Current Trends in Dorsal Augmentation Materials: A Systematic Review

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Introduction

In rhinoplasty, the nasal dorsum represents a challenging nasal subunit to repair, enhance or tame. There are many described surgical techniques to address the nasal dorsum and there have been many materials described for dorsal augmentation. Augmentation materials can be broadly classified as autologous, homologous, or alloplastic grafts. Dorsal defects that warrant augmentation include, but are not limited to, restoration of dorsal height, radix depth, nasal tip projection, and structural support, as well as saddle nose deformity and deficient osteocartilaginous dorsum.

As materials have been developed and approved for use, the preference for the materials has shifted. A systematic review of dorsal augmentation materials was performed by Lee et al in 2011[1]. This review ranged from 1950 to 2010 and was an exhaustive review of all materials represented in the literature[1]. After publication of that review, there has been ample time for development, implementation, and favor for various materials within the industry. The goal of this review is to present a clear and objective systematic review of recently published data for available dorsal augmentation materials and the paradigm shift in their use within the industry.

Methods and Material

A systematic review of the literature in the English language on articles describing dorsal augmentation was conducted in January 2020. The search strategy involved using the key terms described in the aforementioned systematic review. Key terms included "rhinoplasty" and "dorsum" using PubMed, Ovid Medline, and Cochrane Library. This methodology yielded 319 articles. As outlined by Lee et al[1], inclusion criteria mandated retrospective or prospective data provided within the results. Abstracts were screened for the outlined inclusion and exclusion criteria yielding 94 unique articles for full text review. After complete literature review information for 23 articles were included[3-28]. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart for inclusion and exclusion is presented in Figure 1.

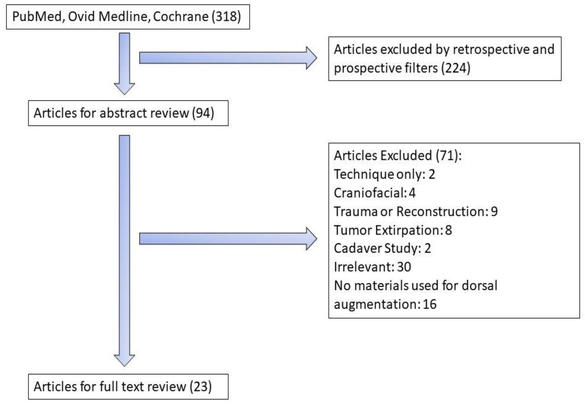

Figure 1. Prisma Flowchart for inclusion and exclusion

Results

Papers reviewed were predominantly retrospective in nature 17 (74%) in conjunction with six (26%) prospective studies. Studies were assigned a level of evidence for research according to the Levels of Evidence for Prognostic Studies outlined by the American Society of Plastic Surgeons[2]. The majority of studies were level IV studies (96%) with only one study being level I evidence (4%)[3-28].

Cartilage:

- Five articles used diced cartilage wrapped in fascia.
- Three articles utilized autologous costal cartilage grafts.
- One utilized cartilage preserved from dorsal hump resection.
- One used septal cartilage diced and mixed with autologous whole blood (turkish delight)[3].
- One used free diced cartilage and compared results with two other groups with similar surgical technique and the addition of fascia wrapping or fascia alone[8].
- Outcomes reported were satisfactory. Diced cartilage in autologous whole blood (turkish delight) did not show a significant difference in long term nasal dorsum cartilage thickness despite objective changes in short term follow up and overall patient satisfaction[3].

Complications:

- Chondrofascial grafts consisted of a hematoma in the postauricular donor area, and skin necrosis in the conchal area, which was treated by excision and suturing.
- Autologous costal cartilage showed notable graft related complications.
- Park et al reported a 12% complication rate[5]. This included warped grafts and infections.
- Hoehne noted visibility of the graft in 14.3% of patients, warping in 4.5%, absorption leading to supratip depression in 10.7% and caudal deviation of the graft in 7.1%[4].
- Miranda et al reported warping of the dorsal rib graft in 26% of patients, and under corrected deviation in 12% of the patients.
- Further Miranda et al reported in the patients who received combined rib graft with Expanded Polytetrafluoroethylene (Gore-Tex) (e-PFTE), 8% presented with infection or extrusion of the implanted material. One patient experienced necrosis of the transcolumellar incision flap[6].

Acellular Dermal Matrix, Autologous Fat, Fascia, and Autologous Bone:

- All articles in review reported good outcomes with overall patient satisfaction. One study (fascia) reported surgical site hematoma requiring drainage.

Synthetic materials:

- Synthetic implants such as e-PFTE, Porous high-density polyethylene (Medpor), and Hyaluronic acid all reported good outcomes.
- Complications related to e-PFTE were reported in two studies. One reported a 5.1% complication rate and a 4% infection rate with 3 out of 76 patients requiring implant removal[7]. Another reported a low infection rate of 0.38% out of 1058 patients[10].
- Porous high-density polyethylene technique (Medpor) was represented by a single study which reported a rejection rate of 5.1%, with three of 58 patients experiencing foreign body reactions and implant rejection[8].
- Hyaluronic acid was represented by a single study which reported a high satisfactory rate amongst patients and surgeons, with no major complications[9].

Image 1. Photo taken from Cerkes et al. for visual representation of diced cartilage grafts wrapped in rectus abdominis fascia[12].

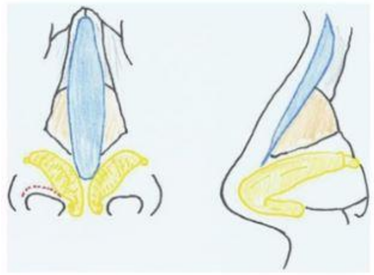

Image 2. Photo taken from Hong et al. for visualization of Gore-Tex implants[15].

Conclusions

- Autologous and homologous tissue materials show good efficacy with relatively low complication rates.
- Research favors the use of cartilage as opposed to other autologous, homologous, or alloplastic materials.
- Our systematic review revealed the level of evidence for literature on dorsal augmentation materials is still predominantly low level by definitions of Levels of Evidence for Prognostic Studies outlined by the American Society of Plastic Surgeons as seen in the previous systematic review..
- Our systematic review suggests that methods of research within facial plastics have not dramatically changed since the investigation by Lee et al[1].
- The primary limitation of our systematic review was variable reporting of data across studies.

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