



REVIEW ARTICLE

USE OF GRAFTS MATERIALS IN DORSAL AUGMENTATION RHINOPLASTY

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Abstract

Background: Various grafting materials are widely used in rhinoplasty. However, the choice of the optimal material in different clinical situations remains a matter of debate. The author analyzes the available literature on the various materials used in rhinoplasty to evaluate the advantages and disadvantages of each.

Methods: For literature analysis, Cochrane Library, Embase and PubMed websites were searched. Autograft, (septal cartilage, auricular cartilage, costal cartilage), allograft, bone grafts, soft tissue grafts, 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. From the 127 articles considered in the analysis, 57 articles that met the inclusion criteria were included. Autologous cartilage grafts are widely used for dorsal augmentation. Autografts can provide varying amounts of cartilage when high structural stability is required, bone can be used. However, surgery to harvest a cartilage autograft is not in all cases acceptable to patients due to the duration of the operation and can cause unpleasant complications at the donor site, such as prolonged pain, pneumothorax, and scarring. An alternative to autograft is allografts (irradiated and non-irradiated rib) and the acellular dermal matrix has the advantage of eliminating the need for an additional surgical site.

Conclusions: With this comprehensive review, the authors hope to clarify the choice of the most optimal material, which can enable the surgeon to obtain a stable nasal architecture, optimal aesthetic and functional results. Further research is needed to establish clear guidelines for selecting an appropriate rhinoplasty material.

Keywords: Autografts; Allografts; Alloplastic Materials; Dorsal Augmentation Rhinoplasty.

Introduction

Rhinoplasty is one of the most applicable surgical interventions in modern aesthetic surgery. It strengthens the harmony of the face and the proportions of the nose, and may also help relieve breathing problems.^{1,2}

Dorsal augmentation rhinoplasty addresses aesthetic and functional disorders caused by nasal dorsum deficiency and is performed using a variety of surgical techniques and grafting materials, all of which have distinct advantages and disadvantages.³

Etiology of nasal deformity

- **Congenital:** Cleft palate
- **Hereditary:** Large dorsal hump
- **Traumatic:** Crooked nose
- **Iatrogenic:** Previous septoplasty/rhinoplasty

Figure 1. Etiology of nasal deformation

To date, there is no system for selecting the optimal material for reconstruction of the nasal septum depending on the clinical situation; there is no analysis of long-term results and possible complications when using various grafts. Graft selection remains the greatest challenge for surgeons performing in dorsal rhinoplasty.⁴

A number of materials are used in rhinoplasty surgery, these include autologous implants (harvested from the patient's own tissue), allogeneous materials (obtained from cadavers), alloplasts (synthetic implants).⁵⁻⁸

Graft materials

- **Autograft:** auricular cartilage, septal cartilage, rib cartilage, iliac crest bone
- **Homograft:** irradiated rib, pooled acellular dermis
- **Synthetic:** silicone, poly-tetra-fluoro-ethylene (Gore-Tex), polyamide mesh
- **Inert bio-implant:** coral, ivory

Figure 2. Graft materials

Each has advantages and disadvantages; these are discussed in this article.

Defects in the dorsal profile are classified into major and minor defects. Small defects can be repaired by placing septal or conchal cartilage precisely along the dorsum⁹. Large dorsal defects require total dorsal augmentation and require a large volume of graft material, autologous sources such as rib autografts and autologous bone grafts of the external table skull for total dorsal augmentation.¹⁰

The main dorsal defects are classified based on their anatomical location: saddle deformity and upper back

curvature.¹¹

A saddle deformity results from excessive angulation of the anterior septum creating an apical depression or separation of the dorsal septum. An upper back tilt is attributed to excessive removal of the nasal bones, which causes a very low and deep root.

Rhinoplasty approaches

- **Endonasal (closed) approach:**
 - Incisions placed inside the nasal cavity only
- **External (open) approach:**
 - Incisions placed inside the nasal cavity and outside on the columella (Rethi Goodman's gull wing or flying bird incision)

Figure 3. Rhinoplasty approaches

The ultimate goal of dorsal augmentation rhinoplasty is to create a soft, smooth nasal bridge with dorsal aesthetic lines. Dorsal nasal reconstruction procedures will include grafts, flaps, osteotomies, as well as camouflage operations. During dorsal augmentation rhinoplasty, the graft is placed in the area of the defect under the periosteum.

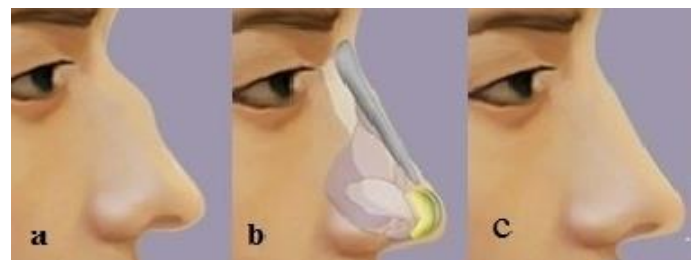


Figure 4. Schematic stages of dorsal rhinoplasty using transplant

The choice of transplant remains the biggest problem for surgeons performing rhinoplasty:^{12,13}

- Optimal material features include;
- Biocompatibility, minimal risk of immunological response;
- Structural elasticity and rebound over physiological and sustained time;
- Easy access with plenty of volume;
- Minimum cost;
- No donor site morbidity.

The ideal graft material must also be readily available in sufficient quantities and cost-effective; it is important to emphasize that no ideal material currently exists.

Graft materials have unique characteristics, uses, and a literature review presents their uses, risks, and benefits.

This review discusses the current and most vaccine options available to the source of the vaccine that may allow the surgeon to obtain optimal aesthetic and functional results fillers are used for small corrections, fascia and fat can be used, supporting implants or grafts are used for large corrections.

Nasal reconstruction often uses autologous bone and/or cartilage.¹⁴⁻¹⁶ Advantages include lowest extrusion and resorption rates and perfect immunogenicity.¹⁷

Autografts

The use of autografts often requires additional surgical fields, complications from donor sites.¹⁸

Cartilage autograft (nasal septum, ear and costal) remains the gold standard for structural nasal reconstruction. The most commonly used autobone are the iliac crest bone and calvarian bone.

Septal cartilage

When performing operations for aesthetic reasons, the nasal septum often serves as a source of plastic material necessary to perform the operation, which, with excessive resection, also leads to an increase in complications of an aesthetic and functional nature. Septal cartilage is ideal for rhinoplasty because of its location, but it is often deficient in some patients.

Septal cartilage consists of 78% water, 8% collagen, 3% sulfated glycosaminoglycan and contains 25 million cells per gram.¹⁹

Septal cartilage is preferred for rhinoplasty because of its ease of access, minimal donor site morbidity, and it provides a single surgical field. The septal cartilage is stable and resistant to infection, showing minimal deformation and resorption.

Conchal cartilage

Conchal cartilage is often used for nasal alar grafts because of its curved shape, but its volume is also limited. The conchal cartilage of the ear has a characteristic curve and is softer and more flexible than septal cartilage. conchal cartilage is ideal for nasal tip grafts.²⁰

Conchal cartilage advantages include low morbidity, relatively large graft volume, and resistance to resorption can be corrected with PDS foil suture fixation,

The average surface of the removed amount of conchal cartilage is 3.5-4.5 cm², it is necessary, with care taken to keep at least.²¹

Costal cartilage

Costal cartilage abundant volume, relative ease of harvesting is considered advantages for reconstructing severe and complex saddle nose deformities.^{22,23}

The main indications for the use of costal cartilage in plastic surgery are:

- Material deficiency as a result of previous rhinoplasty
- Insufficiency of the nasal skeleton due to trauma

The use of costal cartilage is dictated by a number of features of its structure, which have a number of obvious advantages in comparison with ear cartilage:

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

Costal cartilage is collected based on the amount of material required and is possible in several places:

- Cartilages of the 11th ribs on both sides

Important limiting aspects of costal cartilage grafting include donor site morbidity and risk of warping.²⁴

However, the operation of taking a cartilage autograft is not in all cases acceptable to patients due to operative time and can cause distressing donor-site complications such as prolonged pain, pneumothorax, scarring, second surgical site.

Allografts

Alternatively, allografts may be preferable and more acceptable to patients.²⁵⁻²⁷ Allografts can be obtained from patients undergoing septoplasty or taken from donor banks. If taken from patients, patients are screened for viral infections before surgery, including hepatitis B, hepatitis C, and HIV. After the septal cartilage is obtained, the cartilage is placed in a solution containing thiomersal (white merithiolate) and stored in a refrigerator at 4°C in bottles labeled with the

date of extraction.

Allografts obtained from donor banks are disinfected, checked and stored in sterilized glass bottles. Aseptically processed non-terminally sterilized, fresh-frozen allografts from deceased donors were developed and made available as an intended option.²⁸ A costal allograft regulated by the Food and Drug Administration is provided sterilely; untreated donor tissues are pre-treated with a low dose of gamma radiation.

Cadaveric costal cartilage is especially used to support and lift the dorsum of the nose. The advantages include no additional intervention, reduced operating time and the ability to supply in desired quantities.

Its main disadvantages are resorption and curvature. The rate of resorption varies across studies. During preparation, the cartilage is irradiated with 30-50 thousand Gy. It is believed that with increasing radiation power, collagen damage increases and resorption increases accordingly.²⁹

Fresh frozen cadaveric costal allografts have higher rates of resorption, infection, and non-donor site graft-related complications compared with autologous cartilage.

Statistics on this topic are very contradictory. Absorption rates ranging from 1 to 75% have been reported in the long term (5 years or more).³⁰ Resorption can be mild-moderate-complete. It is impossible to predict the resorption process for each patient at the same time.

Infection. It occurs from 1 to 9%. It can often be controlled with antibiotics. In rare cases, the graft may need to be removed.³¹

- Curvature. It is rare when the central part of the cartilage is used or grafts are prepared using the oblique section method.³² Before using the cartilage, it should be kept in saline solution for about 45 minutes and then checked.

Large saddle nose defects are reconstructed using bone graft materials that provide adequate structure for reconstruction. Of the bone allografts, lyophilized Freeze-Dried Allograft Bone is currently used because it is strong enough to provide structural support and overcome soft tissue resistance.³³

AlloDerm is a lyophilized sheet of human dermis collagen matrix and allows the ingrowth of host tissue is a good alternative to autogenous dorsal rhinoplasty.³⁴ Partial AlloDerm absorption, is a definite disadvantage.

Alloplastic materials

Alloplastic materials can be used successfully for dorsal augmentation if both the patient and the surgeon understand the risks involved.³⁵ The most commonly used alloplastic materials for either aesthetic or reconstructive rhinoplasty include silicone, expanded polytetrafluoroethylene (Gore-Tex; W. L. Gore and Associates, Flagstaff, Ariz.), or porous high-density polyethylene (Medpor; Porex Medical, Fairburn, Ga.).³⁵⁻³⁷

Each of these materials has unique structural and biocompatibility qualities and therefore has been used for various procedures and indications. As such, different outcomes and complication profiles can be expected when using any of these materials for procedures involving the underlying nasal architecture.³⁸

Silicone implants should not be used for the tip of the nose because it is unable to build the underlying structure, thereby causing an unnatural result and potential side effects.

Xenograft

Xenograft costal cartilage is rarely used because of significant resorption from strong host immune reactions to foreign antigens in the graft.

Hyaluronic acid (HA)

Rhinoplasty uses hyaluronic acid (HA) due to its effectiveness and short recovery time,³⁹⁻⁴² but HA filler injections are not without complications: blindness and skin necrosis have been reported as a result of nasal filler injections and injection site reactions; infection; hypersensitivity; vascular disorders, etc.⁴³

Liquid cartilage grafts

In aesthetic rhinoplasty for minor contour deformations of the nasal surface, liquid cartilage is also used and its use is a microinvasive procedure.⁴⁴ 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.^{45,46} Its disadvantage is poor mechanical stability and rapid decomposition, leading to wrinkling and deformation.

Autologous fat

Currently, nasal lipofilling using autologous fat is

one of the minimally invasive methods for correcting the aesthetics and contour of the nose; this method is effective, is a relatively low-morbidity and has a low incidence of complications.⁴⁷⁻⁴⁹ Fat injection has been used for over 20 years in facial soft tissue corrections.⁴⁹ Mild complications that did not require additional treatment or surgery were reported.^{50,51}

Despite the growing popularity of fat injections for aesthetically improving the shape of the nose, there is no consensus on the advantages and disadvantages of fat injections.

Platelet-rich fibrin (PRF)

Aesthetic rhinoplasty also uses platelet-rich fibrin (PRF) without cartilage or mixed with high-density fat.^{52,53} Platelet-rich fibrin reduced the rate of resorption of sliced cartilage on the dorsum of the nose, either increasing its viability or maintaining its shape.^{54,55}

The use of platelet-rich fibrin in combination with diced cartilage for dorsal camouflage and augmentation, tip management and revision rhinoplasty have shown good results.⁵⁶ PRF plays a role in stimulating the healing cascade of tendon, muscle cartilage and bone regeneration.⁵⁷

The use of PRF in combination with allogeneic nasal septal cartilage had a positive effect on wound healing, reduced postoperative edema, and improved aesthetic results.

Despite significant advances in biomedical engineering, the ideal transplant material has not yet

been created. The physical properties of the graft must match those of the recipient site with proportionate levels of stiffness or flexibility. The surface properties of the graft should facilitate the attachment of surrounding connective tissue without excessive mesenchymal infiltration and capsule formation.

Dorsal augmentation in rhinoplasty remains a complex and demanding art. Modern technologies allow the use of both autografts and allografts. Various graft materials have been described, each of which has limitations and advantages.

Declarations

Conflicts of interest and financial disclosures

The author declares that he has no conflict percent and there was no external source of funding for the research in question.

Ethical approval

The study was approved by the University ethics committee and was conducted in accordance with the Declaration of the World Medical Association.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Source of funding

The work was not funded.

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ՓՈԽՊԱՏՎԱՆՅՈՒԹԵՐԻ ԿԻՐԱՌՈՒՄԸ ԶԹԻ ՄԵՉԸԻ ՌԻՆՈՊԼԱՍՏԻԿԱՅԻ ՄԵՉ

Արմեն Հարությունյան¹

- ¹ «Աստղիկ» բժշկական կենտրոնի դիմաձևնոտային վիրաբուժության բաժանմունքի պլաստիկ վիրաբույժ, Երևանի Մ. Հերացու անվան պետական բժշկական համալսարանի Վիրաբուժական ստոմատոլոգիայի և դիմաձևնոտային վիրաբուժության ամբիոն, Հայաստան

Ամփոփում

Ներածություն. Ռինոպլաստիկայի մեջ լայնորեն կիրառվում են տարբեր փոխպատվաստման նյութեր: Այնուամենայնիվ, տարբեր կլինիկական իրավիճակներում օպտիմալ նյութի ընտրությունը մնում է քննարկման առարկա: Հեղինակը ուսումնասիրում է ռինոպլաստիկայի մեջ օգտագործվող տարբեր նյութերի վերաբերյալ առկա գրականությունը՝ գնահատելու յուրաքանչյուրի առավելություններն ու թերությունները:

Մեթոդներ. Cochrane Library, Embase և PubMed կայքերը որոնվել են գրականությունը վերանայելու համար: Օգտագործված որոնման հիմնաբառերն էին աուտոփոխպատվաստում (միջնապատի աճառ, ականջի աճառ, կողային աճառ), ալոփոխպատվաստում, ոսկրային փոխպատվաստում, փափուկ հյուսվածքների փոխպատվաստում, PRP, հեղուկ աճառ, ռինոֆիլերներ և ալոպլաստիկ իմպլանտներ; Գնահատվել է յուրաքանչյուր նյութի արդյունավետությունը, ռեգորբցիայի արդյունքները, բարդությունները, հիվանդների ֆունկցիոնալ և էսթետիկ բավարարվածությունը: Վերլուծության մեջ վերանայված 127 հոդվածներից ընդգրկվել են ներառման չափանիշներին համապատասխանող 57 հոդվածներ:

Աուտո աճառի փոխպատվաստումը լայնորեն կիրառվում է քթի մեջքի մեծացման համար: Աուտոփոխպատվաստները կարող են ապահովել աճառի տարբեր քանակություն, երբ պահանջվում է բարձր կառուցվածքային կայունություն, կարող է օգտագործվել աուտոոսկորը: Այնուամենայնիվ, աճառի աուտոփոխպատվաստման վիրահատությունը ոչ բոլոր դեպքերում է ընդունելի հիվանդների համար՝ վիրահատության տևողության պատճառով և կարող է տհաճ բարդություններ առաջացնել դոնորի տեղում, ինչպիսիք են երկարատև ցավը, պնևմոթորաքսը և սպիները: Աուտոփոխպատվաստման այլընտրանքը ալոփոխպատվաստներն են (ճառագայթված և չճառագայթված կողեր), իսկ առանց բջջային մաշկային մատրիցն առավելություն ունի՝ վերացնելով լրացուցիչ վիրաբուժական տեղամասի անհրաժեշտությունը:

Եզրակացություն. Այս համապարփակ վերանայմամբ հեղինակները հույս ունեն պարզաբանել ամենաօպտիմալ նյութի ընտրությունը, որը վիրաբույժին թույլ կտա հասնել քթի օպտիմալ էսթետիկ և ֆունկցիոնալ արդյունքների: Հետագա հետազոտություններ են անհրաժեշտ՝ ռինոպլաստիկայի համապատասխան նյութ ընտրելու հստակ ուղեցույցներ սահմանելու համար:

ИСПОЛЬЗОВАНИЕ ТРАНСПЛАНТАТОВ ПРИ ДОРСАЛЬНОЙ АУГМЕНТАЦИОННОЙ РИНОПЛАСТИКЕ

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Абстракт

Введение: В ринопластике широко используются различные трансплантационные материалы. Однако выбор оптимального материала в различных клинических ситуациях остается предметом дискуссий. Автор анализирует имеющуюся литературу о различных материалах, используемых в ринопластике, чтобы оценить преимущества и недостатки каждого из них.

Методы: Для анализа литературы был проведен поиск на веб-сайтах Cochrane Library, Embase и PubMed. В качестве ключевых слов для поиска использовались аутоотрансплантат (перегородочный хрящ, ушной хрящ,

реберный хрящ), аллотрансплантат, костные трансплантаты, трансплантаты мягких тканей, PRP, жидкий хрящ, ринофиллеры и аллопластические имплантаты; оценивались эффективность применения каждого материала, результаты резорбции, осложнения, функциональная и эстетическая удовлетворенность пациентов. Из 127 статей, рассмотренных в анализе, были включены 57 статьи, соответствующие критериям включения.

Аутологичные хрящевые трансплантаты широко используются для дорсальной аугментации. Аутоотрансплантаты могут обеспечить различное количество хряща, когда требуется высокая структурная стабильность, можно использовать кость. Однако операция по взятию хрящевого аутоотрансплантата не во всех случаях приемлема для пациентов из-за продолжительности операции и может вызвать неприятные осложнения на донорском участке, такие как продолжительная боль, пневмоторакс, рубцевание. Альтернативой аутоотрансплантату являются аллотрансплантаты (облученные и необлученные ребра), а бесклеточный дермальный матрикс имеет то преимущество, что исключает необходимость в дополнительном хирургическом участке.

Выводы: С помощью этого всестороннего обзора авторы надеются прояснить выбор наиболее оптимального материала, который сможет позволить хирургу получить стабильную архитектуру носа, оптимальные эстетические и функциональные результаты. Необходимы дальнейшие исследования, чтобы установить четкие рекомендации по выбору подходящего материала для ринопластики.