Cartilage putty: A novel use of fibrin glue with morselised cartilage grafts for rhinoplasty surgery

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Received 22 January 2014; accepted 18 July 2014

KEYWORDS
Rhinoplasty; Cartilage graft; Fibrin glue; Cleft lip

Summary Cartilage grafts have multiple purposes within rhinoplasty surgery. The senior author has previously used wrapped diced cartilage grafts but found it difficult to maintain the integrity of the graft “package” during placement. Introduction of Tisseel fibrin glue stabilises the cartilage fragments producing a rubbery mass that can be used like “cartilage putty.” This malleable construct can be inserted and moulded with less risk of dispersal.

This technique has now been used on nineteen patients. It has provided a valuable method of reconstruction especially in complex cases such as revision rhinoplasty and patients with a thin dorsal skin envelope. There has been no evidence of graft absorption or requirement for additional surgery to date.

The addition of Tisseel to wrapped diced cartilage grafts, has proven in this series of complex rhinoplasty patients, to be a useful adjunct which aids insertion and contouring. Furthermore, beneficial effects on healing have been demonstrated which contributes to good quality long-term cosmetic results.

Level of Evidence V.

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Introduction

The use of diced cartilage grafts in rhinoplasty surgery is not a new technique being initially described as early as 1943 by Peer. However, the use of autologous cartilage was superseded by prosthetic agents during the latter half of the twentieth century. The description by Erol in 2000, of
"The Turkish Delight" technique in which diced cartilage grafts are wrapped in Surgicel (Johnson & Johnson, Somerville, N.J.), led to a renewed interest. This group provided evidence of extensive use of this technique in primary and secondary rhinoplasty surgery and demonstrated low levels of revision surgery (0.7%) and graft resorption (0.5%). Other authors have also presented evidence of the reliability of this technique. In contrast, Daniel has questioned the use of Surgicel, describing absorption of all surgicel wrapped diced grafts within 3 months. This author has advocated the use of diced cartilage graft wrapped or covered in temporalis fascia. The use of acellular cadaveric dermis (Alloderm) has also been reported.

The senior author has previously used diced cartilage grafts wrapped in Surgicel for augmentation of the nasal dorsum. However, the graft can be hard to handle complicating initial placement with the additional risk of early movement. In an attempt to overcome these issues, he developed a technique whereby a fibrin sealant (Tisseel, Baxter UK, Newbury, UK) was used to coat morselised graft to create a “cartilage putty”. This facilitates the handling and insertion of the construct and aids contouring of the graft. Similar techniques using diced cartilage graft with fibrin glue have been described.

We also believe that Tiseel plays a role in promoting graft take and generalised wound healing. This has previously been shown with skin grafts and also within our department it has been shown to improve alveolar bone graft survival (presented but unpublished). In a recent publication where diced cartilage grafts were stabilised using autologous tissue glue, the authors suggest that fibrin glue promotes cartilage growth and stabilisation. We believe Tisseel has the same properties and this is of particular benefit in the more complex secondary rhinoplasty patients.

Surgical technique

Following a standard open rhinoplasty, cartilage graft harvested from the nasal septum, conchal bowl or costochondral cartilage is morselised using a bone mill (Figure 1). The morselised graft is then coated with Tisseel in its undiluted form (Figure 1). This construct can then be shaped, carved and moulded prior to insertion (Figure 2). The graft is then placed beneath the dorsal skin envelope and further moulding is carried out as required. A nasal splint is applied and left in-situ for up to three weeks.

Clinical series

This technique has now been used in 19 patients. It has provided an invaluable method of reconstruction especially in complex cases in which the individuals have had previous nasal surgery and/or rhinoplasties (n = 5). It has provided a solution in patients with a previous history of extrusion.
(n = 2) or a thin dorsal skin envelope (n = 3) (Figures 3 and 4). It has also been used in patients with a cleft nose deformity both as a primary and secondary procedure (n = 13) (Figures 5 and 6).

All patients have been followed-up for a minimum of a year (range 12–43 months). No early complications have been recorded and there has been no requirement for additional surgery. Subjectively, there has been no evidence of graft absorption and patients have reported satisfaction with the aesthetic and functional results.

Case 1

A 63 year old female presented with a significant nasal deformity and problems with breathing. Following nasal trauma age 13, she had gone on to have four rhinoplasty procedures, including cartilage augmentation and Gortex implants on two occasions, the first requiring removal due to exposure. On examination she had a heavily scarred nasal dosurm with a thin nasal skin envelope and palpable implant material. This was associated with a saddle deformity and a broad poorly supported nasal tip (see Figures 3 and 4).

An open septorhinoplasty was performed and a costochondral graft was harvested and used to provide a solid collumellar strut. Further graft was morselised and coated in Tisseel. This construct was then moulded prior was to insertion and placed under the dorsal skin envelope. A nasal splint was applied following further moulding and left in-situ for ten days.

The patient experienced no early complications. At 3 month follow-up there was improved nasal contour and

![Image](https://via.placeholder.com/150)

Figure 3 Case 1. Patient presents following four previous rhinoplasty procedures, with a heavily scarred nasal dosurm and palpable implant material (above). Post-operative views at 3 months (below).
symmetry and the patient was happy with the aesthetic result (see Figures 3 and 4). The skin envelope remained thin but with no evidence of compromise. She reported good air entry bilaterally.

Case 2

A 33 year old male with a history of bilateral cleft lip and palate was seen with concerns regarding the shape of his nose. Staged cleft lip and palate repair, followed by alveolar bone graft had been performed in childhood. He had then gone on to have revision cleft lip repair together with an open septrhinoplasty three years previously. On examination he had a nasal tilt to the right side with a flattened nasal dorsum and tip (see Figures 5 and 6).

An open septrhinoplasty was performed and a costochondral graft was harvested. The graft was morselised and coated in Tisseel. This construct was then moulded prior to insertion and placed under the dorsal skin envelope. A nasal splint was applied following further moulding and left in-situ for ten days.

The patient experienced no early complications. At 12 month follow-up there was improved nasal symmetry and the patient was happy with the aesthetic result (see Figures 5 and 6). This result was maintained three years following surgery.

Discussion

Although cartilage graft is commonly used in rhinoplasty surgery potential problems are well recognised. The use of diced cartilage grafts provides a solution to a number of these problems. It is of particular advantage in the cartilage depleted patient during revision rhinoplasty surgery.2 Excised nasal cartilage which would otherwise be discarded during a standard rhinoplasty, can be diced and used without the need for a secondary donor site. Where greater volumes of cartilage are required, conchal or costochondral cartilage can be used with equal efficiency. Diced cartilage grafts are also associated with reduced visibility as a more even rounded surface is created. This can be used alone for augmentation of the radix, dorsum or tip and in cases of more severe deformity, diced cartilage grafts can be used to camouflage the onlay block graft. However, in individuals with a thin contracted skin envelope, the sparse subcutaneous tissue leads to visibility of even the smallest contour irregularities. This together with the potential risk of dispersal of a loose graft led to the introduction of wrapped diced cartilage grafts.2,4,6 More recently, Yimaz et al.13 demonstrated a high degree of cartilage cell viability following grafting in a rabbit ear model. Surgicel inhibited cell proliferation, although it did not affect cell survival and actually increased collagen production. This is supported by the findings of Erol2 who demonstrated a mosaic-type fibrocartilaginous alignment in graft specimens excised three to twelve months following surgery. In contrast to these findings, Calvert et al.4 demonstrated viable and non-viable cartilage within the grafts wrapped in Surgicel at similar time points. This was associated with dense fibrous tissue, residual pieces of Surgicel and only scattered evidence of regeneration. Based on these histological findings they suggested that resorption of these surgical wrapped grafts was due to a foreign body reaction.7 In contrast, the grafts wrapped in fascia contained viable regenerating cartilage, within an organised fibrous tissue.

The use of AlloDerm has also been reported with low operation rates and good cosmetic outcome.6 Furthermore, the viability of AlloDerm wrapped cartilage grafts has been demonstrated in an animal study with the authors suggesting superior results with alloDerm than autogenous fascia.15

The senior author has been using Surgicel wrapped diced grafts for some time in rhinoplasty surgery and has found the techniques especially beneficial in cleft noses and revision rhinoplasties. Absorption not been a significant problem but technical insertion of the wrapped graft and early movement beneath the skin envelope has been a drawback. This led to the introduction of morselised

Figure 4 Case 1. Additional pre-operative (above) and post-operative views (below).
cartilage grafts bound by Tisseel to create a malleable "cartilage putty". Since the introduction of this modification, insertion of the graft construct has been facilitated and movement has been reduced. Furthermore, it can be carved and reshaped to suit the specific defect regardless of size be it as an onlay graft or to camouflage a cantilever graft. The use of fibrin glue with morselised cartilage graft also negates the need for any form of wrapping material thus reducing the risk of resorption or the need for further donor site scars. Other authors have also reported success using diced cartilage graft with Tisseel both with regards to ease of application and long-term results.7,8

Bullocks et al.10 used autologous tissue glue in addition to diced cartilage grafts to create a malleable construct without the need for a wrapping material. They use a specimen of the patient’s blood to produce an autologous tissue glue and in their series report no major complications or requirement for explantation. They recommend the use of an autologous tissue glue to reduce the risk of disease transmission and immunogenic reactions. We believe the safety and efficacy of Tisseel has been proven and this ‘off the shelf’ product negates the need for additional equipment required to produce autologous glue.

It has also been suggested that the addition of tissue glue improves graft survival due to growth factors contained within these products.10,16 The benefits of fibrin glue have been presented in association with skin graft take9 and the senior author has demonstrated improved...

Figure 5  Case2. A cleft lip patient presenting with a flattened nasal dorsum and rotated tip following previous open septorhinoplasty (above). Post-operative views at 12 months (below).
alveolar bone graft survival in cleft patients when Tisseel is used (presented but unpublished). With regard to cartilage graft, Kaufman et al.\(^6\) in an animal model, demonstrated enhanced cartilage survival with the addition of a fibrin sealant (Tisseel). They demonstrated reduced resorption of morselised cartilage grafts and reduced chondrocyte dropout rates. These findings are supported by the study of Tasman et al.\(^8\) who reported good graft stability when assessed by sonographic morphometry over a 15 month follow-up period. They also demonstrated histological evidence of viable cartilage and regeneration within the grafts.

Our results also suggest that the addition of a fibrin glue may have beneficial wound healing properties. This has been particularly significant in patients with multiple previous surgeries and a thin skin envelope. Wound healing problems have been overcome in these patients with conservative measures, where previously they would have necessitated further surgery.

The addition of Tisseel to morselised cartilage grafts, has proven in this series to aid insertion, maximise healing and contribute to good long-term cosmetic results. We are not advocating this technique as a solution to all problems or as a substitution for carved rib grafts or strut grafts, but believe it to be a useful adjunct for use especially, in the complex rhinoplasty patient.

Conflict of interest

None.

Funding

No funding was received supporting this work. Neither author has any financial interest in the products used (as below).

Tisseel, Baxter UK.

References