Article published online: 2022-09-23

Outcomes of Closed versus Open Rhinoplasty: A Systematic Review

Rohun Gupta, BA[1] Jithin John, BS[1] Noopur Ranganathan, BS[1] Rima Stepanian, BS[1] Monik Gupta, BA[2] Justin Hart, DO[3] Farideddin Nossoni, DO[3] Kenneth Shaheen, MD[3] Adam Folbe, MD[4] Kongkrit Chaiyasate, MD[3]

[1] Oakland University William Beaumont School of Medicine, Rochester, Michigan
[2] The University of Toledo Health Science Campus, Toledo, Ohio
[3] Department of Plastic Surgery, Beaumont Health Systems, Royal Oak, Michigan
[4] Department of Otolaryngology, Beaumont Health Systems, Royal Oak, Michigan

Address for correspondence Kongkrit Chaiyasate, MD, Department of Plastic Surgery, Beaumont Health Systems, 3555 W 13 Mile Road, #120 Royal Oak, MI 48073 (e-mail: kongkrit.chaiyasate@beaumont.org).

Arch Plast Surg 2022;49:569–579.

Abstract

Open and closed rhinoplasty are two main approaches to perform nasal modifications. According to current literature, there is no current consensus among plastic surgeons and otolaryngologists on which technique is preferred in terms of aesthetic result, complications, and patient satisfaction. This study uses published research to determine whether open or closed rhinoplasty leads to superior patient outcomes. Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines for systematic reviews were followed and a literature search was conducted in four databases based on our search strategy. Articles were then imported into COVIDENCE where they underwent primary screening and full-text review. Twenty articles were selected in this study after 243 articles were screened. There were 4 case series, 12 retrospective cohort studies, 1 prospective cohort study, 1 case–control, and 2 outcomes research. There were three cosmetic studies, eight functional studies, and nine studies that included both cosmetic and functional components. Sixteen studies utilized both open and closed rhinoplasty and four utilized open rhinoplasty. Both techniques demonstrated high patient and provider satisfaction and no advantage was found between techniques. Based on available studies, we cannot conclude if there is a preference between open or closed rhinoplasty in terms of which technique leads to better patient outcomes. Several studies determined that open rhinoplasty and closed rhinoplasty leads to comparative patient satisfaction. To make outcome reporting more reliable and uniform among studies, authors should look to utilize the Nasal Obstruction and Septoplasty Effectiveness scale and the Rhinoplasty Outcome Evaluation.

Keywords
- rhinoplasty
- cosmetic techniques
- reconstructive surgical procedures
- nasal surgical procedures

received
January 1, 2022
accepted after revision
April 18, 2022

DOI https://doi.org/10.1055/s-0042-1756315.
ISSN 2234-6163.

Thieme Medical Publishers, Inc., 333 Seventh Avenue, 18th Floor, New York, NY 10001, USA

Introduction

Rhinoplasty is a surgical procedure utilized to alter and reconstruct nasal structures for cosmetic and functional purposes.[1] Many patients opt for functional rhinoplasty due to narrow nasal passages, a deviated septum from natural development or trauma, or nasal turbinates causing infection or obstruction. In addition, some patients undergo revision rhinoplasty for congenital defects such as craniosynostosis or cleft lip and palate.[2] On the other hand, patients often seek cosmetic rhinoplasty for aesthetic purposes such as an enlarged dorsal hump, asymmetrical nostrils, or to address a deviated septum. Furthermore, in 2020 it was projected that 352,555 cosmetic rhinoplasties were conducted in the United States by board-certified plastic surgeons, making it the most common plastic surgery procedure conducted.[3]

Open and closed are the two main techniques to perform rhinoplasty. Although both approaches alter bone and cartilage, differences arise with mechanisms by which nasal structures are accessed.[4] Open rhinoplasty relies on two incisions within the nostrils in addition to a transcolumellar incision across the columella to connect the two internal incisions.[5] The transcolumellar incision, which allows surgeons to lift the skin of the nose to visualize the relevant anatomy, differentiates between an open and closed rhinoplasty.[4] Open rhinoplasty offers several advantages for patients. By exposing the underlying nasal anatomy, surgeons are better able to fully examine nasal asymmetry or abnormalities in structures, leading to increased precision.[6] However, some studies have reported that open rhinoplasty may lead to scar formation due to the transcolumellar incision.[4] In addition, there are reports of increased swelling, potentially leading to surgical errors and a need for reoperation.[4] All in all, open rhinoplasty has shown to be advantageous for patients requiring correction from a prior rhinoplasty, dorsal hump removal, and those who require significant changes to the size and shape of their nose.[7,8]

On the other hand, closed rhinoplasty minimizes external scarring and requires less time to perform the procedure in comparison to open rhinoplasty.[9] In addition, studies have determined that the recovery period for closed rhinoplasty is significantly less than that of open rhinoplasty. However, closed rhinoplasty offers limited surgical access and visibility, making it difficult to perform precise modifications and potentially increasing the risk of complications.[10] Closed rhinoplasty has seen popularity in patients looking to undergo minor revisions to the size and shape of their nose or those who require minimal nasal bridge modifications.[11]

Regardless of the chosen method, there are several common risks associated with rhinoplasty such as swelling, skin discoloration, and periorbital hematomas.[12] Some studies have indicated that impairments in olfactory sensation have occurred in patients, with sensation returning within a few days postoperatively.[13,14] A few patients have been found to experience temporary rhinitis leading to nasal discharge, rhinitis sicca, and issues with breathing that are relieved with the use of topical agents.[15] Lastly, infections occur very rarely and are seen in patients who have had an extensive history of nasal trauma or prior nasopulmonary infections.[16]

In the last two decades both open rhinoplasty and closed rhinoplasty have evolved tremendously with the incorporation of different cartilage grafts, sutures, and advancements in surgical technology. According to current literature, there is no current consensus among plastic surgeons and otolaryngologists on which technique is superior in terms of aesthetic result, complications, and patient satisfaction. The use of either technique is based on physician training and preference. The purpose of this study is to evaluate and synthesize published literature to make recommendations on when a specific technique may be preferred to obtain optimal patient outcomes.

Methods

This systematic review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews.[17]

Search Strategies

A search strategy with keyword search terms was built to identify articles pertaining to both open and closed rhinoplasty along with complications and other associated procedural effects. Our search strategy relied on the following keywords: open rhinoplasty, closed rhinoplasty, endonasal rhinoplasty, and complications. The online databases utilized include PubMed, COCHRANE, EMBASE, and CINAHL. There were no restrictions when conducting the search in regards to publication date, study language, or study type.

Study Selection

The identified articles were then imported into the COVIDENCE software, an online application tool used for primary screening and data extraction. Once all duplicates were removed, studies were selected based on our inclusion/exclusion criteria of: publication after the year 2000, English language only, no systematic reviews, and publications which only focused on rhinoplasty were utilized. The studies were selected through title and abstract screening by two independent reviewers (R.S. and N.R.). All conflicts were resolved by a third-party individual (R.G.). Once irrelevant studies had been removed from the study group, the papers underwent full-text review by two independent reviewers (R.S. and N.R.), with a third reviewer resolving any conflicts (R.G.).

Data Extraction

Our data extraction forms recorded authorship, year of publication, procedural details, complications, and other details of the study based upon our inclusion/exclusion criteria. Whenever possible we looked to record the following details:

1. Methods: study type, level of evidence, and sample size.
2. Participants: year of study, sample size, age of participants, gender, and procedural indication.
3. Intervention: technique used, details of the procedure, and follow-up period.

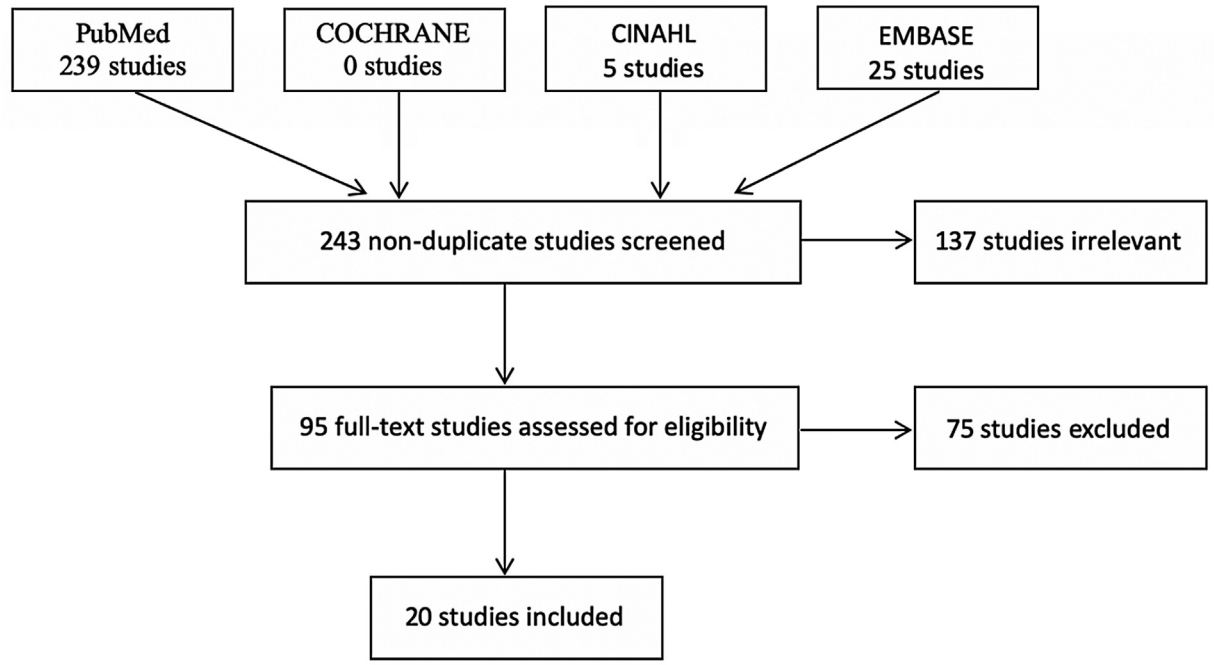

Fig. 1 Study selection based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

4. Outcomes: postprocedural complications, reoperations, aesthetic outcome, patient satisfaction, and long-term complications.

Data Analysis

Our data was synthesized to be presented in an efficient manner in tables and figures. The studies are categorized into three groups based on indication for rhinoplasty: cosmetic, functional, or cosmetic and functional.

Results

The study selection PRISMA flow diagram is shown in ►**Fig. 1**. A total of 269 studies were imported for screening from which 26 duplicates were removed. Two hundred forty-three studies were screened and 137 were screened as irrelevant. One hundred six full-text studies were assessed and 20 papers met our final inclusion/exclusion criteria. Most studies included both open and closed rhinoplasty and identified surgical indications, complications, aesthetic outcome, patient satisfaction, and details of the procedure such as whether or not a preoperative assessment was performed. In addition, many studies had short- and long-term follow-ups, allowing us to identify immediate and delayed surgical complications.

Quality assessment was performed on selected studies (►**Table 1**). We identified 4 case series, 12 retrospective cohort studies, 1 prospective cohort study, 1 case–control, and 2 outcomes research studies. Overall, there were three cosmetic studies, eight functional studies, and nine studies that included both cosmetic and functional components.

In the cosmetic studies, there were a total of 128 patients (89.5%) who underwent open rhinoplasty while 15 patients (10.5%) underwent closed rhinoplasty (►**Table 2**). Of the 143 cases, 10 patients (7.0%) reported complications, all of which underwent open rhinoplasty. Reported complications included nostril-scar contracture, supratip depression, and tip widening. There were 133 patients (93%) who reported no immediate or long-term surgical complications. There were 102 patients that commented on patient satisfaction in regards to aesthetic outcome. Eighty out of 102 patients (78.4%) reported satisfactory results from rhinoplasty although this was not qualified with a formal scale. There were no studies that commented on the functional outcome of the procedures. The follow-up period varied from study to study but there was consistency with a 6-month postoperative follow-up happening in all three studies.

In the functional studies, there were a total of 546 patients (57%) who underwent open rhinoplasty while 411 patients (43%) underwent closed rhinoplasty (►**Table 3**). The study by Reilly and Davison utilized 49 patients but did not discuss how many patients underwent open or closed rhinoplasty.[18] All studies reported performing a preoperative evaluation of patients. While a majority of studies did not report complications, studies that reported complications included nasal tip numbness, columellar scar, slipped dorsal implant, and infection. One study reported that 17 patients experienced postoperative nasal tip numbness, 10 of which were short-term and resolved within 2 weeks. The other seven patients reported long-term nasal tip numbness for up to 8 months, with one patient reporting numbness lasting for over a year. A single study that reported nasal tip numbness in both open and closed rhinoplasty found that there was not a statistically significant association between nasal tip numbness and the type of rhinoplasty that was performed. Lastly, there was one study that failed to report short- or long-term complications. Four studies indicated that there was high patient satisfaction in both open and closed rhinoplasty, with one of

Table 1 Evaluation of quality of included open and closed rhinoplasty studies

Study	Physician specialty	Study design	Level of evidence[a]	Technique (open, closed, or both)	Purpose (cosmetic, functional, or both)	Statistical analysis
Cárdenas-Camarena et al (2002)	Plastic surgery	Retrospective cohort	IIB	Open	Functional	No
Gökçe Kütük and Arıkan (2019)	Otolaryngology	Outcomes research	IIC	Both	Both	Yes
Gruber et al (2007)	Plastic surgery	Retrospective cohort	IIB	Both	Both	No
Han et al (2002)	Plastic surgery	Case series	IV	Open	Cosmetic	No
Jaberoo et al (2016)[19]	Otolaryngology	Retrospective cohort	IIB	Both	Functional	No
Kiliç et al (2015)	Otolaryngology	Retrospective cohort	IIB	Both	Both	Yes
Kim et al (2012)	Plastic surgery	Retrospective cohort	IIB	Both	Functional	Yes
Kirgezen et al (2011)	Otolaryngology	Outcomes research	IIC	Both	Functional	Yes
Metin and Avcu (2021)	Otolaryngology	Retrospective cohort	IIB	Both	Functional	Yes
Motamed et al (2017)	Plastic surgery	Retrospective cohort	IIB	Open	Cosmetic	No
Okur et al (2016)	Plastic surgery	Prospective cohort	IB	Both	Cosmetic	Yes
Ozmen et al (2008)	Plastic surgery	Case series	IV	Both	Both	No
Paul et al (2018)[20]	Plastic surgery	Retrospective cohort	IIB	Both	Both	Yes
Reilly and Davison (2007)	Otolaryngology	Retrospective cohort	IIB	Both	Functional	Yes
Saleh et al (2012)	Otolaryngology	Retrospective cohort	IIB	Both	Both	Yes
Sevin et al (2006)	Plastic surgery	Case series	IV	Open	Both	No
Talmadge et al (2018)	Otolaryngology	Retrospective cohort	IIB	Both	Functional	Yes
Uppal et al (2020)	Plastic surgery	Retrospective cohort	IIB	Both	Both	Yes
Won Kim et al (2002)	Plastic surgery	Case series	IV	Both	Functional	No
Yoon and Kim (2016)	Plastic surgery	Case–control	IIIB	Both	Both	Yes

[a]Oxford Center for Evidence-Based Medicine—level of evidence for the included studies.

these studies utilizing both the Nasal Obstruction Septoplasty Effectiveness (NOSE) score and the Rhinoplasty Outcome Evaluation (ROE) score to report patient outcomes. Two studies demonstrated that both patients and providers were more satisfied with outcomes from open rhinoplasty than that of closed rhinoplasty. Two studies failed to report on functional or aesthetic outcomes in patients. Two studies did not disclose whether a follow-up was done. The majority of studies had follow-ups between 1 and 6 months, with some studies having follow-up periods from as long as 12 to 37 months.

In studies that incorporated both aesthetic and functional components, there were a total of 268 patients (54.3%) that underwent open rhinoplasty and 226 patients (45.7%) that underwent closed rhinoplasty (►**Table 4**). Eight studies utilized both open and closed rhinoplasty while one study performed solely open rhinoplasty. Four studies reported performing a preoperative evaluation while one study did not. Four studies did not indicate whether or not a preoperative assessment was performed. One study reported that there were no complications and five studies failed to describe any short- or long-term complications. From the studies that did report complications, short-term complications included epistaxis, septal perforation, edema, ecchymosis, and some visual disturbances. Long-term complications included nasal shape deformity and an aesthetic narrowing of the middle vault. These complications were seen in both open and closed rhinoplasty. Six studies indicated that there was cosmetic and functional improvement in all studies regardless of approach utilized. Two of these studies utilized the NOSE scale evaluation to obtain these results. One study demonstrated that closed rhinoplasty yielded higher patient satisfaction. Two studies did not mention information in regards to either aesthetic or functional outcome. Follow-up period was not stated in two studies and most studies varied between 1 and 6 months. Some studies followed up to 19 months after surgeries with one study following for up to 64 months.

Case Series

Han et al aimed to assess the aesthetic outcome in an extended incision approach in open rhinoplasty.[21] This technique allowed for further tip projection and the study concluded that the extended incision technique in open rhinoplasty results in higher patient satisfaction and cosmetically appealing results in patients of Asian ancestry.

Table 2 Cosmetic open and closed rhinoplasty studies

Study	Study type	Study period	Number of patients	Age at intervention	Preop assessment	Technique	Complications	Follow-up period	Outcome	Conclusion
Han et al (2002)	Case series	1999–2000	51	18–60	Yes	Open	Nostril-scar contracture (2 patients)	6 months	87.5% of patients were satisfied	The extended incision in open rhinoplasty is safe, reliable, and leads to better aesthetic outcomes
Motamed et al (2017)	Retrospective cohort	2005–2009	62	17–32	Yes	Open	Supratip depression, tip widening	22–72 months	17 patients were pleased while 8 patients were extremely unhappy	Utilization of cephalic dome septal rotation suture in open rhinoplasty is able to maintain optimal position of the nasal tip projection and definition
Okur et al (2016)	Prospective cohort	Not provided	30	17–28	Yes	Both	Not provided	Not provided	Reduced nasal sensation present in patients with both open and closed procedure 1 week after surgery, additional reduced columellar sensation noted only in the open group	Nasal sensation in patients with both open and closed rhinoplasty returned back to normal preoperative sensation 1 month after surgery

Ozmen et al created the upper lateral cartilage fold-in flap technique to prevent potential collapse of the middle vault.[22] In addition, this technique limited internal valve dysfunction when performing dorsal hump reduction during rhinoplasty procedures. With this technique, the authors looked to improve nasal valve integrity and breathing when compared with that of traditional open and closed rhinoplasty techniques. Additionally, they wanted to mitigate issues such as internal nasal valve dysfunction, nasal sidewall asymmetry, and inverted-V deformities that may arise when performing dorsal hump reduction during rhinoplasty. These issues occur primarily when connections between the upper lateral cartilages and the septum are broken.[7,23] Despite expressing an increased exposure afforded in open rhinoplasty with this technique, they noted it can successfully be used in the endonasal approach as well.

Sevin et al performed solely open rhinoplasties, but without the distinctive transcolumellar incision that is the source of the scar associated with the standard approach to the open rhinoplasty.[24] The technique utilized was initially described by Guerrerosantos.[25] They reported high satisfaction in all patients. By recognizing the importance of managing the nasal tip during rhinoplasty, they discussed the benefits of this modified open approach over the classical closed rhinoplasty due to the difficulty associated with attaining similar rotation and projection of the nasal tip.

Won Kim et al contributed to the discussion surrounding how to determine the optimal rhinoplasty approach for treating acute nasal fractures.[26] The researchers grouped fractures based on complexity, which was determined by both clinical and radiologic findings. Next, they devised a novel variation of the endonasal technique utilizing external pins and fluoroscopic imaging for patients with more unfavorable and complex fractures. If these patients were to be treated with the standard closed technique, patients would be more likely to obtain displeasing results with a lasting scar. The study reported having the same effectiveness as the open approach.

Retrospective Cohort

Cárdenas-Camarena et al presents an alternative surgical technique to manage nasal tip augmentation.[27] All nasal tip surgeries were performed with an open approach without transcolumellar incision, allowing for a variety of suture types and variations. Results ultimately proved highly satisfactory, which would be difficult to achieve in a closed technique.

Gruber et al examined the spreader flap technique in primary rhinoplasty.[28] Results concluded that the spreader flap was easy to execute in the open approach, but difficult to perform in the closed approach. Conclusions regarding long-term success of the spreader flap in the closed technique were not obtainable.

Kiliç et al compared edema and ecchymosis in early and late postoperatively after utilization of open versus closed rhinoplasty techniques and types of lateral osteotomy.[29] Results found a statistically significant difference between rate of edema and ecchymosis in early postoperative time

Table 3 Functional open and closed rhinoplasty studies

Study	Study type	Study period	Number of patients	Age at intervention	Preop assessment	Technique	Complications	Follow-up period	Outcome	Conclusion
Cárdenas-Camarena et al (2002)	Retrospective cohort	1999–2001	57	Not stated	Yes	Open	None	Not stated	High patient satisfaction seen in all patients using the open approach technique for the nasal tip without columellar incision	The open technique yields highly satisfactory results with a definition and rotation of the nasal tip which is difficult to achieve using a closed technique
Jaberoo et al (2016)	Retrospective cohort	3 year period, not specified	65	15–67	Yes	Both	Nasal tip numbness, columellar scar, slipped dorsal implant, infection	6–37 months	17 patients total with nasal tip numbness reported, in both the open and closed groups	There is no association between nasal numbness and type of rhinoplasty performed. All patients should be counseled preop on this complication
Kim et al (2012)	Retrospective cohort	2006–2011	356	2–80	Yes	Both	None	Not stated	Patients and physicians were more satisfied with open rather than closed rhinoplasty for nasal bone fracture repair	Open rhinoplasty is more accurate and leads to better patient outcomes in comparison to closed rhinoplasty
Kirgezen et al (2011)	Outcomes research	Not stated	48	18–40	Yes	Both	None	2 and 6 months	Postoperative decrease in nasal muscle strength for some patients, measured experimentally via electroneurography	There is no difference in damage to the nasal mucosal layer between the open and closed techniques
Metin and Avcu (2021)	Retrospective cohort	2015–2019	370	> 18	Yes	Both	None	12 months	Strong correlation between objective results and subjective results (NOSE scores) noted after septorhinoplasty surgery	No difference in postoperative satisfaction related to the type of rhinoplasty performed
Reilly and Davison (2007)	Retrospective cohort	2001–2005	49	Not stated	Yes	Both	None	6 months–5 years	Opening the nasal pyramid in the treatment of acute nasal fractures with associated septal deformity decreased the revision rate from 75.0 to 6.7%	Revision rates can be reduced in patients presenting with acute nasal fractures when an open approach is used at the time of initial repair
Talmadge et al (2018)	Retrospective cohort	2014–2016	50	40–42	Yes	Both	Not stated	Minimum of 1 year	No significant difference found in NOSE scores from patients with open versus endonasal spreader grafts placed	Endonasal spreader graft placement is more cost-effective and has shorter operative times compared to open, so it is the better approach unless open is indicated
Won Kim et al (2002)	Case series	1997–2000	73	19–44	Yes	Both	None	6–17 months	Closed reduction of simple nasal bone fractures with the use of external pins produced outcomes of similar effectiveness to open reduction	Treating nasal bone fractures using a fluoroscopy image intensifier with the application of external pins may be a good alternative to using the open approach

Abbreviation: NOSE, Nasal Obstruction Septoplasty Effectiveness.

Table 4 Functional and cosmetic open and closed rhinoplasty studies

Study	Study type	Study period	Number of patients	Age at intervention	Preop assessment	Technique	Complications	Follow-up period	Outcome	Conclusion
Gökçe Kütük and Arıkan (2019)	Outcomes research	2010–2014	90	Mean: 27.4	Yes	Both	Aesthetically narrow middle vault without significant airway obstruction	1, 3, and 6 months	Favorable postoperative functional and aesthetic outcomes. Higher DAS-24 scores in open vs. closed surgery for at least 3 months after the operation	Improved NOSE, ROE, and DAS-24 scores regardless of the technique (open vs. closed), type (primary vs. revision), and indication (cosmetic vs. functional) of rhinoplasty
Gruber et al (2007)	Retrospective cohort	Not stated	25	18–55	No	Both	Not stated	11–19 months	Spreader flap almost always reconstructed the middle third of the nose with the open rhinoplasty approach. More difficult to execute with a closed approach	Utilization of the spreader flap technique in open rhinoplasty is easier to execute, but conclusions cannot be drawn in regards to the long term success of the spreader flap technique in closed rhinoplasty
Kiliç et al (2015)	Retrospective cohort	2010–2014	120	18–44	Not stated	Both	Edema, ecchymosis, visual disturbances	2 and 7 days	Statistically significant difference in postoperative edema and ecchymosis between endonasal and open approach, endonasal had the better outcome	Closed rhinoplasty should be utilized to prevent the occurrence of edema and ecchymosis in patients
Ozmen et al (2008)	Case series	2004–2007	180	17–63	Not stated	Both	Not stated	2–38 months	Significantly improved nasal breathing in all but nine patients	The upper lateral cartilage fold-in flap rhinoplasty technique for primary rhinoplasty is easier to perform with an open approach
Paul et al (2018)	Retrospective cohort	2007–2016	38	Mean: 37.1 (closed group) and 36.9 (open group)	Yes	Both	Epistaxis, septal perforation, nasal shape deformity	Minimum 4 weeks	Functional improvement in all cases reported using subjective survey data obtained using Nasal Obstruction Symptom Evaluation (NOSE) scale evaluation	The use of the closed rhinoplasty approach with spreader grafting has both objective and subjective functional improvement. It may be a sensible option for repair of nasal valve collapse
Saleh et al (2012)	Retrospective cohort	2004–2009	113	18–91	Not stated	Both	Not stated	11–64 months	No difference between open and closed rhinoplasty patients in postoperative quality-of-life changes, NOSE or ROE scores	Rhinoplasty techniques using modern graft approaches improve quality-of-life in patients compared with traditional techniques

(*Continued*)

Table 4 (*Continued*)

Study	Study type	Study period	Number of patients	Age at intervention	Preop assessment	Technique	Complications	Follow-up period	Outcome	Conclusion
Sevin et al (2006)	Case series	Not stated	23	Not stated	Not stated	Open	None	Not stated	All patients satisfied and satisfactory nasal tip results obtained with open rhinoplasty without transcolumellar incision	Open rhinoplasty without transcolumellar incision technique allows for greater exposure of nasal tip structures than closed approach
Uppal et al (2020)	Retrospective cohort	Not stated	65	22–38	Yes	Both	Not stated	Minimum 7 months	Endonasal approach yielded a better columellar correction and higher reduction in Gunter's distance than open approach	Columella correction can be done satisfactorily with either an open or endonasal rhinoplasty approach
Yoon and Kim (2016)	Case–control	2009–2014	94	Not stated	Yes	Both	Not stated	Not stated	No difference in postoperative satisfaction between patients in open and closed rhinoplasty groups	Closed rhinoplasty is preferred unless there is deviation, exposure, or destruction of the implant, then open technique is necessary

Abbreviations: DAS-24, Derriford Appearance Scale-24; NOSE, Nasal Obstruction Septoplasty Effectiveness; ROE, Rhinoplasty Outcome Evaluation.

between open and closed technique, but no statistical difference in osteotomy. The conclusion drawn from this study reports using the closed technique to prevent edema and ecchymosis, and lateral osteotomy should be based on surgeon experience.

Kim et al examined the best technique for nasal bone reduction.[30] While closed reduction is a common technique, suboptimal results are frequently reported. Results of this study concluded that the indirect open reduction technique results in accurate and satisfactory nasal bone reduction.

Metin and Avcu evaluated the effect of topographic surgical results and functional results of open versus closed septorhinoplasty techniques in regards to patient satisfaction.[29] Results reported functional healing and cosmetic outcomes as factors that contributed to patient satisfaction in septorhinoplasty surgery. Additionally, nasal base and nasal tip were factors of topographical surgical that were imperative to consider.

Motamed et al evaluated outcomes of a new suture technique in rhinoplasty which utilized a cephalic dome septal rotation structure for improved tip definition.[18] Results indicated that the new suture technique maintains the ideal position of the nasal tip projection and definition. The new suture technique also leads to tip definition with slight dorsal tip inclination.

Reilly and Davison measured revision rates required following open and closed repair of nasal fractures.[32] They classified patients into groups based on fracture type and compared the data with respect to whether they performed an open or closed revision of the nasal pyramid. They found reduced revision rates required in patients when the open approach was used.

Saleh et al studied quality-of-life (QoL) in patients after getting rhinoplasty by collecting NOSE and ROE scores.[33] The authors looked to determine if an open or closed technique had influence on QoL differences on the patient surveys they collected. They found no significant difference in QoL scores in patients based on having an open or closed approach done.

Talmadge et al compared outcomes of spreader nasal grafting for open versus closed approach rhinoplasty.[34] They found similar results between the two approaches, but found that the open approach resulted in longer operating room times and thus was more costly. Furthermore, closed spreader nasal grafting may be more cost effective to perform as long as an open approach is not otherwise indicated.

Uppal et al conducted a study to investigate differences in the incidence of columella correction outcomes following open versus closed rhinoplasty.[35] The authors found a higher incidence of columella correction in the closed group compared with that of the open group. However, they acknowledged that sample size between the two groups was a significant limitation. Nevertheless, they reported that their study found a better columella correction was achieved when they used the closed approach.

Prospective Cohort

Okur et al investigated differences in sensation on multiple regions of the nose in patients at various postoperative

stages compared with their preoperative sensation based on whether they underwent open or closed rhinoplasty.[36] Both the open and closed groups had reduced sensation 1 week after surgery. However, the authors found reduced columellar sensation only in the open group that was not present in the closed group. They reported that all sensation differences in both open and closed groups returned to the normal preoperative state by the first month after surgery.

Case–Control

Yoon and Kim investigated postoperative satisfaction differences in patients with (case group) and without (control group) previous rhinoplasty using silicone implants that presented with nasal bone fractures.[37] They found no statistical significance in satisfaction before trauma, before reduction, or after reduction. In addition, the authors did not find a statistically significant difference in reported patient satisfaction between the closed and open reduction methods. They concluded that closed reduction repair is a better approach in patients that had no deviation, exposure, or destruction of the implant noted.

Outcome Research

Gökçe Kütük and Arıkan measured aesthetic and functional outcomes along with psychosocial distress levels in patients undergoing rhinoplasty.[38] The study revealed favorable postoperative aesthetic and functional outcomes and improved psychosocial distress with no difference between open and closed rhinoplasty, primary versus revision type, and cosmetic versus functional indication of rhinoplasty. Results reported significantly improved NOSE, ROE, and Derriford Appearance Scale (DAS-24) scores and concluded that closed rhinoplasty might be preferred due to less psychosocial distress.

Kirgezen et al measured the function of nasal muscles after patients underwent either open or closed rhinoplasty.[39] Results showed no difference in nasal muscular layer injury between open and closed rhinoplasty. Instead, the authors suggested surgical technique, experience, and superficial musculoaponeurotic system are more important to consider when preserving nasal muscle function.

Discussion

This systematic review was an attempt to identify whether the open or closed technique of rhinoplasty leads to better functional or aesthetic outcomes in patients based on trials and studies that have been published. This review of published outcomes in open and closed rhinoplasty yielded a total of 20 studies. Sixteen studies incorporated both open and closed techniques and four techniques focused solely on open rhinoplasty. There were 4 case series, 12 retrospective cohort studies, 1 prospective cohort study, 1 case–control, and 2 outcomes research studies. The limited availability of relevant randomized controlled trials makes it difficult to assign this systematic review as the highest quality of evidence.

Based on our search algorithm and available studies, we cannot conclude if open rhinoplasty or closed rhinoplasty leads to better functional or aesthetic patient outcomes. In studies that looked at the cosmetic result of open and closed rhinoplasty, it was determined that an extended incisional approach and utilization of a cephalic dome septal rotation suture for open rhinoplasty may lead to reliable and better patient results in terms of nasal tip projection and depression. In addition, it was noted that patients often complained of reduced nasal sensation from both open and closed rhinoplasty, but patients with reduced columellar sensation were noted to be only in the open rhinoplasty subgroup. Lastly, the studies found that from a cosmetic approach closed rhinoplasty seemed to lead to minimal scarring, which can be explained by the intranasal incisions that are made when compared with that of the transcolumellar incision in open rhinoplasty.

In studies that looked at the functional aspect in open and closed rhinoplasty, we found the majority of studies found that there was no comparative difference between the type of procedure performed. However, a study by Kim et al established that open rhinoplasty was more accurate and lead to better functional results when compared with that of closed rhinoplasty.[30] Perhaps this finding may be explained by the structures and anatomy that is manipulated in open versus closed rhinoplasty. Although both open and closed rhinoplasty alter the nasal bone and cartilage, the true difference arises due to the transcolumellar incision that is utilized for open rhinoplasty.[5] The transcolumellar incision allows surgeons to lift the skin of the nose to properly visualize and assess the nasal anatomy, which is difficult to do when utilizing closed rhinoplasty.[4] Lastly, beyond being able to better visualize nasal anatomy with the open approach, the technique allows surgeons to be more precise and accurately place complex cartilage grafts. Furthermore, this could be a reason why Reilly and Davison concluded that revision rates may potentially be decreased in patients presenting with acute nasal fractures if an open approach is utilized.[32] Open rhinoplasty would allow surgeons to adequately address structural defects and nasal anatomy at the time of initial repair due to the ability to have full view and access to the nasal structures.

Very few studies that looked at both cosmetic and functional results from open and closed rhinoplasty were able to come to a consensus on which technique was superior. Instead, most of the studies determined that there may be potential indications when a certain technique should be utilized over the other. For instance, Kiliç et al found that closed rhinoplasty should be used in cases where edema and ecchymosis must be prevented.[29] Yoon and Kim determined that closed rhinoplasty is a favorable technique to utilize in most patients unless there is significant deviation, destruction, or exposure of nasal anatomy, which would require the open approach to lead to better patient outcomes.[37] Lastly, the differences in clinical indications for repair or surgery, surgeon technique, skill, and postoperative evaluation and complications add to the difficulty of coming to a consensus on which technique should be utilized for patient outcomes.

There are several limitations of this review that must be taken into account. Primarily, it is difficult to evaluate for

patient satisfaction, cosmetic results, and functional results in the majority of these studies. Most papers failed to utilize a patient satisfaction score such as the NOSE scale and the ROE. As a result, it is incredibly difficult to form scientifically valid conclusions on which technique is more likely to lead to superior outcomes. To combat this issue, quality assessment methods need to be standardized and operation definitions regarding quality items needs to be explicitly provided. In addition, most providers in the gathered studies typically utilize either open rhinoplasty or closed rhinoplasty. There are limited clinicians who have mastered both open and closed rhinoplasty, which makes comparing study results difficult. Thus, it is important to take into account that surgical skill bias exists and must be a factor that cannot be excluded in this study. Lastly, our literature search and data extraction yielded few studies that looked at the cosmetic findings of both open and closed rhinoplasty, making it difficult to properly assess the capabilities of the two approaches to lead to adequate patient satisfaction and surgical outcome.

Conclusion

Rhinoplasty is an extremely complicated technique that requires intensive physician training and skill. The life-long learning curve means that optimal patient outcomes are embedded not in the technique but rather on the skillset of the surgeon. Furthermore, to make outcome reporting more reliable and uniform among studies, authors should look to utilize the NOSE scale and the ROE. This study seeks to establish a novel standard for how to assess the benefits between open and closed rhinoplasty based on NOSE and ROE evaluations.

Disclosure

The authors have no financial interests in relation to the content of the article.

Ethical Approval

Institutional review board approval as well as patient consent were not required for this study.

Authors' Contributions

Conceptualization: R.G., J.J., N.R., R.S., M.G., J.H., F.N., K.S., A.F., K.C. Funding acquisition: None required. Methodology: R.G., J.J. Writing original draft: R.G., J.J., N.R., R.S., M.G., J.H., F.N., K.S., A.F., K.C. Writing - review & editing: R.G., J.J., K.S., A.F., K.C.

Funding

None.

Conflict of Interest

None declared.

References

1 Gowen L, Mawr B. Two types of rhinoplasty explained – cosmetic vs functional. July 23, 2019. Accessed November 25, 2021 at: https://www.plasticsurgery.org/news/blog/two-types-of-rhinoplasty-explained-cosmetic-vs-functional
2 O'Hara J, Ruggiero F, Wilson L, et al. Syndromic craniosynostosis: complexities of clinical care. Mol Syndromol 2019;10(1-2):83–97
3 2020 Plastic Surgery Statistics. Updated April 21, 2021. Accessed November 25, 2021, at: https://www.plasticsurgery.org/news/plastic-surgery-statistics
4 Tasman AJ. Rhinoplasty - indications and techniques. GMS Curr Top Otorhinolaryngol Head Neck Surg 2007;6:Doc09
5 Rohrich RJ, Afrooz PN. Primary open rhinoplasty. Plast Reconstr Surg 2019;144(01):102e–117e
6 Momeni A, Gruber RP. Primary open rhinoplasty. Aesthet Surg J 2016;36(09):983–992
7 Rohrich RJ, Muzaffar AR, Janis JE. Component dorsal hump reduction: the importance of maintaining dorsal aesthetic lines in rhinoplasty. Plast Reconstr Surg 2004;114(05):1298–1308, discussion 1309–1312
8 Gunter JP, Rohrich RJ. External approach for secondary rhinoplasty. Plast Reconstr Surg 1987;80(02):161–174
9 Jayarajan R, Natarajan A, Nagamuttu R. Outcomes of closed versus open technique of rhinoplasty during primary repair of unilateral cleft lip: a systematic review. Cleft Palate Craniofac J 2019;56(01):74–83
10 Fichman M, Piedra Buena IT. Rhinoplasty. In: StatPearls. Treasure Island, FL: StatPearls Publishing June 29, 2021
11 Tebbetts JB. Open and closed rhinoplasty (minus the "versus"): analyzing processes. Aesthet Surg J 2006;26(04):456–459
12 Schreiber JE, Marcus E, Tepper O, Layke J. Discovering the true resolution of postoperative swelling after rhinoplasty using 3-dimensional photographic assessment. Plast Reconstr Surg Glob Open 2019;7(08):11–12
13 Shemshadi H, Azimian M, Onsori MA, Azizabadi Farahani M. Olfactory function following open rhinoplasty: a 6-month follow-up study. BMC Ear Nose Throat Disord 2008;8:6
14 Dengiz R, Haytoğlu S, Görgülü O, Doğru M, Arıkan OK. Effect of septorhinoplasty on olfactory function: assessment using the brief smell identification test. Turk Arch Otorhinolaryngol 2015;53(01):4–9
15 Toriumi DM, Kowalczyk DM, Cristel RT, et al. Evaluation of postoperative infection rates in 3084 rhinoplasty cases using antibiotic soaks and/or irrigations. Facial Plast Surg Aesthet Med 2021;23(05):368–374
16 Rettinger G. Risks and complications in rhinoplasty. GMS Curr Top Otorhinolaryngol Head Neck Surg 2007;6:Doc08
17 Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372(71):n71
18 Motamed S, Otaghvar HA, Niazi F, Moosavizadeh SM, Motaghedi B, Tizmaghz A. Introducing a favourite tip definition and projection with tripod suture in rhinoplasty. J Clin Diagn Res 2017;11(01):PC05–PC07
19 Jaberoo MC, De Zoysa N, Mehta N, et al. A twin-center study of nasal tip numbness following septorhinoplasty or rhinoplasty. Ear Nose Throat J 2016;95(02):E18–E21
20 Paul MA, Kamali P, Chen AD, et al. Assessment of functional rhinoplasty with spreader grafting using acoustic rhinomanometry and validated outcome measurements. Plast Reconstr Surg Glob Open 2018;6(03):e1615
21 Han SK, Woo HS, Kim WK. Extended incision in open-approach rhinoplasty for Asians. Plast Reconstr Surg 2002;109(06):2087–2096
22 Ozmen S, Ayhan S, Findikcioglu K, Kandal S, Atabay K. Upper lateral cartilage fold-in flap: a combined spreader and/or splay graft effect without cartilage grafts. Ann Plast Surg 2008;61(05):527–532
23 Howard BK, Rohrich RJ. Understanding the nasal airway: principles and practice. Plast Reconstr Surg 2002;109(03):1128–1146, quiz 1145–1146
24 Sevin A, Sevin K, Erdogan B, Deren O, Adanali G. Open rhinoplasty without transcolumellar incision. Ann Plast Surg 2006;57(03):252–254

25 Guerrerosantos J. Open rhinoplasty without skin-columella incision. Plast Reconstr Surg 1990;85(06):955–960
26 Won Kim S, Pio Hong J, Kee Min W, Wan Seo D, Kyu Chung Y. Accurate, firm stabilization using external pins: a proposal for closed reduction of unfavorable nasal bone fractures and their simple classification. Plast Reconstr Surg 2002;110(05):1240–1246, discussion 1247–1248
27 Cárdenas-Camarena L, Guerrero MT. Improving nasal tip projection and definition using interdomal sutures and open approach without transcolumellar incision. Aesthetic Plast Surg 2002;26(03):161–166
28 Gruber RP, Park E, Newman J, Berkowitz L, Oneal R. The spreader flap in primary rhinoplasty. Plast Reconstr Surg 2007;119(06):1903–1910
29 Kiliç C, Tuncel Ü, Cömert E, Şencan Z. Effect of the rhinoplasty technique and lateral osteotomy on periorbital edema and ecchymosis. J Craniofac Surg 2015;26(05):e430–e433
30 Kim HS, Suh HW, Ha KY, Kim BY, Kim TY. The usefulness of the endonasal incisional approach for the treatment of nasal bone fracture. Arch Plast Surg 2012;39(03):209–215
31 Metin M, Avcu M. The effect on patient satisfaction of the postoperative nasal topographic, demographic, and functional results of open and closed septorhinoplasty techniques. J Craniofac Surg 2021;32(03):868–873
32 Reilly MJ, Davison SP. Open vs closed approach to the nasal pyramid for fracture reduction. Arch Facial Plast Surg 2007;9(02):82–86
33 Saleh AM, Younes A, Friedman O. Cosmetics and function: quality-of-life changes after rhinoplasty surgery. Laryngoscope 2012;122(02):254–259
34 Talmadge J, High R, Heckman WW. Comparative outcomes in functional rhinoplasty with open vs endonasal spreader graft placement. Ann Plast Surg 2018;80(05):468–471
35 Uppal R, Yousif AH, Maheshwari K. Outcome-based comparative study to examine the correction of columella deformities following rhinoplasty. Plast Reconstr Surg Glob Open 2020;8(07):e3001
36 Okur Mİ, Gökdemir O, Karasu N, Yildirim AM. Comparison of nasal senses following open and closed rhinoplasty. Turk J Med Sci 2016;46(02):287–290
37 Yoon T, Kim Y. Postoperative satisfaction in nasal bone fracture patients who had rhinoplasty. J Craniofac Surg 2016;27(07):1707–1710
38 Gökçe Kütük S, Arıkan OK. Evaluation of the effects of open and closed rhinoplasty on the psychosocial stress level and quality of life of rhinoplasty patients. J Plast Reconstr Aesthet Surg 2019;72(08):1347–1354
39 Kirgezen T, Yigit O, Taskin U, Cakir ZA, Adatepe T. Electromyographic and electroneurographic changes in internal nasal muscles after endonasal and external rhinoplasty. Aesthet Surg J 2011;31(03):297–301

