



Current Status of Grafts Materials Used in Rhinoplasty. Literature Review

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Abstract

Background: The overall aesthetics of the face are significantly affected by the appearance of the nose. Among the nasal defects, the saddle type of nose is often found. Various grafting materials are widely used in rhinoplasty. However, the choice of the optimal material in different clinical situations remains a matter of debate.

Purpose: The purpose of this review was to evaluate effects various grafting materials used in rhinoplasty advantages and disadvantages of each.

Methods: The review included articles from Google Scholar, Medline, Scopus, Web of Sciences, PubMed, Cochrane Library websites were searched. Saddle type of nose, rhinoplasty autograft, (septal cartilage, auricular cartilage, costal cartilage), allograft, PRP, fluid cartilage, rhinofiller and alloplastic implants, were used as search keywords; the effectiveness of the use of each material, resorption results, complications, functional and aesthetic satisfaction of patients were evaluated. Review was conducted according to the PRISMA guidelines.

Results: Out of 127 articles in the literature search, 71 articles that met the inclusion criteria were included in this article. Autograft is very applicable in dorsal rhinoplasty, but autograft surgery of autograft cartilage is not acceptable for all patients in all cases, due to various complications that may occur at the donor site, such as pain, pneumothorax, and scarring. An alternative is allograft (irradiated and non-irradiated rib) which excludes the above-mentioned complications, but has a higher resorption rate; Currently used alloplastic materials also have drawbacks and scientific research in the optimal direction is ongoing.

Conclusions: With this comprehensive review, the authors hope to highlight the advantages and disadvantages of the different materials currently used in aesthetic rhinoplasty, which may enable the surgeon to achieve optimal aesthetic and functional results. Further research is needed to establish clear guidelines for selecting the appropriate material for rhinoplasty.

Keywords

Saddle type of nose, Grafts materials used in rhinoplasty, Autograft, Allograft, PRF, Fluid cartilage, Rhinofiller, Alloplastic grafts materials

Introduction

One of the most popular plastic surgeries in the maxillofacial area is rhinoplasty, which improves the harmony of the face and the proportions of the nose [1].

The etiology of aesthetic defects of the nose is diverse: congenital, traumatic and iatrogenic (violation of the dorsal L-shaped support after septoplasty), which forces the patient to resort to the method of rhinoplasty [2-4].

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Among the nasal defects, the saddle type of nose is often found, which is associated with the loss of the dorsal part of the quadrangular cartilage of the nose [5,6].

Defects in the profile of the nasal dorsum are classified into major and minor defects. There are two different types of rhinoplasty procedures: Open and Closed Rhinoplasty [7]. Depending on the nasal corrections needed to be made, surgeons determine the type of rhinoplasty needed by examining the advantages and risks of both procedures.

In an open rhinoplasty, an incision will be made beneath the tip of the nose where the columella is. A closed rhinoplasty is also known as an endonasal rhinoplasty. In an endonasal rhinoplasty, surgical incisions are made inside the patient's nose.

Different graft materials are used in plastic surgery of the nose, mainly 3 types of grafts are used; [8-23] autogenous, homograft, synthetic.

The purpose of this review was to evaluate effects various grafting materials used in rhinoplasty advantages and disadvantages of each.

Methods

The review included articles from Google Scholar, Medline, Scopus, Web of Sciences, PubMed, Cochrane Library websites were searched.

Autograft, (septal cartilage, auricular cartilage, costal cartilage), allograft, PRP, fluid cartilage, rhinofiller and alloplastic graft materials, were used as search keywords; the effectiveness of the use of each material, resorption results, complications, functional and aesthetic satisfaction of patients were evaluated. Two review authors screened the results of the searches against inclusion criteria and in duplicate. First, articles obtained from the database search were identified; then, articles were selected, excluding duplicates and those not relevant to certain descriptors, by screening titles and abstracts; after this step, an eligibility check was performed with full text reading, excluding articles that did not meet the previously established criteria; finally, relevant articles were included in the systematic review.

Results

From the 127 articles considered in the analysis, 71 articles that met the inclusion criteria were included. Review was conducted according to the PRISMA guidelines (Table 1).

Sources of autogenous grafts remain the gold standard in rhinoplasty of the dorsum of the nose, as they provide sufficient quantity and quality of grafts.

Small defects can be repaired using septum or auricular cartilage [24,25]. Large deformities of the dorsum the preferred graft is costal cartilage [26,27].

Usually, autogenous cartilage is harvested from either the septum, auricle, or rib and each of them is used in different clinical situations based on its specific properties (Figure 1).

Autogenous septal cartilage is the preferred graft material for rhinoplasty because its ability to provide a single surgical

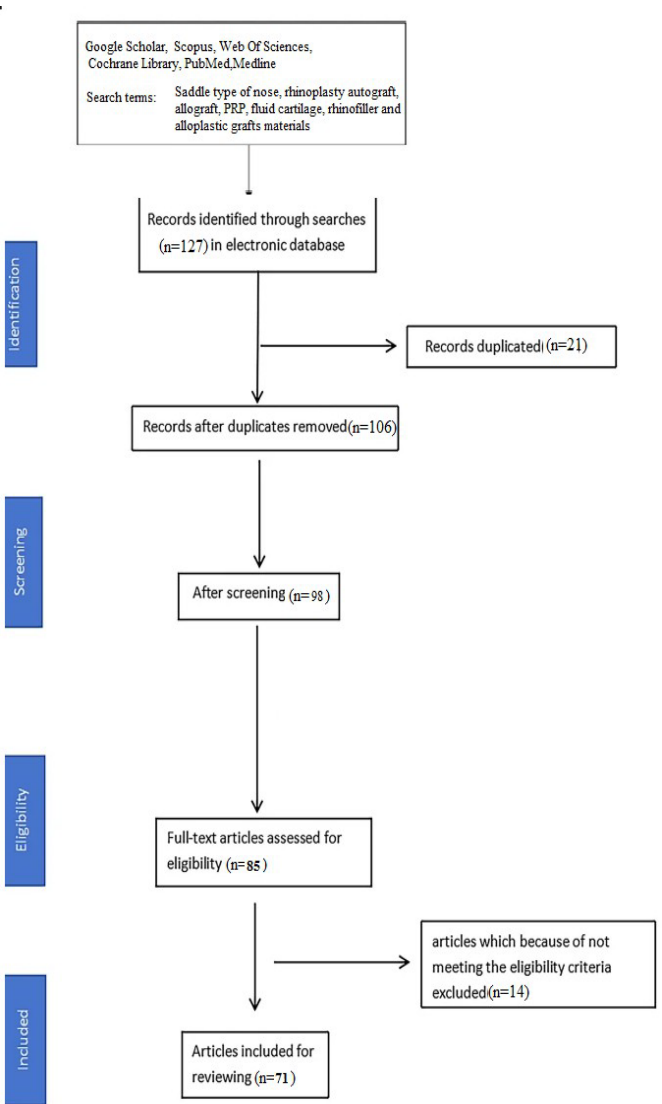


Table 1: PRISMA guidelines.

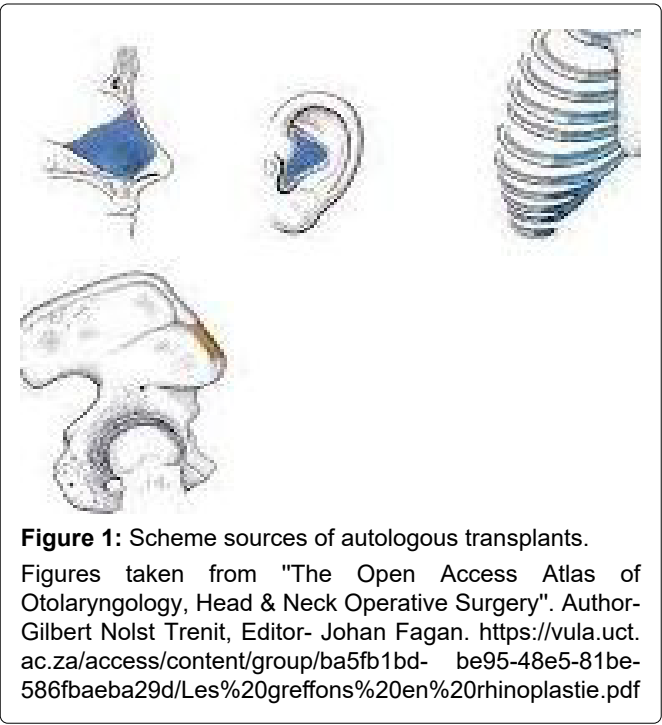


Figure 1: Scheme sources of autologous transplants. Figures taken from "The Open Access Atlas of Otolaryngology, Head & Neck Operative Surgery". Author- Gilbert Nolst Trenit, Editor- Johan Fagan. <https://vula.uct.ac.za/access/content/group/ba5fb1bd-be95-48e5-81be-586fbaeba29d/Les%20greffons%20en%20rhinoplastie.pdf>

field, its stability, and its resistance to infection, with minimal deformation and resorption [24, 28-30]. Autologous septal cartilage grafts integrate well with the surrounding tissues, and their elasticity provides good support, but these surgical methods are undesirable for patients due to donor site morbidity (Figure 2, Figure 3 and Figure 4).

Conchal cartilage is also often used for nasal grafts. It has a characteristic curve and is softer and more flexible than septal cartilage, conchal cartilage is ideal for nasal tip grafts [31,32]. Conchal cartilage advantages include low morbidity, and resistance to resorption (Figure 5 and Figure 6).

The use of costal cartilage is dictated by a number of features of its structure, which have a number of obvious advantages [33].

- Sufficient thickness- upto 5-7 cm;
- Strength;
- The ability to create almost any given configuration;
- Stability of the resulting structure

However, the difficulties associated with obtaining costal cartilage such as various complications: prolonged pain, pneumothorax, scarring, second surgical site make many patients reluctant to resort to this method [15,34] (Figure 7, Figure 8 and Figure 9).

One of the methods of non-surgical rhinoplasty is the use of autologous fat as filler [35]. Currently, nasal lipofilling using autologous fat is one of the minimally invasive methods

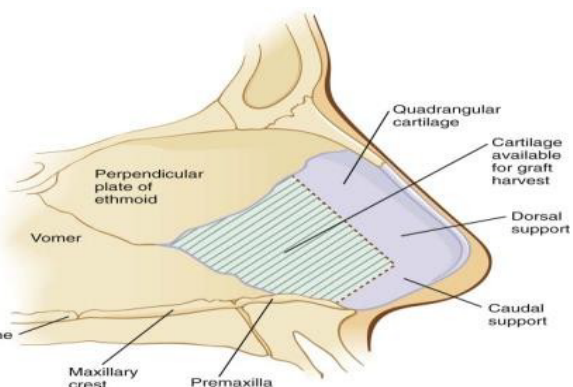


Figure 2: Scheme septal cartilage is preferred for rhinoplasty.

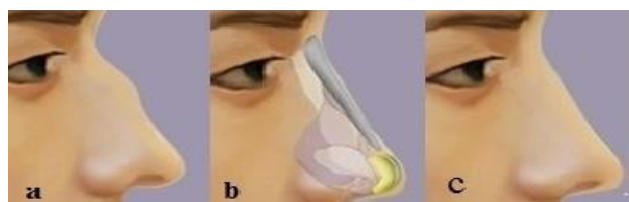


Figure 3: a,b,c) Scheme dorsal rhinoplasty using septal cartilage.

Figures taken from <https://clinica-estetica.ru/news/vnimanie-novosti/>

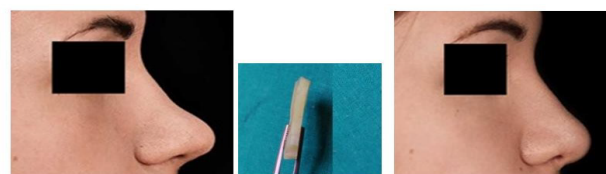


Figure 4: Dorsal rhinoplasty using septal cartilage a) Before rhinoplasty; b) Septal cartilage; c) After rhinoplasty.

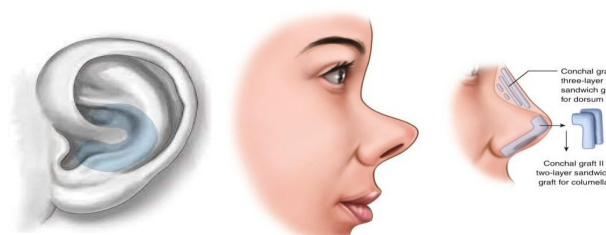


Figure 5: Scheme conchal cartilage is preferred for rhinoplasty.

Figure 6: Scheme dorsal rhinoplasty using conchal cartilage.

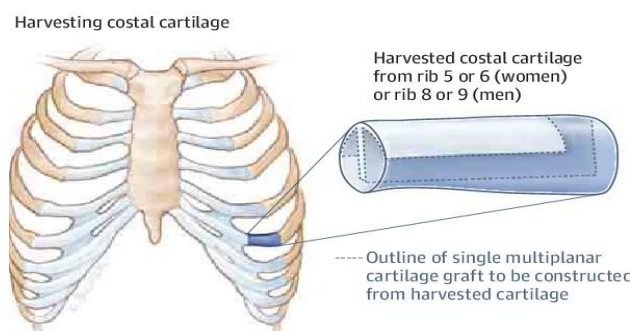


Figure 7: Scheme harvesting costal cartilage for rhinoplasty.



Figure 8: Harvesting costal cartilage for rhinoplasty.

Figure 9: Dorsal rhinoplasty using costal cartilage.

for correcting the aesthetics and contour of the nose; this method is effective, is relatively low- morbidity and has a low incidence of complications [36].

Recently, PRF has also been used in rhinoplasty, which contains factors such as platelet-derived growth factor, vascular endothelial growth factor [37,38].



Figure 10: Harvesting PRF for rhinoplasty.

Figure 11: Crushed allogenic septal cartilage and PRF.



Figure 12: Dorsal rhinoplasty using Freeze-Dried Allograft Bone allograft. a) Before rhinoplasty; b) After rhinoplasty.



Figure 13: AlloDerm.

In dorsal rhinoplasty, crushed septal cartilage and PRF have also been used occasionally when indicated [20,39] (Figure 10 and Figure 11).

For large dorsal defects, rib allograft lyophilized Freeze-Dried Allograft Bone used; it has high osteo conductivity, is strong enough to provide structural support, and overcome soft tissue resistance [40-42] (Figure 12).

However, allograft also has disadvantages such as inflammatory reactions, infection, and resorption. During preparation, the cartilage is irradiated with 30,000-50,000 Gy. It is believed that with increasing radiation intensity, collagen damage increases and resorption increases accordingly [17,43-45].

Small dorsal defects can be repaired by AlloDerm, it is a lyophilized sheet of human dermis collagen matrix and allows the ingrowth of host tissue is a good alternative to autogenous dorsal rhinoplasty [46]. Partial AlloDerm resorption, is a definite disadvantage (Figure 13).

Hyaluronic acid (HA) is also used for rhinoplasty due to its effectiveness and short recovery time, but HA filler injections are not without complications. HA filler injections can cause some complications: skin necrosis; hypersensitivity; vascular disorders, etc. [47-52].

In aesthetic rhinoplasty for minor contour deformations of the nasal surface, liquid cartilage is also used and its use is a microinvasive procedure [53].

Liquid cartilage grafts are more flexible for filling lesions, they are prepared from septal, lateral or less commonly conchal cartilage and are inserted through a needle from the surface of the skin or mucosa shell into the defect area without any incision or raising a skin flap [54]. Its disadvantage is poor mechanical stability and rapid decomposition, leading to wrinkling and deformation (Figure 14).

Alloplastic materials can be used successfully for dorsal augmentation. The most commonly used alloplastic materials include silicone, expanded polytetrafluoroethylene (Gore-Tex; W. L. Gore and Associates, Flagstaff, Ariz.), or porous high-density polyethylene (Medpor; Porex Medical, Fairburn, Ga) as they are readily available to avoid complications associated with the donor site [55,56]. Silicone implants should not be used for the tip of the nose as it fails to build up the underlying structure, thereby causing an unnatural result and possible side effects. Problems associated with alloplastic materials in rhinoplasty described in the literature [57] (Figure 15 and Figure 16).

Each of these materials has unique structural and biocompatibility properties and is therefore used for different procedures and indications. Each of the grafts has advantages and disadvantages, and the choice of the ideal graft material remains a matter of debate.



Figure 14: a,b) Preparation of liquid cartilage grafts.

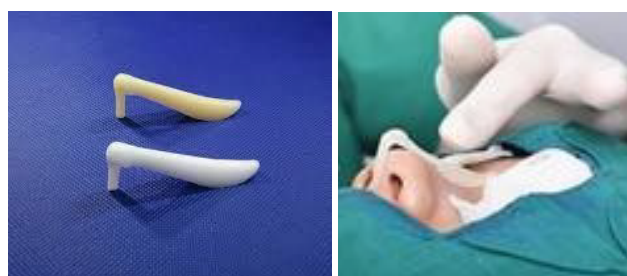


Figure 15: Silicone implants dorsal.

Figure 16: Rhinoplasty using silicone implants.

Discussion

Surgical rhinoplasty techniques are constantly being improved, and work continues on the use of the optimal biocompatible graft [58].

Cartilage allografts are optimal for rhinoplasty [59]. The biochemical composition of septal cartilage includes 90-95% collagen II, and the rest contains collagens I, IX, X, and XI [60-63].

One of the common complications of cartilage grafts is their resorption.

It has a low rate of resorption, extrusion, and deformation [64].

Currently, gamma-irradiated cartilage allografts are also used in rhinoplasty [65,66].

According to published literature, the resorption rate of irradiated homologous lateral cartilage (31%) is significantly higher than that of autologous cartilage (3%), which is due to the lack of viable cells in cartilage allografts [67].

PRF is currently used in rhinoplasty because it provides angiogenesis [37,42].

The presented literature review shows that the selection of the optimal graft in aesthetic rhinoplasty is a topical and urgent issue that requires a thorough long-term study.

Conclusions

With this comprehensive review, the authors hope to highlight the advantages and disadvantages of the different materials currently used in aesthetic rhinoplasty, which may enable the surgeon to achieve optimal aesthetic and functional results. Further research is needed to establish clear guidelines for selecting the appropriate material for rhinoplasty.

Declarations

Competing interest: No competing interest.

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