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EC MICROBIOLOGY
Review Article

Advances in Rhinoplasty

Mohammed Attallah Alharbi[1]*, Mebsam Hassan Alzayer[2], Abdulaziz Mesfer Alotaibi[3], Ahmed Bakor Abdulkreem[4], Laila Naif Alotaibi[5], Abdulelah Saleh Alhabib[6], Aishah Nabil Azam[7], Yousef Ali Alghamdi[8], Mohammed Saeed Kadasah[9], Khalid Basim Harakah[10] and Ali Abduljabbar Alkhawaja[11]

[1]Consultant of Plastic Surgery, Head of Plastic Surgery, King Abdullah Medical City, Makkah, Saudi Arabia

[2]Khafji General Hospital, Khafji, Saudi Arabia

[3]Shaqra University, Shaqra, Saudi Arabia

[4]Yanbu Royal Commission Medical Center, Yanbu, Saudi Arabia

[5]King Saud Medical City, Riyadh, Saudi Arabia

[6]King Saud University, Riyadh, Saudi Arabia

[7]Tibah University, Al Madinah, Saudi Arabia

[8]Saudi Red Crecent Authority, Jeddah, Saudi Arabia

[9]King Fahad Medical City, Riyadh, Saudi Arabia

[10]Umm Al-Qura University, Makkah, Saudi Arabia

[11]Dammam Medical Complex, Dammam, Saudi Arabia

***Corresponding Author**: Mohammed Attallah Alharbim, Consultant of Plastic Surgery, Head of Plastic Surgery, King Abdullah Medical City, Makkah, Saudi Arabia.

Received: August 17, 2019; **Published:** August 22, 2019

Abstract

Introduction: During the modern eras of rhinoplasty, the invention of external rhinoplasty was supported by many researchers but was also opposed by others. Throughout time, nevertheless, the tenor of this controversy has become increasingly ecumenical.

Aim of Work: In this review article the anatomy, the incisions, and the different approaches that are available to surgeons will be reviewed.

Methodology: We did a systematic search for recent advances in rhinoplasty using PubMed search engine and Google Scholar search engine.

Conclusions: When considering the decision-making of choosing the most appropriate approach, much could be acquired when taking into consideration the previous experiences of other surgeons who had an opportunity to see the results of these surgeries over a long period of time. The important philosophic concept is not in fact either open surgery or closed surgery, but actually, the focus on structural diagnosis while preserving the supportive structures.

Keywords: *Rhinoplasty; ENT; Surgery; Nose*

Introduction

During the modern eras of rhinoplasty, the invention of external rhinoplasty was supported by many researchers but was also opposed by others. Throughout time, nevertheless, the tenor of this controversy has become increasingly ecumenical. Most physicians now know

the wide range of uses for both endo-nasal and extra-nasal approaches. Most of them also understand that there are many cases where a certain approach will give more advantages and might be thought to be the best. In addition, most physicians also think that there is a significant "gray area" where neither the endo-nasal approach nor the extra-nasal approach would be considered suitable for use, and the choice among different approaches might be thought to become a toss-up. Most physicians already acknowledge the fact that the surgeon's comfort with a certain approach is a significantly important issue to always keep in mind. In this review article the anatomy, the incisions, and the different approaches that are available to surgeons will be reviewed.

Methodology

We did a systematic search for recent advances in rhinoplasty using PubMed search engine (http://www.ncbi.nlm.nih.gov/) and Google Scholar search engine (https://scholar.google.com). All relevant studies were retrieved and discussed.

We only included full articles in English.

The terms used in the search were: rhinoplasty, ENT, surgery, nose.

Anatomy, incisions, and approaches

Nasal anatomy

Despite the fact that the structure of the nose has been well-understood for a long time, it was recently when has there been a good understanding of the long-term impact that follows significant surgical alterations on the nasal functions and nose appearance. A thorough understanding of the nasal structure is considered to be crucial to be able to perform a successful rhinoplasty operation. In fact, an accurate evaluation of the structural differences that are presented by a patient will allow the surgeon to create a rational realistic plan for surgery. In addition, detecting differences in the nasal structure is considered to be crucial for the prevention of developing any dysfunctions or any complications.

Keystone area: Is the area where the upper lateral cartilages overlap with the nasal bones.

Scroll area: Is the area of the cephalic margin of the lateral crus that overlies the upper lateral cartilage.

Incisions and approaches

Incisions are considered to be the main methods of getting the access into the bony nasal structures and cartilaginous structures. Incisions include the trans-cartilaginous incisions, the inter-cartilaginous incisions, the marginal incisions, and the trans-columellar incision. Different approaches give surgical exposures of the nasal anatomy including the nasal tip and the nasal dorsum. The most important rhinoplasty approaches are the cartilage-splitting approach (which uses the trans-cartilaginous incision), the retrograde approach (which uses the inter-cartilaginous incision along with the retrograde dissection), the delivery approach (which uses the inter-cartilaginous one marginal incisions), and the external approach (which uses the trans-columellar and the marginal incisions). According to the results of an analysis of individual patient's nasal structure, the best incisions, approaches, and techniques might be selected by the surgeon [1]. Apart from these incisions and the approaches which are selected, the surgical dissection itself should be done within the proper areolar tissue planes to decrease tissue injury and the resulting scarring, keep hemostasis in its normal values, and increase the red-raping of the skin-soft tissue envelope. Performing dissection within good tissue planes is important to aid in preserving the vascular structures of the flap, insure the viability of the flap, and decrease the development of bleeding, post-operative edema, and scarring.

The indications for endo-nasal versus external approach

An operative protocol usually gives a beneficial initial point in determining the incisions, the approaches, and the techniques that are used during a nasal tip surgery. Within every case, the patient's nasal structure helps determining the selection of the better technique. As the structural deformity becomes more abnormal, a gradual approach is important. On the other hand, other factors, including the need

for the use of spreader grafts, complex nasal deviation, surgeon's preference, and other factors might also significantly impact the final selection of each certain approach [2].

Tip support mechanisms, incisions, and approaches

The major tip support mechanisms include:

- Length and strength of lower lateral cartilages
- Attachment of cephalic margin of lateral crura with caudal margin of upper lateral crura
- Attachment of medial crura to caudal septum.

There minor tip support mechanisms include:

- Interdomal ligament between lower lateral cartilages
- Sesamoid complex
- Soft tissue skin envelope and its attachment to lower lateral cartilage
- Anterior nasal spine
- Cartilaginous septal dorsum
- Membranous septum.

Incisions: methods of gaining access

Generally, the endo-nasal approach is considered to be preferred to be used among patients who require conservative profile reduction, conservative tip modification, specific revision rhinoplasty patients, and/or other cases where conservative modifications are being done. The advantages of using less invasive protocols include the less resulting dissection, the less resulting edema, and the less resulting healing. On the other hand, less invasive protocols achieve by definition less exposure that in many cases might be considered to be a significant disadvantage [3]. On the other hand, extra-nasal rhinoplasty approaches are indicated in many cases including the presence of asymmetrical tip of the nose, the presence of a crooked nose deformity (within the nasal lower two-thirds), the presence of a saddle nose deformity, the presence of a cleft-lip nasal deformity, the presence of a secondary rhinoplasty that requires a complex structural grafting, and/or a septal perforation repair. Other indications usually include the presence of complex deformity of the tip of the nose, the presence of a deformity of the middle nasal vault, and specific nasal neoplasms [3].

Many practicing surgeons prefer the use of the open approach in cases of relatively less complex deformities of the nasal tip because of the precision that they assume it will offer to them when compared with the other endo-nasal approach. Main advantages of the extra-nasal approach usually include the presence of the maximum possible exposure during the operation, the possibility for the surgeon to have a more accurate structural diagnosis. The extra-nasal approach also gives the opportunity for surgeons for precise manipulation of the tissues along with accurate tissue suturing, and grafting. On the other hand, disadvantages of this approach cab include the use of trans-columellar incision, which is a wide field dissection that causes significant loss of support, and higher rates of edema of the nasal tip [4].

Apart from the approach that is used, surgeons should always take into consideration the necessity to have sufficient support of anatomical structures. When the used surgical approach disrupts the support of the tip, the use countermeasures, like placing a columellar strut, becomes a requirement. When the upper lateral cartilages support is disrupted, the use of spreader grafts might be a good option [5].

External and endonasal approaches to the upper third

The bony pyramid of the nose could be significantly decreased, moved, or increased using a completely closed approach. On the other hand, in their report Larrabee et al, concluded that the use of a closed approach has been considered to be reliable for demonstrating

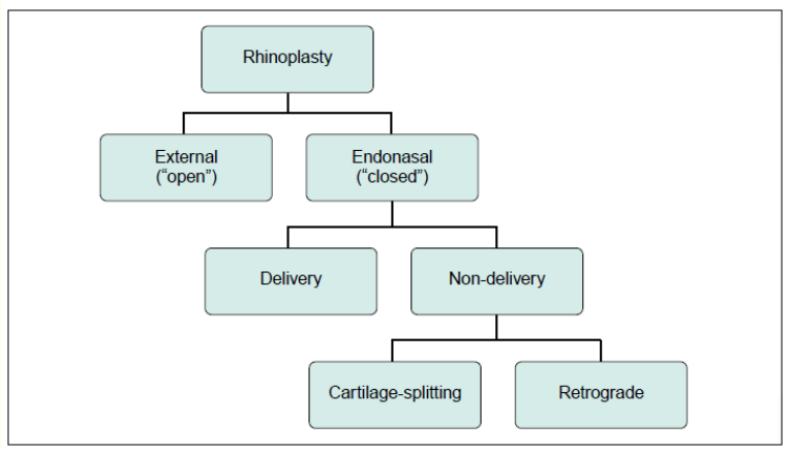

Figure 1: *Surgical approaches for rhinoplasty.*

most bony profile deformities. Nevertheless, they suggest that when performing an open rhinoplasty, sometimes a hump reduction under direct visualization could be used [4,6].

External and endonasal approaches to the middle nasal vault

Determining the need for spreader grafts or spreader flaps might have a significant role during the determination on to whether the open approach is going to be used or not, even in cases where the tip of the nose can be sufficiently addressed using endo-nasal approaches. Modern rhinoplasty techniques usually focus on the preservation of cartilaginous substructures along with bony substructures. Preserving these cartilaginous substructures and bony substructure is of special significance within the middle nasal vault, as this support preservation of the upper lateral cartilages will help avoid the collapse of the middle vault and the linked internal nasal valve. Middle vault collapse and nasal valve collapse could result in over-narrowing of the nasal middle third, as well as the inverted V deformity and nasal obstruction. When the support and the contour of the middle vault need reconstitution, spreader grafts or spreader flaps could be utilized. The use of either spreader grafts or spreader flaps in primary rhinoplasty is becoming increasingly frequent [7]. They could potentially be effective for the maintenance the contour of the middle vaults following hump reduction. Despite that it might be generally more convenient to place the spreader grafts and spreader flaps using an external approach, they could also be placed using an endonasal approach.

Narrowing of the middle vault of the nose can occur in cases where the T configuration of the nasal septum is resected along with the dorsal hump removal and might cause significant problems in patients who have high-risk.10 Spreader grafts and flaps both work as a spacer between the septum and the upper lateral cartilage, to prevent excessive narrowing among high-risk patients or to recover an over-narrow middle vault when it's present. As Sheen et al, previously described [8], unilateral sub-mucoperichondrial tunnels or bilateral sub-mucoperichondrial tunnels could be prepared by the elevation of the muco-perichondrium bridging the upper lateral cartilages to the septum. The space between the upper lateral cartilage and septum could be easily filled with a cartilage strip that is insinuated and secured using suture-fixation into the existing pocket, lateralizing, therefore, the upper lateral cartilages and improving the airway by significantly recovering or even widening the width of the middle nasal vault.

Spreader grafts and spreader flaps can be comfortably used during both external and endonasal techniques. In more complex reconstructions, specifically complicated by multiple abnormalities, an extra-nasal rhinoplasty approach might facilitate precise dissection and graft suture fixation. Some physicians consider the external approach to be easily a technically simpler method that undertakes the

spreader graft or spreader flap placement. It must be also considered that using an external rhinoplasty approach might result in a higher need for a spreader graft or a spreader flap to maintain the nasal valve and the middle nasal width that might become at risk because of the loss of support to the upper lateral cartilages that is caused by more extensive skin undermining. Determining high-risk patients during initial preoperative analysis is considered to be crucial for maintaining the excessive narrowing of the middle nasal vault along with the internal nasal valve collapse (2). In their study, Sheen., *et al*. [8] detected a structural variant which they called the narrow nose syndrome. As demonstrated by Toriumi., *et al*. [9] frequently used surgical techniques could cause the loss of support of the middle vault. A large en-bloc hump excision must be avoided, as the nasal septum T-shaped support is removed and the intra-nasal mucosa (that gives significant support to the upper lateral cartilage) is at a significantly high risk of damage. The cephalic trim (volume reduction) of the lateral crura causes disruption of the scroll recurvature and freeing of the upper lateral cartilage caudal margin. The lateral osteotomies might additionally medialize the upper lateral cartilages. The upper lateral cartilages could fall toward the narrowed dorsal septal edge, creating a significant middle vault and an internal valvular collapse [9].

Middle vault collapses might emphasize the caudal edges of the nasal bones to create the characteristic inverted V disruption [9]. In most cases, combining these maneuvers would not cause the development of complications; nevertheless, among patients with high-risk, this combination of different techniques might cause excessive narrowing of the middle vault along with a collapse of the internal valve. Therefore, significant experience is needed to be able to develop a reliable surgical judgment concerning the better use of spreader grafts and spreader flaps. Following spreader grafts or spreader flaps securing in position internally or using an open approach, the middle vault might look mildly wide. As time passes, this area of the nose will tend to narrow as edema will resolve and the scar contracture will pull the upper lateral cartilages medially [9].

Extra-nasal approaches and endo-nasal approaches to the nasal tip

Traditional tip rhinoplasty techniques, like the cephalic trim and the dome binding sutures, have been well studies for the use in both extra-nasal rhinoplasty and endo-nasal rhinoplasty. Advanced nasal tip procedures, like the lateral crural strut grafts, the lateral or the intermediate crural overlay techniques, and “tongue-in-groove” retro-displacement of the medial crura onto the caudal septum, might also be performed via either approach. For some of these nasal tip approaches, the individual physician might consider the exposure afforded by the open approach to be preferred [10].

Extra-nasal and endonasal approaches to revision rhinoplasty

During revision surgery, once the nose is opened, any supportive association which is present between the scar tissue and the underlying structures will be lost, and the cartilage grafting might be needed to support and contour the skin–soft tissue envelope which will now undergo renewed scar contracture and healing. If not, the healing and scar contracture might leave a worse deformity than previous to surgery. Thus, in revision surgeries with relatively slight abnormalities or those which could be recovered using accurate pocket grafting, a closed technique is usually preferred. Spreader grafts, batten grafts, and onlay grafts are all considered to be examples of maneuvers that could be well-placed using precise pocket, endo-nasal techniques [7]. Despite that endo-nasal surgery can be a reliable option for a significant proportion of revision cases, an open surgery might be unavoidable in complex revision cases.

Endonasal and extra-nasal approaches to the deviated caudal septum

In cases of severe caudal septal deviation, the open approach might give a more facile and efficacious approach, when swinging door, doorstop, and other similar approaches have already failed [11]. Despite that many techniques to address cases of severe caudal deviation could be performed using both open approaches or closed approaches, the advantages and disadvantages of each specific approach should be well-compared to detect the most appropriate approach. To a certain extent, this is mainly a personal judgment by the surgeon, who is usually guided by critical self-assessment.

Philosophic considerations-a graduated approach: the big picture

When considering the decision-making of the choice of the most appropriate approach, much could be acquired when taking into consideration the previous experiences of other surgeons who had an opportunity to see the consequences of these surgeries over long

time. The important philosophic concept is not in fact either open surgery or closed surgery, but actually, the focus on structural diagnosis with preserving the supportive structures. A main tenet of rhinoplasty decision-making is the understanding of a gradual approach. This concept is mainly based on the idea that achieving the wanted targets with the least surgical dissection will give the highest chance of succeeding. On the other hand, an important issue here is how much exposure is actually required to achieve reliable execution of any certain technical approach. Adamson., *et al*. [12] has demonstrated that there is not a single ideal surgical technique, and in fact, every surgeon must develop a special approach that is based on the concepts outlined and the techniques and experiences they have created during the course of their eclectic training. An experienced surgeon will be able to make intra-operative structural diagnosis using whether the endo-nasal approach or the extra-nasal approach. Taking this into consideration, an essential factor that could potentially affect outcomes is the possible challenge in diagnosing different deformities and abnormalities using the endonasal approach. Another important factor is the manual difficulty while correcting these deformities once diagnosed, specifically impacting such maneuvers as vertical cartilage divisions, graft placement, and suturing approaches. Surgeons who are trained to perform the closed approach will usually tend to do most of their rhinoplasty surgeries using this approach, maintaining the open approach for relatively more challenging cases. This evaluation can vary among different surgeons.

Perkins., *et al*. [13] demonstrated an improvement in their clinical philosophy that reflected many issues involved in the decision-making process and provided significant insight into the improvements of the decision-making that occurred over the two decades. Despite that the concept of a gradual approach to achieve a pleasing esthetic outcome has been foremost in his philosophy, the improving necessity to achieve more refined outcomes and avoid the development of long-term complications has caused an increased use of the open technique that allows the opportunity to use certain grafting techniques. Perkins., *et al*. continued to strongly recommend that the approach which is selected must give the least intervention in the shortest term to provide satisfactory outcomes and achieve the patient's targets. Nevertheless, they suggest that the choice of must change based also on the probability of developing long-term complications.

Conclusions

Most physicians think that there is a significant "gray area," where neither the endo-nasal approach nor the extra-nasal approach will be considered to be suitable for use, and the choice among different approaches might be thought to become a toss-up. Most physicians already acknowledge the fact that the surgeon's comfort with a certain approach is a significantly important factor to always keep in mind. When considering the decision-making of the choice of the most appropriate approach, much could be acquired when taking into consideration the previous experiences of other surgeons who had an opportunity to see the consequences of these surgeries over long time. The important philosophic concept is not in fact either open surgery or closed surgery, but actually, the focus on structural diagnosis with preserving the supportive structures. The method used should be based on the patient's problem, the goals for surgery, and the surgeon's skill in a given technique.

Bibliography

1. Tardy ME and Toriumi DM. "Philosophy and principles of rhinoplasty". 2nd edition. In: Cummings. Chapter 31 in otolaryngology-head and neck surgery. Philadelphia: Saunders (2001): 278-274.
2. Tardy ME. "Rhinoplasty: the art and the science". Philadelphia: W.B. Saunders (1997).
3. Becker DG. "Open and closed rhinoplasty". Philadelphia: SCR Publishers (2012).
4. Becker DG. "The powered rasp: advanced instrumentation for rhinoplasty". *Archives of Facial Plastic Surgery* 4.4 (2002): 267-268.
5. Gunter JP. "The merits of the open approach in rhinoplasty". *Plastic and Reconstructive Surgery* 99.3 (1997): 863-867.
6. Larrabee WF. "Open rhinoplasty and the upper third of the nose". *Facial Plastic Surgery Clinics of North America* 1.1 (1993): 23-38.

7. Wise JB., *et al*. "Intermediate crural overlay in rhinoplasty: a deprojection technique that shortens the medial leg of the tripod without lengthening the nose". *Archives of Facial Plastic Surgery* 8.4 (2006): 240-244.

8. Sheen JH. "Spreader graft: a method of reconstructing the roof of the middle nasal vault following rhinoplasty". *Plastic and Reconstructive Surgery* 73.2 (1984): 230-237.

9. Toriumi DM. "Management of the middle nasal vault". *Operative Techniques in Plastic and Reconstructive Surgery* 2.1 (1995): 16-30.

10. Soliemanzadeh P and Kridel RWH. "Nasal tip overprojection: algorithm of surgical deprojection techniques and introduction to medial crural overlay". *Archives of Facial Plastic Surgery* 7.6 (2005): 374-380.

11. Pastorek NJ and Becker DG. "Treating the caudal septal deflection". *Archives of Facial Plastic Surgery* 2.3 (2000): 217-220.

12. Adamson PA. "Nasal tip surgery in open rhinoplasty". *Facial Plastic Surgery Clinics of North America* 1.1 (1993): 39-52.

13. Perkins SW. "The evolution of the combined use of endonasal and external columellar approaches to rhinoplasty". *Facial Plastic Surgery Clinics of North America* 12.1 (2004): 35-50.

Volume 15 Issue 9 September 2019