

## ORIGINAL RESEARCH

# Addressing the Rhino in the Room: ChatGPT Creates "Novel" Patent Ideas for Rhinoplasty

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## Abstract

**Background.** OpenAI's ChatGPT can generate novel ideas for a number of applications. The aim of this study was to prompt the chatbot to generate possible innovations in aesthetic surgery relating to rhinoplasty.

**Methods.** ChatGPT was prompted to develop rhinoplasty patents. The resulting outputs were tabulated and categorized based on technology domain and anatomic location. A Google Patents search was conducted to find uses of the term "rhinoplasty" between 2021 and 2023. Patents not pertaining to rhinoplasty were excluded. Filed patents were compared with those generated by ChatGPT to determine predictive power.

**Results.** A total of 40 patents resulted from ChatGPT and 42 Google Patents from 2021 to 2023 were included. Patents generated without a detailed description command were related to preoperative planning (35%), intraoperative tools (30%), functional evaluation (15%), and 3D printing and implants (10%). Patents with a detailed description command resulted in the majority being postoperative tools (40%), followed by intraoperative tools (30%), 3D printing and implants (10%), and nonsurgical (10%) categories. The anatomic locations included the airway, dorsum, septum, and nasal tip. ChatGPT's predictive power yielded 45% for the detailed prompting, which was higher than the prompt without the detail command.

**Conclusions.** ChatGPT has reasonable potential to generate ideas for innovations in plastic surgery with the assistance of an experienced surgeon-innovator. With new artificial intelligence generations and updates, chatbots will continue to improve. Determining whether these technologies can assist in the later portions of the patent process beyond idea generation will be crucial.

## Introduction

Chatbots have gained wide interest from the public for their capabilities and ease of use. These large language models leverage natural language processing to provide the end user with a technology that imitates face-to-face conversations. Within seconds of prompting chatbots, execution of the input command occurs. The outputs generated have ranged from answers to standardized examination questions, to formulated editorials and ideas for projects, among others.<sup>1-3</sup> However, chatbots are in their infancy and their development will likely outpace our ability to keep up with their new innovations. This is particularly true with respect to clinical medicine, where their integration could be beneficial. Therefore, it is important to explore various medical applications of chatbots. OpenAI, a company focused on making artificial intelligence (AI) more widely available through their products, recently released their chatbot, ChatGPT.

The field of plastic surgery is ripe with surgeon-innovators who span regenerative medicine, craniofacial surgery, transplantation, and hand surgery, among others. With the expanding scope of other specialists limiting plastic surgeon involvement in certain subspecialties, the future of plastic surgery relies on innovation.<sup>4</sup> Prominent plastic surgeons in the field have stated, "You can never have too much innovation," and "Plastic surgery needs a constant flow of innovations."<sup>5</sup> Innovation can certainly shape practice and often radically improve it with paradigm shifts. Some of the most notable innovations in plastic surgery are transplantation, flaps, implants, tissue expansion, and microsurgery. More recent advances include negative pressure wound therapy, robotics, regenerative medicine, fat grafting, and stem cells.

Tools such as chatbots are useful as they can help generate ideas efficiently and give a foundation for other ideas to be built upon. Efforts can become more targeted and time that would have been spent brainstorming can be invested in the latter phases of innovation, which consist of product development, implementation, and marketing. ChatGPT has been applied to several use cases; however, its ability to create ideas specifically for innovation in aesthetic surgery have yet to be explored.<sup>6-8</sup> The chatbot can assist in producing ideas for new technologies but the viability of these queries is yet to be determined. The purpose of this study was to use ChatGPT to develop ideas for aesthetic surgery patents pertaining to rhinoplasty and evaluate if they have previously been pursued.

## Methods and Material

### Natural Language Processing Artificial Intelligence

OpenAI's ChatGPT 3.5 was queried to develop novel patent ideas for rhinoplasty. The chatbot was given the following prompts: (1) develop 20 novel devices that have not been patented for rhinoplasty and (2) develop 20 novel devices that have not been patented for rhinoplasty *with detailed descriptions*. It developed a total of 20 ideas for each prompt. GPT 3.5 series was trained on datasets and code from 2021.

### Prompt Engineering

The prompts used in this study were iterated to determine if the chatbot would produce additional ideas and to determine how this could influence its suggestions. Each of the previously mentioned prompts were given 3 times to the chatbot. Individuals using ChatGPT can design prompts to better leverage the chatbot and to refine its responses. Assessing the feasibility and practicality of the novel rhinoplasty device ideas can be accomplished preliminarily on a global level by prompting ChatGPT to determine if compatibility testing, validations for accuracy, measurements, and so on are needed. However, appropriate feasibility and validation would require evaluating each concept and exploring the regulations, market demand, and potential challenges specific to the idea. Moreover, rigorous research and development efforts would be needed to advance the ideas and determine viability for patenting and commercializing the products.

### Patent Search Engine

Google Patents search engine was used to identify patents related to rhinoplasty with the search term *rhinoplasty*. The search results were limited using advanced search options. The following restrictions were placed on the resulting search: English (language), patent (type), United States Patent and Trademark Office (patent office), and 2021+ (filing dates). Patents that were unrelated or too general were removed from the search. The resulting patent ID, title, assignee, inventor/author, priority date, filing/creation date, publication date, and grant date were tabulated.

### Categorization of ChatGPT's Ideas into Domains, Anatomic Location, and Accuracy of Predictability

To characterize the ideas generated by ChatGPT, outputs were organized into domains based on: the operative phase it assists with (eg, preoperative, intraoperative, postoperative), technology type (eg, 3D printing, implant), functional evaluation, educational, or nonsurgical. Anatomic region of the nose was separated into the dorsum, nasal tip, alar base, septum, airway, or indeterminate or relating to multiple anatomic regions of the nose. Patents from Google Patent search for 2021 to 2023 were classified. The patent ideas from ChatGPT were also classified by ChatGPT itself. ChatGPT ideas and the patents filed were compared. If ChatGPT suggested an idea relevant to a patent filed from 2021 or beyond, it was counted as a predicted patent idea. Otherwise, it was deemed as irrelevant to the narrowed down years and nonpredictive. This analysis was performed by 3 independent reviewers, with any disagreements adjudicated by a majority vote.

## Results

### ChatGPT's Suggestions for Innovation in Plastic Surgery and Patent Ideas for Rhinoplasty

A summary of ChatGPT's opinions on how plastic surgeons can innovate is presented in **Table 1** and outlined verbatim in **Supplemental Material 1**. It highlights attending conferences, collaboration with other specialties, performing research, encouraging feedback from patients, and engaging with technologies as possible avenues to increase innovation.

ChatGPT Suggestions for Plastic Surgeons	Explanation
Attend Conferences and Seminars	<ul style="list-style-type: none"> <li>Plastic surgeons can learn about the latest techniques, technologies, and trends in the field. Surgeons can also network and exchange ideas with others in the field.</li> </ul>
Collaboration	<ul style="list-style-type: none"> <li>Multidisciplinary collaboration with teams of engineers, scientists, and software developers can lead to development of new technologies and techniques. Using an interdisciplinary approach can result in innovative solutions and thinking outside the box.</li> </ul>
Conducting Research	<ul style="list-style-type: none"> <li>Conducting research can identify areas that need innovation. Clinical trials can also be conducted to determine the efficacy of the products that can be brought to market from bench to bedside.</li> </ul>
Encouraging Patient Feedback	<ul style="list-style-type: none"> <li>Asking patients for feedback on their procedures and taking this input to improve existing methods can lead to innovations. Paradigm shifts often result from identifying a clinical need and attempting to address it.</li> </ul>
Utilize Technology and AI in Practice	<ul style="list-style-type: none"> <li>Utilizing technology, such as VR and 3D printing, to simulate procedures can provide an avenue to simulate an environment for new procedures or techniques. By interacting with updated technology, a new frontier could be established for old approaches and the standard of care can be improved.</li> </ul>

AI, artificial intelligence; 3D, three-dimensional; VR, virtual reality

Adapted using ChatGPT's output from Supplemental Material 1.

Table 1. ChatGPT Suggestions for Plastic Surgeons to Generate More Ideas That Are Innovative and Patentable

**Table 2** reports the categories that the ChatGPT patent ideas comprise. The majority of innovations without a detailed description command were relating to preoperative planning (35%), followed by intraoperative tools (30%), functional evaluation (15%), and 3D printing and implants (10%), whereas the majority of innovations with a detailed description command were postoperative tools (40%) followed by intraoperative tools (30%), 3D printing and implants (10%), and nonsurgical (10%) categories.

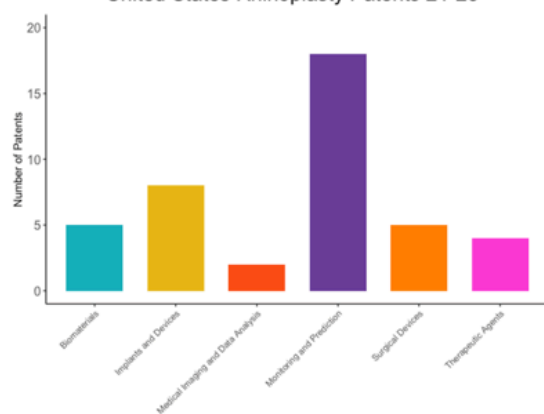
Category of Patent Ideas	W/Out Detailed Description	W/ Detailed Description
Preoperative planning	7 (35)	1 (5)
Intraoperative tool	6 (30)	6 (30)
Postoperative tool	2 (10)	8 (40)
Functional evaluation	3 (15)	0 (0)
3D printing and implants	2 (10)	2 (10)
Education	0 (0)	1 (5)
Nonsurgical	0 (0)	2 (10)

w/, with; w/out, without

Table 2. Categorization of ChatGPT Patent Ideas Based on the Domain That the Idea Captures

The Google Patents were narrowed down to 42 relevant patents on rhinoplasty that were included in the final analysis. The resulting patents were classified into categories for the years 2021 to 2023 in **Figure 1A**. The majority were for monitoring and prediction (17, 40%) followed by implants and devices (8, 19%) and biomaterials (5, 12%). Ethicon (incorporated as a separate company under the Johnson & Johnson umbrella) was the private entity that filed most of the patents (10, 24%), and with respect to academic institutions, Johns Hopkins University and New York University both were responsible for filing 1 patent each between 2021 and 2023. **Figure 1B** depicts ChatGPT's own classification of the patent ideas it developed. The majority of ideas were for surgical devices followed by technologies for monitoring and prediction, and medical imaging and data analysis.

A) United States Rhinoplasty Patents 21-23



B) ChatGPT Patent Classifications

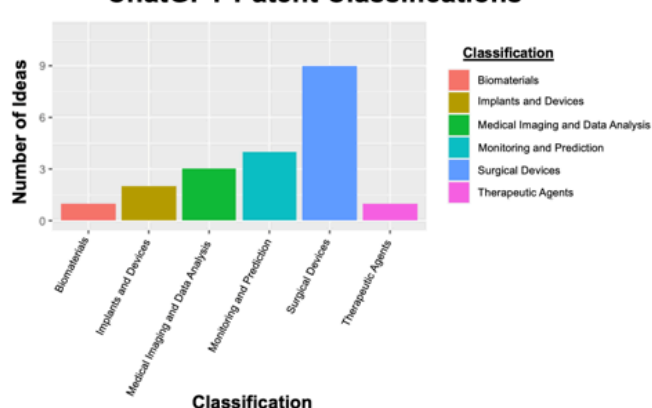


Figure 1. Categorization and classification patents. (A) Google Patents relevant to rhinoplasty filed between 2021 and 2023 in the United States. (B) Patent ideas generated by ChatGPT based on themes of the patent claims.

The anatomic location pertaining to each patent idea is outlined in **Table 3**. For commands without a detailed description, the majority of ideas related to the airway (15%), dorsum (10%), and nasal tip (10%). However, the highest proportion were indeterminate or being applicable to multiple anatomic locations (55%). When prompting the chatbot with the command to provide details, the most common areas were the airway (30%) and septum (5%); however, the highest were categorized as indeterminate or being applicable to multiple anatomic locations (65%).

Anatomic Location of Patent Ideas	W/Out Detailed Description	W/ Detailed Description
Dorsum	2 (10)	0 (0)
Nasal tip	2 (10)	0 (0)
Alar base	1 (5)	0 (0)
Septum	1 (5)	1 (5)
Airway	3 (15)	6 (30)
Indeterminate or capable of being used in multiple places w/, with; w/out, without	11 (55)	13 (65)

Table 3. Anatomic Location of ChatGPT Patent Ideas Based on the Region of the Nose That the Idea Pertains To

**Table 4** summarizes the capabilities of ChatGPT's predictive power of filed patents in the calendar years of 2021 to 2023. The prompting style without detail was slightly less predictive (40%) than the prompting style with commands to provide detailed descriptions (45%). **Figure 2** outlines the predictability of future filings based on the classification of each patent type. For medical imaging and data analysis, ChatGPT had the highest predictability based on the prompting scheme with additional detail and the lowest for implants and devices based on the prompting scheme without the additional detail requested.

Variable	W/Out Detailed Description	W/ Detailed Description
Number of predicted patents, N (%)	8 (40)	9 (45)
w/, with; w/out, without		

Table 4. Predictability of Future Patent Filings Based on ChatGPT Prompt Type

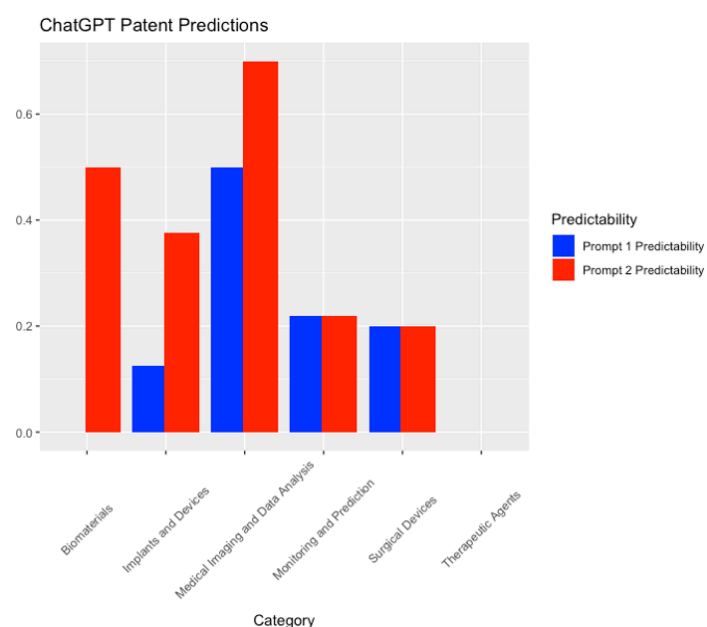


Figure 2. Predictability of future patent filings based on ChatGPT outputs for each prompt type.

**Supplemental Material 2** outlines the exact prompts and outputs that were generated by ChatGPT. The prompts were iterated 3 more times (**Supplemental Material 3**). Strategies for iterative prompting from ChatGPT are provided in **Supplemental Material 4**.

## Discussion

We have described the process of using AI to produce patentable ideas in rhinoplasty surgery. Using ChatGPT to develop innovative ideas for patents in plastic surgery is valuable to explore. Simply asking ChatGPT to generate patent ideas was surprisingly effective, with 2 separate prompts resulting in a total of 40 ideas. ChatGPT is trained using data prior to 2021. Generated ideas were compared with actual patent filings in the Google Patents database from the calendar years of 2021 to 2023.<sup>9</sup> The highest predictive capabilities were observed with the use of detailed commands, with 45% of future filings captured by ChatGPT outputs. Outputs encompassed a variety of categories addressing several aspects of rhinoplasty. Categories included preoperative planning, intraoperative tools, postoperative tools, 3D printing and implants, education, and nonsurgical approaches. In addition, ChatGPT generated innovative ideas to address multiple anatomic locations of the nose. In this way, AI proves to adopt a comprehensive approach when addressing rhinoplasty.



Innovation is not a foreign concept in plastic surgery and has led to improved patient outcomes, time and money saved, and broadened practice scope.<sup>10</sup> ChatGPT has the ability to assist a user with the development of innovative ideas; however, novelty is not guaranteed. This has been demonstrated in previous studies assessing ChatGPT's capabilities in developing novel systematic review ideas in the field of plastic surgery. The ideas produced by ChatGPT exhibited limited originality, as only 65% of the proposed systematic review ideas were considered novel within a smaller sample size (n = 20).<sup>11-14</sup> Furthermore, this limited originality in idea generation may further reinforce the concerns exhibited by the scientific community in regards to plagiarism and originality of content produced by AI. It is unclear whether ChatGPT has the capability to predict patents or whether its output represents innovations generated via a comprehensive search of available literature and databases.<sup>15</sup>

Traditionally, surgeons develop novel ideas after identifying a problem in their field. These ideas tend to address outcomes, resources (eg, wasted time, money, personnel), or a combination of the two.<sup>16</sup> For the busy plastic surgeon, recognizing a problem may be simple; however, time and energy are required to address it. In the future, ChatGPT may be used for initial idea generation and to develop a foundation for innovation. This will leave surgeons more time to focus on discussions with stakeholders and the latter portions of implementation and bringing a product to market. According to the United States Patent and Trademark Office (USPTO), the patent application and maintenance process consists of 8 steps.<sup>17</sup> ChatGPT can be used as a preliminary step in idea generation; however, it is unlikely to completely replace the human efforts required to complete this arduous process. Whilst the originality of the idea generation may still be lacking, the platform can assist in helping formulate the foundations of their ideas in the early research stages. It is not feasible for ChatGPT to assist in all steps of the patent process. While idea generation is foundational, human thought processes, discretion, and input are irreplaceable with regard to bringing an idea to market. Time and cost are important factors that must be considered by every innovator. Financial feasibility dictates whether an individual will need to apply for grants or seek institutional support.<sup>18</sup> While significant effort is needed to complete the patent process, increasing the ease with which plastic surgeons initiate innovation using AI technology may alleviate some of this burden.<sup>19</sup>

## Future Directions

Looking forward, AI will likely be used as a supplementary tool to help innovate in plastic surgery. As this technology continues to develop, the outputs of potential ideas will improve and better assist surgeons in patent brainstorming. Increasing plastic surgeon use of these platforms will allow for technology adaptation to better address problems in the field. It will ultimately be a community effort to educate these programs to best serve our needs. In this way, innovation can become more intentional and consequential.

## Limitations

There are a few limitations to this study. First, ChatGPT does not have the ability to run patent searches, which is why we used Google Patents to assess each idea. Another limitation is that searches only identify approved patents and not filings under review, so there may be additional inventions that are not searchable through current USPTO and Google engines. This is particularly relevant to international patents, which may be overlooked since patents from regions outside the United States were not captured. The search is dependent on real-time learning, which means that one novel idea produced may influence the output of the next. In this way, the output of 20 patentable ideas is not as diverse as may be expected due to reliance on past outputs. This can be overcome with a new chat in ChatGPT; however, we wanted to influence outputs based on the addition of commanding the addition of details. Outputs may also be impractical or nonsensical, supporting the need for a surgeon to vet ideas prior to discussion with stakeholders. Interestingly, ChatGPT acknowledges that it can only act as one piece of the puzzle and reports that "developing new medical devices requires extensive research and testing and should be done under the guidance of medical professionals and in accordance with established safety standards." We also cannot definitively state whether ChatGPT conceptualized these patents itself or whether they were developed from finding similar technologies in its database query. Despite these limitations, plastic surgeons have the opportunity of harnessing the potential of AI in partnership with lawyers, engineers, and their institutions.

## Conclusions

This study leverages ChatGPT to develop patent ideas in the field of rhinoplasty. Generated ideas were diverse and spanned a wide range of operative phases and anatomical regions of the nose. The implications of using chatbots to generate innovative ideas is exciting; however, surgeons should proceed with caution as the genesis of these outputs may not be completely novel. With chatbot updates and new releases, it will be interesting to see how these technologies develop. For now, the human logic and knowledge of the patent process is required for ideas to become reality.

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**Ethics:** For this type of study, formal consent is not required.

**Disclosures:** Dr Dorafshar is entitled to a technology he invented based on a licensing agreement between KLS Martin (Jacksonville, FL) and Johns Hopkins University (Baltimore, MD); is entitled to receive royalties on a book he published under a licensing agreement with Elsevier (Amsterdam, the Netherlands); receives honorarium for educational lectures from De Puy Synthes (Raynham, MA); receives indirect research support from KLS Martin and De Puy Synthes; and has received payment from KCI (Sparks, MD) as a consultant. Dr Cohen serves in advisory board roles for WideawakeVR, Inc, Pathware, Inc, and GigXR, Inc. The remaining authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

## Supplemental Material

**Supplemental Material 1.** Prompt that was given to ChatGPT to develop ideas to assist plastic surgeons in innovation.

*Prompt:* How can plastic surgeons innovate more and develop more patent ideas?

*ChatGPT Response:*

"Plastic surgeons can innovate and develop more patent ideas by staying up-to-date with the latest research and advancements in their field. Here are some suggestions:

1. Attend conferences and seminars: By attending conferences and seminars, plastic surgeons can learn about the latest techniques, technologies, and trends in their field. They can also network with other professionals and exchange ideas.
2. Collaborate with other professionals: Plastic surgeons can collaborate with other professionals, such as engineers, scientists, and software developers, to develop new technologies and techniques. This interdisciplinary approach can lead to new and innovative solutions.
3. Conduct research: Plastic surgeons can conduct research in their field to identify areas where innovation is needed. They can also participate in clinical trials to test new products and techniques.
4. Encourage patient feedback: Plastic surgeons can ask their patients for feedback on their procedures and use this information to develop new ideas and improve existing ones.
5. Utilize technology: Plastic surgeons can use technology, such as virtual reality and 3D printing, to simulate procedures and develop new techniques.

By incorporating these strategies, plastic surgeons can innovate and develop new patent ideas that improve the outcomes of their procedures and enhance the patient experience."

**Supplemental Material 2.** Patent ideas generated from ChatGPT with each prompt entered.

*Prompt 1:* Develop 20 novel devices that have not been patented for rhinoplasty

*ChatGPT Response:*

"Sure, here are 20 novel devices that have not been patented for rhinoplasty:

1. A device for simulating the results of rhinoplasty surgery using augmented reality technology.
2. A device for creating a 3D digital model of a patient's nose for pre-surgical planning and simulation.
3. A device for measuring the elasticity of nasal cartilage to aid in the selection of the appropriate surgical technique.
4. A device for measuring the thickness of nasal skin to aid in the selection of the appropriate surgical technique.

5. A device for non-invasive measurement of nasal airflow and resistance to aid in the diagnosis of nasal obstruction.
6. A device for intraoperative monitoring of nasal airflow and resistance to aid in the assessment of surgical outcomes.
7. A device for creating a custom-fit nasal implant using 3D scanning and printing technology.
8. A device for enhancing the accuracy of nasal bone fractures reduction using augmented reality technology.
9. A device for minimizing the risk of complications during rhinoplasty surgery using real-time intraoperative monitoring of tissue oxygenation.
10. A device for improving the precision and accuracy of nasal tip refinement using a laser-assisted sculpting tool.
11. A device for improving the precision and accuracy of nasal bone reshaping using a high-precision pneumatic tool.
12. A device for improving the precision and accuracy of nasal cartilage reshaping using a high-precision electromagnetic tool.
13. A device for improving the precision and accuracy of nasal septum correction using a computer-assisted navigation system.
14. A device for improving the precision and accuracy of nasal valve reconstruction using a bioresorbable implant.
15. A device for improving the precision and accuracy of nasal alar base reduction using a pneumatic tissue-sculpting tool.
16. A device for minimizing the risk of postoperative bleeding in rhinoplasty patients using a bioadhesive nasal packing material.
17. A device for enhancing patient comfort and reducing postoperative swelling in rhinoplasty patients using a wearable cold therapy device.
18. A device for improving the precision and accuracy of nasal dorsum reshaping using a high-precision robotic system.
19. A device for improving the precision and accuracy of nasal hump reduction using a high-precision mechanical planning tool.
20. A device for improving the precision and accuracy of nasal tip projection using a high-precision hyaluronic acid injection system."

*Prompt 2:* Develop 20 novel devices that have not been patented for rhinoplasty with detailed descriptions

*ChatGPT Response:*

"As an AI language model, I can provide 20 possible ideas for novel devices that have not been patented for rhinoplasty, but it's important to note that these ideas have not been tested or verified in any way. Additionally, developing new medical devices requires extensive research and testing, and should be done under the guidance of medical professionals and in accordance with established safety standards.

Here are 20 possible ideas for novel devices for rhinoplasty:

1. 3D-printed nasal splint: A custom-fit splint that is designed using a 3D scan of the patient's nose, providing more precise support and reducing the risk of post-operative complications.
2. Pneumatic nasal dilator: A device that uses compressed air to gently expand the nasal passages, allowing for easier breathing and improved nasal symmetry.
3. Nasal irrigation system: A device that uses a gentle stream of saline solution to flush out debris and mucus from the nasal passages, reducing the risk of infection and improving healing after rhinoplasty.
4. Intraoperative nasal tissue imaging system: A device that provides real-time imaging of nasal tissue during surgery, allowing for more precise incisions and better results.
5. Nasal temperature monitor: A device that measures the temperature of nasal tissue during surgery, helping to prevent damage to delicate tissue and reducing the risk of complications.
6. Rhinoplasty simulator: A virtual reality or augmented reality system that allows surgeons to practice and refine their rhinoplasty techniques in a realistic, risk-free environment.
7. Smart nasal pack: A device that automatically adjusts to the shape and size of the nasal cavity, providing more precise packing and reducing the risk of complications.
8. Nasal implant material: A novel material that is biocompatible and can be customized to fit the individual patient's needs, improving the durability and long-term success of nasal implants.
9. Nasal filler injection system: A device that uses a fine-tipped needle to inject fillers into the nose, providing more precise results and reducing the risk of complications.
10. Nasal airway stent: A device that provides temporary support for the nasal airway, reducing the risk of post-operative complications and improving breathing.
11. High-resolution nasal endoscope: A device that provides a high-resolution view of the nasal cavity, allowing for more precise incisions and better results.
12. Nasal bone cutting guide: A device that provides a precise guide for cutting nasal bone during surgery, reducing the risk of complications and improving results.
13. Nasal bone stabilizer: A device that stabilizes the nasal bone during surgery, reducing the risk of displacement and improving results.
14. Nasal tissue expander: A device that gently stretches nasal tissue over time, allowing for better results and reduced recovery time.
15. Portable nasal suction system: A handheld device that provides suction to the nasal cavity, reducing the risk of complications and improving healing after rhinoplasty.
16. Custom-fit nasal implant: A novel implant material that is designed using a 3D scan of the patient's nose, providing a precise fit and improved results.

17. Nasal tissue patch: A novel material that can be used to patch and repair nasal tissue after rhinoplasty, improving healing and reducing the risk of complications.
18. Dual-function nasal dilator: A device that combines pneumatic dilation with a gentle vibration, improving nasal airflow and reducing congestion.
19. Nasal tissue regeneration system: A device that uses stem cells or other regenerative techniques to promote the growth and regeneration of nasal tissue after rhinoplasty.
20. Nasal septum straightening device: A device that provides gentle, precise pressure to straighten the nasal septum, reducing the risk of complications and improving results."

**Supplemental Material 3.** Iteration of the initial prompts three more times.

*Prompt 1(x3):* Develop 20 novel devices that have not been patented for rhinoplasty

*ChatGPT Response:*

"Sure, I'd be happy to help you generate 20 novel device ideas for rhinoplasty that haven't been patented. Please note that while I can provide creative suggestions, it's essential to consult with medical professionals and legal experts before pursuing any patent applications. Here are the device ideas:

1. Nasal Bridge Augmentor: A non-invasive device that uses adjustable pressure to gently shape and enhance the nasal bridge without surgery.
2. 3D Nasal Imaging System: A portable scanner that captures detailed 3D images of the patient's nose, aiding in pre-surgery planning and post-operative assessment.
3. Nasal Cartilage Sizer: A handheld device that measures and analyzes nasal cartilage dimensions to assist surgeons in selecting appropriate graft sizes for augmentation procedures.
4. Nasal Tip Reshaping Tool: A minimally invasive device that employs ultrasonic technology to reshape the nasal tip through controlled tissue sculpting.
5. Nasal Implant Anchoring System: A magnetic anchoring system that secures nasal implants in place, providing stability during the healing process.
6. Smart Nasal Splint: An IoT-enabled nasal splint that monitors post-operative healing progress and sends real-time data to the surgeon for remote monitoring.
7. Bioresorbable Nasal Stents: Dissolvable stents that provide structural support during the healing process and gradually degrade over time.
8. Nasal Dermal Regenerator: A device that uses low-level light therapy to stimulate collagen production and promote healing in nasal dermal tissues.
9. Nasal Fracture Reduction Simulator: A virtual reality tool that allows surgeons to practice and refine their techniques for nasal fracture reduction.
10. Nasal Scar Minimizer: An ultrasound-based device that breaks down scar tissue and encourages smoother healing after rhinoplasty.
11. Nasal Airflow Optimizer: A device that uses computational fluid dynamics to optimize nasal airflow post-surgery, improving breathing and reducing congestion.
12. Nasal Bone Fusion Enhancer: A device that emits low-frequency vibrations to enhance bone fusion and healing after nasal bone adjustments.
13. Nasal Tip Contour Mapper: A device equipped with pressure sensors that helps surgeons achieve precise and natural-looking nasal tip contours.
14. Nasal Skin Tightening Wand: Utilizing radiofrequency technology, this device tightens and firms nasal skin after rhinoplasty.
15. Nasal Sensation Simulator: A sensory feedback device that helps patients regain a sense of touch and sensation in the nasal area after surgery.
16. Nasal Inflammation Monitor: An implantable device that monitors inflammation levels post-surgery and alerts patients and surgeons to any abnormal changes.



17. Nasal Implant Material Analyzer: A handheld tool that analyzes the compatibility of different implant materials with the patient's nasal structure.
18. Nasal Symmetry Calibrator: A computer-assisted tool that measures and corrects nasal asymmetry, ensuring a balanced appearance.
19. Nasal Scar Camouflage Kit: A set of specialized makeup and skincare products designed to camouflage and minimize post-surgery scars.
20. Nasal Bone Density Scanner: A non-invasive device that measures nasal bone density and helps guide the choice of surgical techniques for optimal results.

Remember that these ideas are conceptual, and you should thoroughly research and consult with medical professionals and legal experts before pursuing any patent applications.

Certainly, here are 20 more novel device ideas for rhinoplasty that haven't been patented:

1. Nasal Tissue Regenerator: A device that utilizes stem cell technology to accelerate tissue regeneration, aiding in post-surgery healing and minimizing scarring.
2. Virtual Rhinoplasty Simulator: An immersive virtual reality system that allows patients to visualize and experience potential rhinoplasty outcomes before surgery.
3. Nasal Haptic Feedback Probe: A surgical tool with haptic feedback technology that provides surgeons with a tactile sense of tissue resistance during rhinoplasty procedures.
4. Nasal Cartilage Printing System: A 3D bioprinter that creates patient-specific nasal cartilage grafts for precise augmentation and reconstruction.
5. Nasal Hemostasis Device: A handheld device that uses focused energy to quickly and safely control bleeding during and after rhinoplasty surgery.
6. Nasal Biomechanics Analyzer: An instrument that measures nasal biomechanics during surgery, helping surgeons optimize techniques for stability and desired aesthetics.
7. Nasal Scarless Suturing Tool: A robotic-assisted device that performs intricate suturing with minimal tissue trauma, reducing the appearance of scars.
8. Nasal Anesthesia Patch: A patch infused with local anesthetics and cooling agents that provides prolonged pain relief and reduces swelling post-surgery.
9. Nasal Shape Memory Implant: An implant that adapts to the patient's nasal anatomy over time, providing gradual and natural-looking augmentation results.
10. Nasal Nerve Mapping Probe: A tool that maps nasal nerve pathways, enhancing surgeons' ability to avoid nerve damage during rhinoplasty.
11. Nasal Bone Fusion Enhancer: A device that emits electromagnetic pulses to stimulate bone fusion and reduce healing time for nasal bone adjustments.
12. Nasal Filler Dissolver: An enzyme-based device that dissolves dermal fillers used in previous rhinoplasty procedures, allowing for corrective interventions.
13. Nasal Airflow Restriction Trainer: A device that simulates restricted nasal airflow, allowing patients to gradually adapt to their new nasal structure after surgery.
14. Nasal Symmetry Projection System: A device that projects a holographic image of the desired nasal symmetry onto the patient's face, aiding surgeons during procedures.
15. Nasal Sensation Rehabilitation Kit: A kit containing specialized exercises and sensory stimulation tools to help patients regain sensation in the nasal area post-surgery.
16. Nasal Biofilm Scanner: An imaging device that detects and analyzes bacterial biofilms in the nasal area, preventing potential infections after rhinoplasty.

17. Nasal Bone Density Enhancer: A device that uses targeted ultrasound to promote increased bone density in the nasal area for improved support and stability.

18. Nasal Tissue Elasticity Assessor: A handheld tool that measures nasal tissue elasticity, guiding surgeons in achieving natural and flexible post-surgery results.

19. Nasal Scar Prevention Patch: A bioactive patch that releases growth factors to promote scar prevention and minimize scar formation after surgery.

20. Nasal Digital Follow-up App: A smartphone app that enables patients to take and upload regular 3D images of their healing progress, allowing surgeons to remotely monitor recovery.

As always, ensure thorough research and expert consultation before pursuing any patent applications related to these ideas.

Of course, here are 20 more novel device ideas for rhinoplasty that haven't been patented:

1. Nasal Tissue Optimizer: A device that uses bioregenerative technology to enhance the quality of nasal tissues before surgery, leading to improved post-operative outcomes.

2. Nasal Contouring Holograph: A device that projects a holographic 3D model of the patient's nose, enabling surgeons to visualize and plan contouring procedures accurately.

3. Nasal Scar Massage Roller: A handheld roller equipped with vibration and heat therapy to facilitate scar tissue breakdown and smoother healing after surgery.

4. Nasal Bone Locking Clamp: A precision clamp that secures nasal bones in the desired position during the healing phase, ensuring stable and predictable results.

5. Nasal Implant Biointegrator: An implant that gradually integrates with the patient's natural tissues over time, creating a seamless and natural-looking nasal augmentation.

6. Nasal Sinus Clearance Device: A handheld device that uses gentle vibrations to help clear nasal passages and sinuses post-rhinoplasty, reducing congestion and promoting healing.

7. Nasal Skin Elasticity Enhancer: An at-home wearable device that utilizes mild electromagnetic stimulation to improve nasal skin elasticity and tightness.

8. Nasal Infection Alert System: An implantable device that detects early signs of infection after surgery and sends alerts to both patients and surgeons.

9. Nasal Bone Density Analyzer: A handheld tool that measures nasal bone density before surgery, aiding surgeons in selecting appropriate techniques and implants.

10. Nasal Shape Memory Splint: A customizable splint that molds to the patient's nasal contours, offering support during healing and helping maintain the desired shape.

11. Nasal Tissue Oxygenator: An implant that delivers oxygen directly to nasal tissues, accelerating healing processes and reducing the risk of complications.

12. Nasal Vibrational Resonator: A device that uses controlled vibrations to stimulate nasal tissue regeneration and enhance post-operative healing.

13. Nasal Sensation Restoration Kit: A comprehensive kit comprising sensory exercises, neuromuscular stimulation, and sensory training tools to restore nasal sensation post-surgery.

14. Nasal Scar Nanopatch: A nano-sized patch that releases scar-reducing compounds directly onto surgical sites, promoting minimal scarring during healing.

15. Nasal Aesthetic Simulator: An augmented reality headset that overlays potential rhinoplasty outcomes on the patient's face, allowing them to visualize results before surgery.

16. Nasal Bone Support Frame: A 3D-printed implant that provides structural support to nasal bones during healing, preventing deformities and asymmetry.

17. Nasal Biofeedback Device: A wearable device that provides real-time feedback on nasal muscle movement, helping patients learn optimal facial expressions post-surgery.

18. Nasal Inflammation Regulator: An implant that releases anti-inflammatory agents over time to prevent excessive inflammation and swelling after rhinoplasty.

19. Nasal Projection Microadjuster: A handheld device that enables surgeons to make micro-adjustments to nasal projection during or after surgery for precise results.

20. Nasal Tissue Volumizer: A non-surgical device that uses controlled suction to stimulate tissue expansion, aiding in non-invasive nasal augmentation.

As always, ensure thorough research, expert consultation, and patent searches before pursuing any patent applications based on these ideas."

*Prompt 2 (x3):* Develop 20 novel devices that have not been patented for rhinoplasty with detailed descriptions

*ChatGPT Response:*

"Certainly, here are 20 detailed descriptions of novel devices for rhinoplasty that haven't been patented:

1. Device: Nasal Shape Mapper

Description: A handheld 3D scanner that captures precise nasal measurements and contours, allowing surgeons to create accurate surgical plans for rhinoplasty procedures.

2. Device: Cartilage Reshaping Microprobe

Description: A fine-tipped microprobe with adjustable temperature settings, enabling surgeons to reshape nasal cartilage with controlled thermal energy during surgery.

3. Device: Scarless Nasal Implant Anchor

Description: A dissolvable anchor system that securely holds nasal implants in place during the healing process, reducing the risk of complications and visible scarring.

4. Device: Nasal Bone Density Analyzer

Description: An instrument that employs ultrasound waves to measure nasal bone density, helping surgeons select appropriate techniques and materials for bone adjustments.

5. Device: Nasal Healing Oxygen Mask

Description: A mask delivering controlled oxygen levels directly to the nasal area, promoting accelerated healing and reducing recovery time after rhinoplasty.

6. Device: Nasal Symmetry Augmented Reality App

Description: An app that uses augmented reality to superimpose symmetrical templates on the patient's face, aiding in visualizing potential rhinoplasty outcomes.

7. Device: Nasal Microbiome Monitor

Description: An implantable sensor that continuously monitors nasal microbiome changes, providing early alerts for infection risks and post-surgery complications.

8. Device: Nasal Nerve Preservation Tool

Description: A minimally invasive surgical tool equipped with advanced imaging and guidance systems to help surgeons avoid damaging nasal nerves during procedures.

9. Device: Nasal Biometric Preoperative Planner

Description: A software solution that uses AI to analyze facial features and recommend personalized rhinoplasty plans, ensuring natural results aligned with patient preferences.

10. Device: Nasal Pressure Garment

Description: A pressure-sensitive garment worn post-surgery to gently apply pressure and control swelling, enhancing healing and maintaining the new nasal shape.

11. Device: Nasal Bone Fusion Promoter

Description: A device emitting low-intensity ultrasound waves that stimulate bone fusion and enhance stability in the nasal area after bone adjustments.

12. Device: Nasal Tissue Hydration Patch

Description: A patch infused with hydrogel that delivers controlled hydration to nasal tissues post-surgery, minimizing dryness and promoting optimal healing conditions.

13. Device: Nasal Tissue Elasticity Enhancer

Description: A handheld device utilizing microcurrent technology to improve nasal tissue elasticity and firmness, supporting natural and youthful results.

14. Device: Nasal Implant Customizer

Description: A 3D printer that creates patient-specific nasal implants based on detailed scans, ensuring precise fit and reduced risk of rejection.

15. Device: Nasal Sensation Rehabilitation App

Description: An app that guides patients through sensory rehabilitation exercises, helping them regain tactile sensitivity in the nasal area after surgery.

16. Device: Nasal Contour Projection Device

Description: A handheld device that projects light patterns onto the nose, aiding surgeons in achieving precise contouring and symmetry during surgery.

17. Device: Nasal Implant Material Tester

Description: A tool that evaluates the compatibility of various implant materials with the patient's nasal tissue, ensuring safe and effective augmentation.

18. Device: Nasal Dermal Biofeedback Sensor

Description: An implantable sensor that measures dermal tension and provides real-time feedback to help patients avoid overexertion and promote proper healing.

19. Device: Nasal Scar Minimizing Gel Dispenser

Description: A handheld device that applies scar-reducing gel with precise pressure, promoting even distribution and minimizing visible scarring.

20. Device: Nasal Shape Memory Bandage

Description: A bandage infused with shape memory materials that adapt to the new nasal contours, providing support and maintaining the desired shape during healing.

Remember to consult with medical professionals and legal experts before pursuing any patent applications based on these ideas.

Certainly, here are 20 detailed descriptions of novel devices for rhinoplasty that haven't been patented:

1. Device: Nasal Cartilage Tension Gauge

Description: A handheld device with microsensors that measures the tension in nasal cartilage during surgery, assisting surgeons in achieving precise shaping and alignment.

2. Device: Nasal Implant Integration Monitor

Description: An implantable sensor that tracks the integration of nasal implants with surrounding tissues post-surgery, providing real-time data to assess healing progress.

3. Device: Nasal Shape Simulation Software



Description: A computer program that uses patient-specific data to simulate potential rhinoplasty outcomes, allowing surgeons to visualize and refine surgical plans.

#### 4. Device: Nasal Blood Flow Optimizer

Description: A non-invasive device that uses photobiomodulation to enhance blood circulation in nasal tissues, promoting faster healing and reducing downtime.

#### 5. Device: Nasal Scar Elevation Massager

Description: A handheld massager with adjustable vibrations and pressure settings, designed to stimulate scar tissue elevation and promote smoother healing.

#### 6. Device: Nasal Bone Healing Stimulator

Description: An implant that emits targeted electromagnetic fields to accelerate bone healing after rhinoplasty, reducing recovery time and enhancing stability.

#### 7. Device: Nasal Nerve Regeneration Kit

Description: A kit containing bioactive agents and neurostimulation tools that facilitate nerve regeneration in the nasal area post-surgery, restoring sensation.

#### 8. Device: Nasal Soft Tissue Scanner

Description: A portable scanner that captures high-resolution 3D images of nasal soft tissues, aiding surgeons in precise planning for tissue augmentation.

#### 9. Device: Nasal Contour Projection System

Description: A handheld device that uses advanced holographic projection to superimpose the desired nasal contours onto the patient's face during consultations.

#### 10. Device: Nasal Pressure Equalizer

Description: A wearable device that gently applies adjustable pressure to different parts of the nose post-surgery, aiding in even healing and reducing swelling.

#### 11. Device: Nasal Blood Vessel Visualizer

Description: An imaging tool that uses near-infrared light to visualize blood vessels in the nasal area, helping surgeons avoid vascular complications during surgery.

#### 12. Device: Nasal Tissue Regeneration Chamber

Description: An implantable chamber that creates an ideal environment for tissue regeneration, promoting faster healing and minimizing scar formation.

#### 13. Device: Nasal Skin Texture Enhancer

Description: A handheld device that uses microdermabrasion and photon therapy to improve nasal skin texture, enhancing overall aesthetic results after surgery.

#### 14. Device: Nasal Implant Biocompatibility Tester

Description: A device that tests the compatibility of various implant materials with the patient's immune system, ensuring safe and effective augmentation.

#### 15. Device: Nasal Sensory Feedback Implant

Description: An implant that interfaces with nasal nerves, providing sensory feedback to the patient post-surgery and aiding in adaptive healing.

#### 16. Device: Nasal Bone Displacement Simulator

Description: A virtual reality tool that allows surgeons to practice and refine techniques for precise nasal bone displacement, enhancing surgical accuracy.

17. Device: Nasal Scar Camouflage Projector

Description: A handheld projector that emits light patterns to visually camouflage scars during the healing phase, promoting aesthetic outcomes.

18. Device: Nasal Shape Memory Splint

Description: A splint made from shape memory materials that gradually conforms to the new nasal shape, providing support and maintaining desired contours.

19. Device: Nasal Vibration Massage Cushion

Description: A cushion with built-in vibration and heat therapy that patients can sit on to promote tissue healing, reduce discomfort, and enhance recovery.

20. Device: Nasal Augmentation Patch

Description: A bioabsorbable patch infused with growth factors and collagen stimulators, applied post-surgery to enhance nasal augmentation results.

As always, seek professional advice and conduct thorough research before pursuing any patent applications based on these ideas.

Certainly, here are 20 detailed descriptions of novel devices for rhinoplasty that haven't been patented:

1. Device: Nasal 3D Printing System

Description: A precision 3D printer that generates patient-specific nasal implants using biocompatible materials, ensuring optimal fit and aesthetic outcomes.

2. Device: Nasal Holographic Healing Chamber

Description: An enclosed chamber that projects healing-focused holographic images onto the nasal area, accelerating tissue regeneration and reducing scarring.

3. Device: Nasal Augmentation Hydrogel Injection Pen

Description: A handheld pen that injects a specialized hydrogel for non-invasive nasal augmentation, providing customizable results without surgery.

4. Device: Nasal Micro-LED Phototherapy Mask

Description: A wearable mask equipped with micro-LEDs that emit precise wavelengths of light to accelerate healing and reduce post-operative swelling.

5. Device: Nasal Tissue Bioreactor

Description: An implantable bioreactor that supports the growth of patient-specific nasal tissues, enabling grafting and reconstructive procedures with native tissues.

6. Device: Nasal Virtual Reality Training System

Description: A VR system that simulates virtual rhinoplasty procedures, allowing surgeons to practice and refine techniques in a realistic digital environment.

7. Device: Nasal Bone Density Enhancement Bracelet

Description: A wearable bracelet emitting low-intensity vibrations that promote bone density and healing in the nasal area after bone adjustments.

8. Device: Nasal Tissue Elasticity Stimulator

Description: An implantable device that uses electromagnetic stimulation to enhance nasal tissue elasticity, contributing to natural and youthful results.

9. Device: Nasal Scar-Free Closure Clips

Description: Specialized clips that provide tension-free closure of incisions after surgery, reducing tension on the skin and minimizing scar formation.

10. Device: Nasal Implant Material Customizer

Description: A system that allows surgeons to custom-tailor implant materials based on patient-specific factors for safe and harmonious integration.

11. Device: Nasal Augmentation Balloon Inserter

Description: A minimally invasive device that inserts and inflates a specialized balloon for nasal augmentation, gently expanding tissues for natural results.

12. Device: Nasal Sensory Rehabilitation Glove

Description: A sensory glove with integrated haptic feedback that patients wear to aid in the restoration of tactile sensation in the nasal area post-surgery.

13. Device: Nasal Vascular Flow Monitor

Description: An implantable device that continuously monitors nasal blood flow and vascular health, alerting both patients and surgeons to any anomalies.

14. Device: Nasal Contour Haptic Resonator

Description: A handheld device that uses haptic feedback to guide surgeons in achieving precise nasal contours during rhinoplasty procedures.

15. Device: Nasal Scar Reduction Gel Applicator

Description: A handheld device that applies scar-reducing gel with adjustable pressure and controlled distribution, promoting minimal scarring post-surgery.

16. Device: Nasal Bone Fusion Accelerator

Description: A device that emits low-frequency vibrations to stimulate bone fusion and healing after nasal bone adjustments, enhancing stability.

17. Device: Nasal Tissue Cooling System

Description: A non-invasive device that provides controlled cooling to nasal tissues during and after surgery, minimizing inflammation and discomfort.

18. Device: Nasal Aesthetic Projection Mask

Description: A mask that projects the patient's desired nasal aesthetics onto their face, allowing them to assess potential outcomes before surgery.

19. Device: Nasal Implant Biointegration Enhancer

Description: An implant that releases growth factors to enhance biointegration of nasal implants, reducing the risk of rejection and complications.

20. Device: Nasal Shape Adaptive Splint

Description: A splint made from shape-adaptive materials that conform to the patient's evolving nasal shape during the healing process, providing support and stability.

As always, seek professional advice and conduct thorough research before pursuing any patent applications based on these ideas."

**Supplemental Material 4.** Strategies for iterative prompting of ChatGPT.

#### Supplemental Material 4. Strategies for iterative prompting of ChatGPT.

Strategy	Description of Strategy
Initial prompt	<ul style="list-style-type: none"><li>• Give the chatbot a baseline prompt to initiate the idea generation process</li></ul>
Iterative prompt	<ul style="list-style-type: none"><li>• Repeat the same prompt multiple times or provide slight variations with additional context</li><li>• Specific constraints can be provided or a specific industry or technology can be indicated</li><li>• Aim to develop either a broader range or narrow focus depending on the goals of the prompting</li></ul>
Comparative analysis	<ul style="list-style-type: none"><li>• Analyze results to identify patterns, variations, and any new concepts that emerged</li><li>• Compare the results across the iterative prompting schemes to see evolution</li></ul>
Synthesis and selection	<ul style="list-style-type: none"><li>• Chose the most promising ideas</li><li>• Combine elements from various rounds of prompts to create hybrid concepts or refined ideas</li></ul>

#### References

1. Kung TH, Cheatham M, Medenilla A, et al. Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models. *PLOS Digit Health*. Feb 2023;2(2):e0000198. doi:10.1371/journal.pdig.0000198
2. Hopkins BS, Nguyen VN, Dallas J, et al. ChatGPT versus the neurosurgical written boards: a comparative analysis of artificial intelligence/machine learning performance on neurosurgical board-style questions. *J Neurosurg*. Mar 24 2023:1-8. doi:10.3171/2023.2.JNS23419
3. D'Amico RS, White TG, Shah HA, Langer DJ. I asked a ChatGPT to write an editorial about how we can incorporate chatbots into neurosurgical research and patient care. *Neurosurgery*. Apr 1 2023;92(4):663-664. doi:10.1227/neu.0000000000002414
4. Oliver JD, Hu AC, Maan ZN, Hu MS. Innovation in plastic surgery: a call for re-emergence of the surgeon-scientist. *Plast Reconstr Surg*. Apr 2020;145(4):892e. doi:10.1097/PRS.00000000000006694
5. Rohrich RJ, Rosen J, Longaker MT. So you want to be an innovator? *Plast Reconstr Surg*. Nov 1 2021;148(5S):55S-57S. doi:10.1097/01.prs.0000794856.25019.d0
6. Biswas SS. Potential use of ChatGPT in global warming. *Ann Biomed Eng*. Jun 2023;51(6):1126-1127. doi:10.1007/s10439-023-03171-8
7. Rao A, Kim J, Kamineni M, Pang M, Lie W, Succi MD. Evaluating ChatGPT as an adjunct for radiologic decision-making. *medRxiv*. Feb 7 2023. doi:10.1101/2023.02.02.23285399
8. Macdonald C, Adeloye D, Sheikh A, Rudan I. Can ChatGPT draft a research article? An example of population-level vaccine effectiveness analysis. *J Glob Health*. Feb 17 2023;13:01003. doi:10.7189/jogh.13.01003
9. Arif TB, Munaf U, Ul-Haque I. The future of medical education and research: is ChatGPT a blessing or blight in disguise? *Med Educ Online*. Dec 2023;28(1):2181052. doi:10.1080/10872981.2023.2181052
10. Hallock GG. Innovations: a dawning of a new age. *Arch Plast Surg*. Mar 2021;48(2):147-148. doi:10.5999/aps.2021.00255
11. Najafali D, Camacho JM, Reiche E, Galbraith L, Morrison SD, Dorafshar AH. Truth or lies? The pitfalls and limitations of ChatGPT in systematic review creation. *Aesthet Surg J*. Apr 5 2023. doi:10.1093/asj/sjad093
12. Najafali D, Reiche E, Camacho JM, Morrison SD, Dorafshar AH. Let's chat about chatbots: additional thoughts on ChatGPT and its role in plastic surgery along with its ability to perform systematic reviews. *Aesthet Surg J*. Mar 11 2023. doi:10.1093/asj/sjad056
13. Gupta R, Park JB, Bisht C, et al. Expanding cosmetic plastic surgery research using ChatGPT. *Aesthet Surg J*. Mar 21 2023. doi:10.1093/asj/sjad069



14. Gupta R, Pande P, Herzog I, et al. Application of ChatGPT in cosmetic plastic surgery: ally or antagonist. *Aesthet Surg J*. Feb 25 2023. doi:10.1093/asj/sjad042
15. George A, Walsh T. Artificial intelligence is breaking patent law. *Nature*. May 2022;605(7911):616-618. doi:10.1038/d41586-022-01391-x
16. Riskin DJ, Longaker MT, Gertner M, Krummel TM. Innovation in surgery: a historical perspective. *Ann Surg*. Nov 2006;244(5):686-693. doi:10.1097/01.sla.0000242706.91771.ce
17. USPTO. Accessed May 15, 2023. <https://www.uspto.gov/patents/basics/patent-process-overview#step1>
18. Wouters OJ, McKee M, Luyten J. Estimated research and development investment needed to bring a new medicine to market, 2009-2018. *JAMA*. Mar 3 2020;323(9):844-853. doi:10.1001/jama.2020.1166
19. Boms O, Shi Z, Mallipeddi N, et al. Integrating innovation as a core objective in medical training. *Nat Biotechnol*. Mar 2022;40(3):434-437. doi:10.1038/s41587-022-01253-x

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