge of human science, ethical awareness, social responsibility, and cultivate the ability to provide patients with humanistic care.

By combining medical knowledge with psychological insights, doctors can gain a deeper understanding of patients' psychological states and tailor treatment plans to individual needs. In plastic and reconstructive surgery training, doctors learn about mental health and psychological intervention skills to effectively support patients' psychological needs. Patience is key to encourage expression, which helps with better communication and thus more likely to achieve better results [48]. Studies indicate that the results of plastic and reconstructive surgery are closely related to patients' psychological states [50, 51], with preoperative anxiety and depression affecting surgical choices and outcomes, and postoperative psychological conditions directly impacting quality of life [52–54].

The integration of human science into the education of plastic and reconstructive surgery helps doctors gain a comprehensive understanding of patients' individuality, emotions, values, and their needs for personalized treatment. Knowledge of aesthetic concepts allows doctors to satisfy patients' aesthetic needs besides functional restoration, balancing out the surgery outcome. Plastic and reconstructive surgery emphasizes cultural aesthetic diversity, and through diverse theoretical education, medical students can enhance their aesthetic awareness and communication skills, and ultimately become capable of providing solid solutions for personalized treatment [55, 56].

In summary, the knowledge in the field of medical engineering, medical science and basic science, and human science plays a significant role in plastic and reconstructive surgery education. Collectively, the combination of knowledge enhances the comprehensive development and improvement of plastic and reconstructive surgery education, which enables well trained professionals to better address the complex medical challenges and meet patient needs.

Challenges and prospects of "Interprofessional Education" in medical teaching

Currently, many medical schools and educational institutions lack sufficient recognition of the importance and potential of interprofessional education. Currently the teaching model and system are still on trial stage or under discussion. A mature and standard system needs to be established to develop qualified professionals with sufficient knowledge of different fields of study. Additionally, medical schools around the world tend to follow traditional approaches and disciplines in plastic and reconstructive surgery education, primarily focusing on basic clinical skill training other than systematic teaching. Only a few universities offer "interprofessional education" courses as electives. Therefore, it is urgent to establish a more comprehensive educational system to provide a solid foundation for future medical innovation and practice.

In recent years, there has been a growing emphasis on the cultivation of interdisciplinary talent, with the medical education community gradually recognizing the importance of training professionals with interdisciplinary backgrounds. However, while the cultivation of interdisciplinary medical talent is highly beneficial, we must also be cautious of the potential risks involved in this process. For example, the combination of databases and artificial intelligence can help doctors make better diagnoses, but for young doctors with limited experience, over-reliance on existing databases and AI may weaken their clinical reasoning abilities. Moreover, the requirement of students to master an enormous amount of knowledge and skills from multiple fields, largely increases their academic burden. Additionally, the assessment standards for interprofessional courses are unclear, making it difficult to measure students' learning outcomes and increasing the complexity of management. Therefore, we must remain vigilant and avoid placing undue trust in new technologies that are not yet mature. At the same time, we should continue to emphasize clinical reasoning and foundational education to develop professionals who possess well-rounded medical knowledge.

In the future, medical schools and educational institutions can explore the application of interprofessional teaching models in the following ways: (1) update school curriculum, by offering more interdisciplinary courses, and explore new teaching methods such as project-based learning, practical teaching, and offer remote courses to enhance students' innovative thinking and interdisciplinary collaboration skills; (2) increase cooperation and exchanges with partner institutions to provide medical professionals with interdisciplinary knowledge; increase cooperation and exchanges among schools, medical institutions, research institutions, and enterprises to provide more practical opportunities and develop industry-university-research training models; (3) invest resources in internal software development, and introduce or design customized courses, and invest in modern equipment; (4) raise more awareness of the importance of "interprofessional education" among students and society, and attract more talents to engage in learning and research in related fields.

Discussion

In summary, plastic and reconstructive surgery is a critical branch of medical science that focuses on repairing, reconstructing, and optimizing human appearance and function. In the current global context that emphasizes "interprofessional education" and "multidisciplinary integration and development", the importance of medical engineering in plastic and reconstructive surgery education is increasingly evident. Extended reality technologies, such as virtual reality and augmented reality, are of great significance for precise diagnosis and teaching in plastic and reconstructive surgery. Additionally, with the accelerated digital transformation in the global technology industry, advanced methods such as surgical robots, three-dimensional scanning, and printing technology are gaining prominence in plastic and reconstructive surgery education. Furthermore, the integration of medical science and human science also brings new insights to plastic and reconstructive surgery education. The application of mathematics and big data provides strong support for precise diagnosis and treatment, while education in human science, aesthetics, and psychology helps to cultivate students' comprehensive quality and humanistic spirit.

Despite the urgent need for cutting-edge technology in plastic and reconstructive surgery, "interprofessional education" in medical teaching still faces numerous challenges, such as the lack of accuracy of AR technology, the tremendous investment in training medical staff of new technologies, and the huge economic costs of software development. To promote the implementation of "interprofessional education" we must confront these challenges. We need to tackle the key technological problems, encourage surgical education innovation, and form solid surgical practices to win patients' trust.

Looking forward, through continuous innovation in teaching methods, strengthening curriculum construction, deepening cooperation and exchanges, and cultivating interdisciplinary talents, we are confident that we can elevate plastic and reconstructive surgery education to a new height. This advancement will not only lay a solid foundation for the future development of plastic and reconstructive surgery but also inject continuous vitality into the overall progress and innovation of medical education.

Conclusion

This review highlights the critical role of Interprofessional Education (IPE) in plastic and reconstructive surgery, emphasizing its capacity to enhance the precision, effectiveness, and personalization of patient care. The incorporation of advanced technologies within IPE is crucial for modernizing surgical training, fostering innovation, and equipping medical professionals with a comprehensive approach to meeting patient needs.

Despite its benefits, the widespread integration of IPE into medical curricula faces challenges such as financial constraints, technological limitations, and the lack of standardized evaluation methods. Additionally, there is a need to carefully consider the potential risks of overreliance on technology, including the potential erosion of fundamental clinical skills.

Looking ahead, medical institutions need to innovate educational models that not only embrace IPE principles and interdisciplinary studies but also leverage technological advancements while focusing on essential clinical competencies. By integrating these elements, IPE can substantially contribute to nurturing well-rounded professionals who are adept at tackling the complex challenges of modern healthcare. The future of IPE is promising for enhancing educational experiences and patient outcomes, as long as the identified challenges are effectively addressed.

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Clinical trial number
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Authors' contributions
YingfeiSun, JiayiMao and YinghongSu contributed to the drafting, and critical review of the manuscript. TaoZan,WenzhengXia and Qingfeng Li contributed to the critical review of the manuscript. All authors read and reviewed the final version of the manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
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Competing interests
The authors declare no competing interests.

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