Autologous Fat Injection for Augmentation Rhinoplasty: A Systematic Review

Seied Omid Keyhan, DDS, OMFS¹; Shaqayeq Ramezanzade, DDS*²; Behnam Bohlouli³, Hamid Reza Fallahi, DDS, OMFS⁴; Sanaz Mirzahoseini, PhD⁵; Foad Nahai, MD, FACS⁶

1- Delegate researcher in CMFRC, National Advance for Craniomaxillofacial reconstruction, Tehran, Iran.
2- Private dental practice, Isfahan, Iran.
3- Oral and Maxillofacial Surgery, University of Toronto, Toronto, Canada.
4- Private practitioner, Ahvaz, Iran.
5- Department of Biomedical Engineering, Central Tehran Branch, Islamic Azad University, Tehran, Iran.
6- Adjunct professor, Emory University, Atlanta, GA

*Corresponding Author:

Shaqayeq Ramezanzade, DDS; Private dental practice, Isfahan, Iran.

Yousef abad, Mouj Street, Tehran, Iran.

Tel: 989219024795

Email: shaqayeq.ramezanzade@gmail.com
Disclosures: The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

Funding: The authors received no financial support for the research, authorship, and publication of this article.
ABSTRACT

Background: Autologous fat has become more frequently used for nasal volume augmentation and nasal correction. Nasal lipofilling refers to the use of injectable autologous fat grafts for nonsurgical aesthetic corrections.

Objectives: This systematic review aims to assess the satisfaction, complication, and retention rates of fat injection in nasal shape corrections.

Methods: We searched PubMed/Medline, and Google Scholar up to and including October 2020 with no time and language restrictions for pertinent materials. The reference list of included studies were also hand searched for potential studies. Two authors conducted a duplicate searching process independently to determine proper materials based on the inclusion and exclusion criteria. One author retrieved the following data from the finally included studies based on a predefined checklist worksheet and two authors supervised the accuracy.

Results: The included studies report data from a total of 564 patients undergoing nasal fat injection in 12 studies. The mean score in our included materials was 6.08 with a range of 4 to 7 scores. In most of our included materials, no complication was reported for the peri/postsurgical period. Although some papers reported manageable complications such as: an insufficient volume or decreased volume by resorption, tip excess and supra-tip fillness, and mild displacement. More than half of our included materials reported on patient satisfaction with aesthetic results of fat injection. The satisfaction rates were mostly high and ranged from 63% to 100%.

Conclusions: Autologous fat injection is an effective and minimally invasive treatment for nasal aesthetic and contour correction with a high satisfaction rate and low complication rate. Although clinical expertise is essential to have a safe injection and to minimize the potential complications. Preserving the excess fat for further fat injection (if needed) is recommended.
Surgical rhinoplasty remains the first indication and the gold standard for patients seeking higher aesthetic nasal shape. Although, there is an increasing demand for aesthetic improvement of nasal shape without undergoing surgical procedures. Nonsurgical rhinoplasty procedures involve dorsal augmentation, nasal sidewall deformity corrections, alteration in tip projection/rotation, nose elongation, and deep radix correction. Different injectable fillers such as autologous (autologous fat, and cartilage), heterogeneous (bovine collagen) and alloplastic (silicone, methyl-methacrylate spheres, Polytetrafluoroethylene, Hyaluronic acid, and calcium hydroxyapatite) fillers have been used to refine the shape of the nose by external molding mostly with local or no anesthesia and with minimal recovery time. Synthetic injectable materials such as Hyaluronic acid and calcium hydroxyapatite are more commonly used as they preclude the need for a donor site and further morbidities, it has the routine office performance and no general anesthesia or sedation are needed. Although, there have been cases of necrosis after injection of alloplastic fillers injection. The autologous fillers like fat grating should be preferred to alloplastic and heterogeneous injections. Fat injection is a relatively low-morbidity and low-risk nonsurgical procedure that has been used for over 20 years in facial soft tissue corrections. Augmentation using the autologous fat injection is readily available, biocompatible, involves minor invasion and is associated with low harvesting-site morbidity, and brings a natural appearance. However fat grafts are known as unpredictable procedures. The complications are rare but a handful of cases have experienced serious complications such as permanent blindness after fat emboli. Fat injection camouflages slight to moderate aesthetic imperfections not very marked nose deformities or respiratory malfunctions. Despite the growing popularity of fat injection in the aesthetic improvement of nasal shape, there is no general agreement on the advantages and disadvantages of fat injection. This systematic review aims to assess the satisfaction, complication and retention rates of fat injection in nasal shape corrections.

METHODS

PRISMA registration

We followed the PRISMA guidelines for conducting this systematic review in this work and specified and registered our search protocol at PROSPERO (International prospective register of systematic reviews) with registration no. CRD42020219380.
PICO question
Patient: Patients with nasal deformities undergoing augmentation rhinoplasty using fat transplantation.
Intervention: Augmentation rhinoplasty using fat transplantation.
Comparison: None.
Outcome: Injection location, aesthetic results, and satisfaction and complication rates of fat injection.

Search strategy
We searched PubMed/Medline (United States National Library of Medicine [NLM], Bethesda, MD) and Google Scholar (Google, Mountain View, CA) up to and including October 2020 with no time and language restrictions for pertinent materials. The reference list of included studies were also hand searched for potential studies. The following search strategies were advocated for each database:

1) PubMed/Medline: ((((((rhinoplasty[Title/Abstract]) OR (revisional rhinoplasty[Title/Abstract])) OR (augmentation[Title/Abstract])) OR (augmentation rhinoplasty[Title/Abstract])) OR (sequelae of rhinoplasty [Title/Abstract])) AND (((((autologous fat[Title/Abstract]) OR (Autologous fat grafting[Title/Abstract])) OR (Lipofilling[Title/Abstract])) OR (Microcannula[Title/Abstract])) OR (Fat injection[Title/Abstract])))
2) Google Scholar: (xxx papers)

Concept 1: allin"rhinoplasty" OR "revisional rhinoplasty" OR "dorsal augmentation" OR "sequelae of rhinoplasty " "autologous fat"

Concept 2: allin"rhinoplasty" OR "revisional rhinoplasty" OR "dorsal augmentation" OR "sequelae of rhinoplasty " "Fat"

Inclusion and exclusion criteria
The inclusion criteria were:
1. Controlled and non-controlled trials, prospective and retrospective cohort studies, and case series on the aesthetic results and/or satisfaction, and/or complication rates of fat injection in nasal shape corrections.
2. Papers written in English only.
3. Human studies.
The exclusion criteria were (the reasons for excluding articles were also recorded in Table 1):
1. Studies reporting only Ratios (Risk Ratio, Odds Ratio, Hazard Ratio) instead of the absolute outcomes were not of our interest.
2. Reports of nasal augmentation rhinoplasty with using grafts and materials other than fat.
3. Case reports, technical notes, and case series with less than 10 cases were excluded.
4. Studies with less than 5 participants.

**Study selection**

Two authors conducted a duplicate searching process independently to determine proper materials based on the inclusion and exclusion criteria. Instances of divergence of opinion were resolved by consulting a third author. The full-text version of papers were obtained for all titles that appeared to meet the inclusion criteria or in case of any hesitancy. After that, each paper was studied at least twice by one author (Sh.R).

**Data extraction**

One author retrieved the following data from the finally included studies based on a predefined checklist worksheet and two authors supervised the accuracy. In case of missing data or any hesitancy, we contacted the corresponding author of the study via email, as the poorly reported outcomes of included materials could thread the validity of our work. The following data were extracted: first author, year of publication, country of origin, study type, mean age, sex, number of cases, mean follow up (range), fat harvesting site, outcome measurement tools, rates of complications, donor-site morbidities, revision surgical procedures, Satisfaction rate (percent). The injection location, aesthetic results, and satisfaction and complication rates of fat injection.

**Risk of bias assessment**

The methodological quality and synthesis of case series and case reports by Murad et al. was used for bias assessment. There were 8 questions in the following domains: selection, ascertainment, causality, and reporting.
RESULTS

Study selection

Figure 1 illustrates the PRISMA flow diagram for the study selection at different levels. 675 papers were found throughout the initial search. After duplication removal, 649 papers remained which titles and abstracts were assessed. Of those, 27 were submitted to full-text analysis. At this level, 15 papers were excluded with reason (Table 1), and 12 papers were finally included.

Study characteristics

The characteristics of the studies included in this review were shown in Table 2. The included studies report data from a total of 564 patients undergoing nasal fat injection in 12 studies. 302 cases were female and 44 cases were male. The gender was not specified in 218 cases. The mean age of patients was 30.02 with a range of 14 to 76.

In 493 cases, the fat injection was the primary procedure and in 57 patients, it was a secondary/tertiary procedure. Papers (14 patients) did not report the primary or secondary status of the procedure. The fat harvesting sites were abdomen in 6 studies, knees, inner thigh, not reported. Studies were conducted in the following countries: China, USA, France, Spain, Turkey, and Taiwan.

Duration of follow ups

The mean follow up were reported by 7 papers and the total mean follow up was 1.67 years. The follow up range started from 2 weeks to 5.2 years.

Results of risk of bias assessment

The mean score in our included materials was 6.08 with a range of 4 to 7 scores.
The injection location

Different deficient sites were treated with the autologous fat transplant. Some papers reported the specific fat injection location in nose or paranasal areas as followed: nasal dorsum, tip, radix, and glabella.

Aesthetic results, and patients’ satisfaction

The reported satisfaction were as follows: eight papers reported the patients’ satisfaction rates: Cárdenas et al assessed 78 patients and reported 68 excellent, 9 good, and one unsatisfactory result. In the study by Batista et al, only two cases out of 20 were not satisfied with the result and required a second session. Lin et al reported 100% satisfaction for all 13 cases included and no further injection was required. After 6 months of follow-up, 4 cases were assessed and the fat graft retention rate was 40%. The overall patient satisfaction was reported as 80%, 87.6%, and 63.1% in three included studies. Also in two studies, most cases reported a high degree of satisfaction for the aesthetic results of autologous fat grafting but the exact percent was not reported. The remaining 4 papers did not mention patient satisfaction directly.

Complication rates of fat injection

The complications reported were as follows: most of the papers experienced no complication while/during the postoperative period. Although some reported mild complications that did not require additional treatment or surgical interventions. Monreal et al reported one combined (fat injection plus surgical rhinoplasty) case of mild displacement which was furtherly treated without severe consequences. In the study by Yuksel et al the nasal contour adjustments, solely or in combination for primary rhinoplasty, of 59 cases 3 had tip excess and 4 had supratip fillness (all of them due to vertical shift). Likewise, the height was insufficient in 3 cases. The fat grafting was repeated 1 to 3 times, in their study differentially. One paper did not directly mention the assessment of complications.
DISCUSSION

Autologous fat has become more frequently used for nasal volume augmentation and nasal correction. Nasal lipofilling refers to the use of injectable autologous fat grafts for nonsurgical aesthetic corrections. Although surgical rhinoplasty is still the treatment of choice, nasal lipofilling is replacing some of the traditional rhinoplasty procedures and gaining attention as they have a relatively good safety profile, are more cost-effective, do not cause significant fat harvesting site morbidities and do not trigger an immune response. Various synthetic or autologous grafts have been used for improving the nasal contour and correcting various deformations. Among them, alloplastic materials such as the non-biodegradable fillers are long-lasting and have a much longer duration of efficacy than autologous grafts such as autologous fat grafts. Foreign body reaction and its consequences are one of the most common complications in alloplastic materials. In case of serious complications, complex removal surgery might be needed which sometimes contributes to further complications such as cerebrospinal fluid leakage, surgical scar, shortnose deformity, and the remaining unsatisfactory aesthetic results. Fat grafting offers several benefits over such synthetic fillers; It improves the skin quality at the recipient site and body contour at the harvesting site (mostly abdomen or thigh) without causing immunogenicity and foreign body reaction. Likewise, fat injection is a cost-benefit treatment option.

More than half of our included materials reported on patient satisfaction with aesthetic results of fat injection. The satisfaction rates were mostly high and ranged from 63% to 100%.

In most of our included materials, no complication was reported for peri/postsurgical period. Although some papers reported manageable complications such as: an insufficient volume or decreased volume by resorption, tip excess and supra-tip fullness, and mild displacement. A common unpleasant finding in most patients receiving lipofilling is experiencing postsurgical numbness/paresthesia which is expected to recover partially or completely over the first 3 months postoperative period and gradually diminish to none.

Although rare, but there are several reports of serious, even mortal, complications after augmentation rhinoplasty with fat grafting. The ophthalmic artery occlusion is an ocular complication after autologous fat injection. The acute pressure increase caused by the forceful fat injection into the injected site artery might force a fat embolus to travel to the ophthalmic artery.

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26
There was a report of mortal sepsis after augmentation rhinoplasty using silicone implant, and fat grafting. Due to the anatomical features of the septal mucosa (rich blood supply), infection might easily spread to the brain. Aggressive treatment is the best strategy to prevent sepsis in such cases. Therefore, clinicians should give particular attention to inform patients regarding the potential adverse effects of fat grafting. In order to have a safe injection and to minimize the potential complications:

- Safety measures should be advocated to lower the risk of arterial cannulization. For instance, the lumen of the angular artery should be compressed using finger pressure, and fat delivery be done while withdrawing from the recipient site. likewise, sharp needles should be avoided.

- Generating excessive pressure while injecting fat should be avoided, therefore the use of a ratcheting gun is not proper for this purpose.

**Fat graft retention rate and the need for fat injection touch up process**

To date, the main critics of lipofilling is the unpredictability of long-term retention. Two types of variables affect the long-term retention rate: intrinsic patient-related variables such as age, status, and location of recipient site, accompanying additional surgical procedures, and extrinsic variables such as fat harvesting, processing and delivery techniques. Only the latter group is controllable. In order to achieve the desired aesthetic results, repeating the injection for some cases seemed necessary. Lin et al reported a further fat injection after one year necessary in 23% of cases. Some preserve the excess fat using cryopreservation for further series of fat injection (if needed). Although, the overcorrection by injecting the excess fat under pressure is not advised especially for sites with minimal skin laxity such as the dorsum as it might result in irregular resorption and necrosis.

**Limitations and strengths**

This systematic review was not flawless. First, only a small number of published papers were found on the use of fat injection for nasal aesthetic correction. Second, the included materials were all case series and retrospective reviews with various follow up times and no control group which made the meta-analysis not viable. Case series mostly suffer low internal
validity because of lacking comparator groups exposed to the same variables, although reporting similar outcomes might increase their total value.

Another limitation was the language of the included studies. We excluded languages other than English which might cause some levels of detection bias and missing parts of literature regarding the topic.

The follow ups had a range 2 weeks to 5.2 years. The wide range makes it difficult to draw any final conclusion on injectable fat grafts. Due to the limited number of included papers, considering papers with follow-up beyond 6 months was not possible.

Nonetheless, to our knowledge, no systematic review has assessed the clinical outcome of fat injection for nasal correction. Future studies with larger sample sizes and long-term follow-ups on complications and retention rate are warranted.

CONCLUSIONS

Autologous fat injection is an effective and minimally invasive treatment for nasal aesthetic and contour correction with a high satisfaction rate and low complication rate. Although clinical expertise is essential to have a safe injection and to minimize the potential complications.
REFERENCES

1. Johnson ON, 3rd, Kontis TC. Nonsurgical Rhinoplasty. *Facial Plastic Surgery*. 2016;32(5):500-506.

2. Erol OO. Injection of Compressed Diced Cartilage in the Correction of Secondary and Primary Rhinoplasty: A New Technique with 12 Years' Experience. *Plastic and Reconstructive Surgery*. 2017;140(5):673e-685e.

3. Kao WP, Lin YN, Lin TY, et al. Microautologous Fat Transplantation for Primary Augmentation Rhinoplasty: Long-Term Monitoring of 198 Asian Patients. *Aesthetic Surgery Journal*. 2016;36(6):648-656.

4. Simonacchi F, Bertozzi N, Grieco MP, Grignaffini E, Raposio E. Procedure, applications, and outcomes of autologous fat grafting. *Annals of Medicine and Surgery (2012)*. 2017;20:49-60.

5. Talbot SG, Parrett BM, Yaremchuk MJ. Sepsis after autologous fat grafting. *Plastic and Reconstructive Surgery*. 2010;126(4):162e-164e.

6. Lazzeri D, Agostini T, Figus M, Nardi M, Pantaloni M, Lazzeri S. Blindness following cosmetic injections of the face. *Plastic and Reconstructive Surgery*. 2012;129(4):995-1012.

7. Murad MH, Sultan S, Haffar S, Bazerbachi F. Methodological quality and synthesis of case series and case reports. *BMJ Evidence-Based Medicine*. 2018;23(2):60-63.

8. Ozer K, Colak O. Micro-Autologous Fat Transplantation Combined With Platelet-Rich Plasma for Facial Filling and Regeneration: A Clinical Perspective in the Shadow of Evidence-Based Medicine. *The Journal of Craniofacial Surgery*. 2019;30(3):672-677.

9. Gabrick K, Walker M, Timberlake A, Chouairi F, Saberski E, Steinbacher D. The Effect of Autologous Fat Grafting on Edema and Ecchymoses in Primary Open Rhinoplasty. *Aesthetic Surgery Journal*. 2020;40(4):359-366.

10. Gerth DJ, King B, Rabach L, Glasgold RA, Glasgold MJ. Long-term volumetric retention of autologous fat grafting processed with closed-membrane filtration. *Aesthetic Surgery Journal*. 2014;34(7):985-994.

11. Huang L. Does Sensation Return to the Nasal Tip After Microfat Grafting? *Journal of Oral and Maxillofacial Surgery*. 2015;73(7):1396.e1391-1396.

12. Maia M, Lukash FN. Autologous fat grafting in young patients: a simple and effective way to achieve facial balance. *Annals of Plastic Surgery*. 2019;83(3):253-257.
13. Monreal J. Fat grafting to the nose: personal experience with 36 patients. *Aesthetic Plastic Surgery*. 2011;35(5):916-922.

14. Baptista C, Nguyen P, Desouches C, Magalon G, Bardot J, Casanova D. Correction of sequelae of rhinoplasty by lipofilling. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2013;66(6):805-811.

15. Cárdenas JC, Carvajal J. Refinement of rhinoplasty with lipoinjection. *Aesthetic Plastic Surgery*. 2007;31(5):501-505.

16. Xu J, Jiang B, Shen Y. Effectiveness of Autologous Fat Grafting in Scaring After Augmentation Rhinoplasty. *Journal of Craniofacial Surgery*. 2019;30(3):914-917.

17. Kornstein AN, Nikfarjam JS. Fat Grafting to the Forehead/Glabella/Radix Complex and Pyriform Aperture: Aesthetic and Anti-Aging Implications. *Plastic and Reconstructive Surgery Global Open*. 201:8(3):5e500.

18. Yuksel E, Spira M, Yazgan H. Role of fat grafting in primary rhinoplasty. *Plastic and Reconstructive Surgery*. 2012;130(5S-1):44-45.

19. Lin S, Hsiao YC, Huang JJ, et al. Minimal Invasive Rhinoplasty: Fat Injection for Nasal Dorsum Contouring. *Ann Plast Surg*. 2017;78(3 Suppl 2):S117-s123.

20. Gabrick K, Gary C, Saberski E, et al. Autologous Fat Grafting’s Role in Primary Rhinoplasty. *Plastic and Reconstructive Surgery Global Open*. 2018;6(9 Suppl).

21. Kao W-P, Lin Y-N, Lin T-Y, et al. Microautologous fat transplantation for primary augmentation rhinoplasty: long-term monitoring of 198 Asian patients. *Aesthetic Surgery Journal*. 2016;36(6):648-656.

22. Clauser L, Zavan B, Galiè M, Di Vittorio L, Gardin C, Bianchi AE. Autologous Fat Transfer for Facial Augmentation: Surgery and Regeneration. *The Journal of Craniofacial Surgery*. 2019;30(3):682-685.

23. Coleman SR. Structural fat grafts: the ideal filler? *Clinics in Plastic Surgery*. 2001;28(1):111-119.

24. Erol OO. Microfat Grafting in Nasal Surgery. *Aesthetic Surgery Journal*. 2014;34(5):671-686.

25. Mojallal A, Lequeux C, Shipkov C, et al. Improvement of skin quality after fat grafting: clinical observation and an animal study. *Plastic and Reconstructive Surgery*. 2009;124(3):765-774.

26. Xing L, Almeida DR, Belliveau MJ, et al. Ophthalmic artery occlusion secondary to fat emboli after cosmetic nasal injection of autologous fat. *Retina*. 2012;32(10):2175-2176
27. Kim MH, Baik BS, Yang WS, Ha W, Ji SY. Sepsis Leading to Mortality after Augmentation Rhinoplasty with a Septal Extension Graft and Fat Grafting. *Archives of Plastic Surgery*. 2016;43(3):295.

28. Coleman SR. Avoidance of arterial occlusion from injection of soft tissue fillers. *Aesthetic Surgery Journal*. 2002;22(6):555-557.

29. Mojallal A, Shipkov C, Braye F, Breton P, Foyatier JL. Influence of the recipient site on the outcomes of fat grafting in facial reconstructive surgery. *Plastic and Reconstructive Surgery*. 2009;124(2):471-483.

30. Erdogan B, Tuncel A, Adanali G, Deren O, Ayhan M. Augmentation rhinoplasty with dermal graft and review of the literature. *Plastic and Reconstructive Surgery*. 2003;111(6):2060-2068.

31. Jie L, Xiaoning Y, Xin L, et al. Clinical Study of Rhinoplasty with Autologous Rib Cartilage and Facial Fat Grafting to Rebuild Facial Balance. *Journal of Tissue Engineering and Reconstructive Surgery*. 15(1):32.

32. Nguyen PS, Baptista C, Casanova D, Bardot J, Magalon G. [Autologous fat grafting and rhinoplasty]. *Annales de Chirurgie Plastique et Esthetique*. 2014;59(6):548-554.

33. YAN Z, WANG G-m, HU Y, ZHUO T. Augmentation rhinoplasty by autologous fat grafting [J]. *Chinese Journal of Aesthetic Medicine*. 2010;12.

34. CHEN J-j, WU Y-j, LU J-l, et al. The application of autologous fat granules injection in augmentation rhinoplasty. *Chinese Journal of Aesthetic Medicine*. 2013(1):2.

35. Na D-S, Jung S-W, Kook K-S, Lee Y-H. Augmentation rhinoplasty with dermofat graft & fat injection. *Archives of Plastic Surgery*. 2011;38(1):53-62.

36. Lo S, Sinrachtanant C. Immediate autologous fat graft augmentation rhinoplasty after removal of extruding or infected silicone implant. *Clinical Otolaryngology*. 2012;37(4):333-334.

37. Kim YK. Orbital Fat Pad for Nasal Tip Augmentation in Far Eastern Rhinoplasty. In: *Advanced Aesthetic Rhinoplasty*. Springer; 2013:745-752.

38. Piotet E, Beguin C, Broome M, et al. Rhinopharyngeal autologous fat injection for treatment of velopharyngeal insufficiency in patients with cleft palate. *European Archives of Oto-Rhino-Laryngology*. 2015;272(5):1277-1285.

39. Nakakita N, Sezaki K, Yamazaki Y, Uchinuma E. Augmentation rhinoplasty using an L-shaped auricular cartilage framework combined with dermal fat graft for cleft lip nose. *Aesthetic Plastic Surgery*. 1999;23(2):107-112.
40. Bektas G, Cinpolat A, Rizvanovic Z. Nasal Filling in Plastic Surgery Practice: Primary Nasal Filling, Nasal Filling for Post-rhinoplasty Defects, Rhinoplasty After Hyaluronidase Injection in Dissatisfied Nasal Filling Patients. *Aesthetic Plastic Surgery*. 2020.

41. Sterodimas A. Stromal enriched lipograft for rhinoplasty refinement. *Aesthetic Surgery Journal*. 2013;33(4):612-614.

42. Ciloglu S, Duran A, Yigit AK, Buyukdogan H, Keskin E. Keutel syndrome: Augmentation of the nose with serial fat grafting. *Annals of Maxillofacial Surgery*. 2015;5(2):287.

43. Sterodimas A. Stromal enriched lipograft for rhinoplasty refinement. *Aesthetic Surgery Journal*. 2013;33(4):612-614.

44. Klinger F, Pajardi G, Vinci V, et al. Minimal Invasive Rhinoplasty: Fat Injection for Nasal Dorsum Contouring. *Ann Plast Surg*. 2018;80(1):90.
FIGURE LEGEND

Figure 1. The PRISMA flowchart of included studies.
| Study (first author/year) | Reason for exclusion |
|--------------------------|---------------------|
| Jie et al. 2019          | Not English         |
| Nguyen et al. 2014       | Not English         |
| Yan et al. 2010          | Not English         |
| Jian-jun et al           | Not English         |
| Na et al                 | Not English         |
| Sinrachtanant et al. 2012| Case report         |
| Kim et al. 2013          | Technical Note      |
| Piotet et al. 2015       | Fat injection not for aesthetic nasal correction |
| Erdogan et al. 2002      | No fat injection    |
| Nakakita et al. 1999     |                     |
| Bektas et al. 2020       | Using materials other than fat |
| Sterodima (2013)         | Case report         |
| Ciloglu (2015)           | Case report         |
| Sterodima (2013)         | Case report         |
| Klinger et al. 2018      | Letter to the editor |
### Table 2. The Characteristics of Included Studies

| Author (year), country of origin, language | Study type | Measurement | Mean follow up (range) | Number of cases, Primary/Secondary | Complication/satisfaction | Mean age /Sex | Fat harvesting site | Overall efficacy | Relative safety |
|------------------------------------------|------------|-------------|------------------------|-----------------------------------|--------------------------|----------------|-------------------|----------------|-----------------|
| Kornstein, 2014 USA English              | retrospective review | reviewed pre- and postoperative images | FG group; mean follow-up, 3.3 years | 26 patients (secondary rhinoplasty/underwent fat grafting alone, and 19 had fat grafting plus rhinoplasty) | No complications occurred in either group | The FG group comprised of 24 women and 2 men, with a mean age of 44.15 years (range, 23–60 years) | NR | Autologous fat grafting to the forehead/glabella/radix complex and pyriform aperture is a reliable method to favorably influence the nasofrontal and nasolabial angles, respectively. Such treatment optimizes the interplay between the nose and the adjacent facial features, enhancing overall aesthetics. | Fat grafting provides a safe and long-lasting means of controlling the position of the radix |
| Baptista 2013 | retrospective review | Reviewed pre- and postoperative images. | Followed up for 18-24 months | 20 patients (15 cases of primary and 5 secondary rhinoplasty in 5 cases) | In our practice, we have never had complications with the use of adipose tissue and the literature confirms the reliability of this procedure. 18 had satisfactory aesthetic results after one procedure and two required a second session. | The mean age of the patients was 53 years. (women) | Fat was harvested at the following donor sites: the internal side of the knees and the subombilical region | In patients who undergo multiple procedures, lipofilling can be a simple and reliable alternative to correct imperfections following rhinoplasty. In our experience, the smaller cannulae used for the microinjection of adipose fat present numerous advantages. The procedure can be performed under local anesthesia. It is more precise and less traumatic, which means that there is very little or no ecchymosis and edema, thereby enabling patients to immediately return to their normal lives. | \( \text{NR} \) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Xu 2019 | retrospective review | The pre- and postoperative states were evaluated and followed up for 12 to 24 months | 9 patients (All cases secondary) | Most common complications are infection and capsular (8 females and 1 male) | the inner thigh as the donor site | All 9 patients achieved nasal aesthetic and functional | The real mechanism of fat grafting in scar is still under investigation. | \( \text{NR} \) |
A high degree of satisfaction was obtained with a mean dose of 1.0 mL (range 0.5–1.5 mL), effectively avoiding complicated operation. Male improvement, and reduction for pain, stiff, irregular, relief, and pliability (P<0.05) in POSAS scores was statistically significant. The efficiency is limited on the short nose deformity, and repeated injection is needed for improvement.
| Study | Type | Methodology | Follow-up | Results |
|-------|------|-------------|-----------|---------|
| Monreal 2011 Spain | Case series | by comparison with pre- and postoperative control photographs | a maximum follow-up period of 14 months (mean, 7 months) | The initial analysis of postoperative results showed a good to high level of patient satisfaction, particularly in primary cases, with virtually no complications or severe side effects. The current series of patients experienced no complications or untoward results that required additional treatment or surgical interventions. Only in one combined case did minimal displacement of the grafted fat in the radix occur, probably caused during the nasal splinting. |
| Kao et al 2016 USA English | Case series | Most patients were monitored beyond this duration. Photographs were taken at each visit for comparisons over time. | Patients received follow-up for an average of 19 months (range, 6-42 months). All patients received routine follow-up at an outpatient clinic at 1, 3, and 6 months postoperatively. | There were no major complications. AutoLOGous fat grafting is an effective and reliable technique for aesthetic and reconstructive nose reshaping for patients who refuse surgical treatments. Although optimal results can be achieved with this technique, they are not comparable with those obtained by surgical rhinoplasties. |
| Reference                                      | Study Type      | Study Details                                                                 | Results                                                                                                                                                                                                 | Conclusion                                                                                                                                                                                                 |
|-----------------------------------------------|-----------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ozer et al. 2019                              | Retrospective   | NR Were followed up minimum 9months. 14 patients                               | No major complications (e.g., infection, skin necrosis, nodulation, fibrosis, calcification, asymmetry, or vascular insults) were recorded. Surveys conducted were modules of satisfaction with facial appearance, satisfaction with cheeks, satisfaction with skin, psychological function, social function, aging appearance appraisal, and satisfaction with the outcome. | A combination of PRP and micro-fat grafting with soft harvesting and processing can be viewed as a useful surgical technique to restore volume and enhance skin quality in facial soft tissue augmentation. Minimal damage during harvesting the fat graft, appropriate processing, and the addition of PRP in combination with the fat graft may increase patient and surgeon satisfaction related to outcomes. |
| Carvajal et al. 2006                          | Case series     | By comparison with pre- and postoperative control photographs From 1 to 36 months (average, 15 months). 78 rhinoplasties were performed, with injection of autologous fat. Of the 78 patients, 61 were primary rhinoplasties and 17 were secondary rhinoplasties. | There were no complications with this procedure such as infection, hematoma, or bleeding from the donor site; nor was there any infection in the nasal dorsum. We did not observe any minor irregularities, and the aspect and quality of the skin improved in all of the patients. A total of 77 patients were satisfied with the procedure. One patient was dissatisfied, but for reasons unrelated to the lipoinjection procedure. | Fat injection into the nose as a refinement of rhinoplasty is a fast, easy, inexpensive procedure for obtaining regular and smooth contours on the nasal dorsum that lasts over time. Adipose tissue is an ideal origin of transplantation cells for augmentation of soft tissues because it is abundant, easy to obtain in large quantities, and safe to harvest. |
ideal source of stem cell tissue, the injection of fat tissue can increase the concentration of mesenchymal stem cells in the recipient tissue. Its application at regular intervals during adulthood can maintain volume and elasticity wherever it is applied.

Yuksel et al 18 2012 USA

| Study | Study type | Duration | Number of cases | Description | Complications | Results | Notes |
|-------|------------|----------|----------------|-------------|---------------|---------|-------|
| Yuksel et al | Case series | 8 weeks | 59 primary rhinoplasty cases | In 12 cases “external nasal fat grafting” (without dissection) was the only component of the rhinoplasty, while in 47 cases it was part of the rhinoplasty in addition to cartilage grafting and other steps. | Tip Excess: 3 (due to vertical shift) Supratip fullness: 4 (due to vertical shift) Inadequate height: 3 (required additional grafting) | Nasal augmentation can be achieved in primary rhinoplasty cases. Volume shift due to the gravity may occur in some cases, use of PRP and extended external stabilizing pressure can be utilized to prevent this. Fat grafting can play a significant role in primary rhinoplasty cases, and delivers the advantage of minimized dissection, and improved skin quality due to the preadipocyte contribution. It can be utilized solely in limited number of cases. | N.R |

Yuksel et al 18 2012 USA

Case series

Case series

8 weeks

59 primary rhinoplasty cases. In 12 cases “external nasal fat grafting” (without dissection) was the only component of the rhinoplasty, while in 47 cases it was part of the rhinoplasty in addition to cartilage grafting and other steps. Complications were evaluate Complications Tip Excess: 3 (due to vertical shift) Supratip fullness: 4 (due to vertical shift) Inadequate height: 3 (required additional grafting) in 59 cases. NR NR Nasal augmentation can be achieved in primary rhinoplasty cases. Volume shift due to the gravity may occur in some cases, use of PRP and extended external stabilizing pressure can be utilized to prevent this. Fat grafting can play a significant role in primary rhinoplasty cases, and delivers the advantage of minimized dissection, and improved skin quality due to the preadipocyte contribution. It can be utilized solely in limited number of cases. N.R
| Maia et al 12 | Case series | reviewed pre- and postoperative images | The mean follow-up was 3 years. | 22 patients (all primary) | The majority of patients reported high degree of satisfaction. No complications were observed. | age, 15–19 years | Fat was harvested from flanks (most common donor site) and inferior abdomen | The combination of rhinoplasty and autologous fat grafting offers very satisfactory esthetic outcomes and improvement of facial balance with minimal added time, cost, and risk. | Autologous fat grafting is a simple, repeatable, and safe alternative method to correct volumetric deficiencies in the face. |
|---|---|---|---|---|---|---|---|---|---|
| eLin et al, 2017 | Preoperative and postoperative 3-dimensional (3-D) photography images. | 3 months | 13 consecutive patients (all primary) | Serious complications, such as retinal artery occlusion and stroke, have been reported in the literature as a result of arterial injection of synthetic fillers or autologous fat graft. | 12 women and 1 man. The mean age of the patients was 34.03 ± 7.28 years (range, 22–47 years) | The lower abdomen | Different anatomical recipient sites may have different graft retention rates; a graft retention rate of 44.54% (range, 21–74%) was reported (Figs. 8–11); knowledge of the expected graft retention rate for each recipient site is valuable which allows the clinicians to better inform the patients and determine if serial injections are necessary. The mean retention rate was 44.54% (range, 21–74%). | The procedure will be more safe considering the following safety measures during fat injection of the nose is that: 1) providing vasoconstriction and decreasing the chance of arterial injection by use of epinephrine 2) Applying finger pressure to compress the lumen of angular artery during injection. The finger pressure is lifted only after the injection is completed. | 19 | Taiwan. |
| Huang 2015 USA | a prospective study | The McNemar-Bowker test (time vs nasal tip sensation) was used to detect statistical significance. The follow-up period were weeks 2, 4, 8 and 12. 30 Patients (all primary) | None of the patients was noted to have any complications during the postoperative period. Postoperative numbness occurs in most patients receiving nasal microfat injections. Partial to complete recovery of nasal tip sensation can be expected to occur over a 3-month period. (P < .05). The percentage of those experiencing paresthesia after the microfat injections also gradually diminished to none. young women (age 20.04 ± 3.63 years) | Using less invasive techniques; however, the variation in the long-term outcomes regarding transplanted volume loss has been reported. The loss and recovery of nasal tip sensation after microfat grafting was quantified. It is known that the nasal tip, along with other areas, is the most susceptible part of the body | N.R |
### Table 3. The Risk of Bias Assessment for Included Studies

| First author (year) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Overall appraisal |
|---------------------|---|---|---|---|---|---|---|---|-------------------|
| Kornstein et al\(^{17}\) 2014 | Y | Y | Y | N | N | Y | Y | Y | 6/8 |
| Xu\(^{16}\) 2019 | Y | Y | Y | Y | N | Y | Y | Y | 7/8 |
| Gabrick\(^{7}\) 2019 | Y | Y | Y | Y | N | Y | Y | Y | 7/8 |
| Cárdenas\(^{12}\) 2007 | Y | Y | Y | Y | N | N | Y | Y | 6/8 |
| Monreal\(^{17}\) 2011 | Y | Y | Y | Y | N | Y | Y | Y | 7/8 |
| Kao\(^{20}\) 2016 | N | Y | N | N | N | Y | Y | Y | 4/8 |
| Ozer\(^{8}\) 2019 | Y | Y | Y | Y | N | Y | Y | Y | 7/8 |
| Yuksel\(^{19}\) 2012 | N | Y | Y | Y | N | Y | N | Y | 5/8 |
| Maia\(^{12}\) 2019 | Y | Y | Y | Y | N | Y | Y | Y | 7/8 |
| Lin\(^{14}\) 2017 | N | Y | Y | Y | N | Y | N | Y | 5/8 |
| Huang\(^{11}\) 2015 | Y | Y | Y | Y | N | Y | N | Y | 6/8 |
| Baptista\(^{14}\) 2013 | Y | Y | Y | Y | N | N | Y | Y | 6/8 |
Figure 1

- **Identification**
  - Records identified through Pubmed and Google Scholar: 670
  - Additional records identified through other sources: 5
  - Records after duplicates removed: 649
  - Records screened: 649

- **Screening**
  - Records excluded after reading titles/abstracts: 620

- **Eligibility**
  - Full-text records assessed for eligibility: 27
  - Full-text records excluded with reasons: 15

- **Included**
  - Studies included: 12