Permacol in Augmentation Rhinoplasty

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50.1 Introduction

Rhinoplasty surgeons often wish to implant graft materials into the nose, to either augment the tip or nasal dorsum or to camouflage irregularities of the bony dorsum or the upper and lower lateral cartilages. A range of both autologous and non-autologous grafts are available. Autologous cartilage is usually thought of as the ideal graft, but there are times when it is not readily available in the nose or its use is undesirable (e.g. in autoimmune conditions). A wide range of non-autologous materials provide alternatives in such cases, including Silastic, Gore-Tex and a growing number of biological products. Permacol™ was introduced for hernia repair and soft tissue damage but has been used increasingly in a wide range of soft tissue reconstructive procedures. The authors describe how and when Permacol is used in rhinoplasty.

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The ideal graft material for augmentation should be readily available in the required volume and economical. It should provide volume replacement that is stable over time; it should be easy to shape and should maintain the structural integrity of the nose. It must be biocompatible and should not cause discolouration of the overlying skin, become infected or extruded. It must not permit transmission of infective agents to the recipient. The authors believe that Permacol offers all of these properties.

Permacol™ is a sheet of acellular cross-linked porcine dermal collagen and its constituent elastin fibres. It was been approved for surgical soft tissue repair in Europe in 1998. It is soft and moist and is claimed to be non-allergenic, non-toxic and devoid of foreign body response (unpublished data, Tissue Science Laboratories Plc). It is pliable but provides structural integrity while being invisible and impalpable when placed below the dermis. The material is easy to fashion and suture. The manufacturing process produces a graft that is resistant to collagenase and is sterilized by gamma irradiation. The material comes in a variety of dimensions, with variable thickness ranging from 0.5 to 1.5 mm. The current cost of a single unit of 5×5 cm Permacol with 0.5-mm thickness is £240.

Autogenous grafts require increased operative time for harvesting and have morbidity and potential for complications resulting from this. There is a need to slightly overcorrect the deformity to allow for resorption of cartilaginous grafts. These problems are avoided using Permacol, which, as

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Fig. 50.1 Permacol biocompatibility reduces the infection and extrusion rates found with other synthetic materials

an 'off-the-shelf' product, is readily available and has been shown not to degrade while allowing vascularisation and integration with host collagen [1]. This biocompatibility reduces the infection and extrusion rates found with other synthetic materials (Fig. 50.1) [2]. The graft is sterilized, thus reducing infection risks. Importantly, unlike bovine products, there is no risk of transmission of prion infection.

Permacol has been used widely in abdominal and gynaecological surgery since its introduction, but use in surgery to the face has been less widely reported. Saray [3] reported some success with usage of Permacol for facial contour augmentation, and Benito-Ruiz et al. [4] has published a successful reconstruction of the lip using Permacol. Fu et al. [5] has published a single case report, and Pitkin et al. [2] have used Permacol in over 45 rhinoplasty patients and have reported good results with just two complications, of which only one required the removal of the graft. They found that the infection rate with Permacol is lower than Gore-Tex (4–5.4%) and silicone (removal incidence 9.8%) and that Permacol provides excellent cosmetic results [2]. Thinakarajan and Srinivasan [6] reported the use of Permacol augmentation in 12 patients with a minimum of 12 months follow-up, of whom 11 had successful outcomes, but in 1 patient the Permacol extruded at 2 months.

There are a number of other biocompatible grafts available. Results of augmentation rhinoplasty using AlloDerm (acellular dermis) have been reported, but partial resorption rates of up to 67% have been described [7]. Surgisis (acellular pig intestinal mucosa) is being used in some centres, especially in the USA. There are no comparative studies available. In a recent systematic review, there is surprisingly little difference between the various grafts in terms of complication rates, including infection and extrusion rates, in the published literature. However, outcomes, both in terms of objective measures and patient-reported outcomes, are too infrequently reported (only 35% of published series) to allow meta-analysis [8].

50.2 Surgical Techniques

Permacol comes in a variety of sizes, and between 0.5- and 1.5-mm thickness may be used, depending upon indication and volume of augmentation required. The authors most frequently use 3×3 cm and 0.5-mm thickness.

Grafts may be sited by an open or closed rhinoplasty approach, depending on other cosmetic or functional indications. One dose of intravenous antibiotic is administered perioperatively. At the end of the procedure, Plaster of Paris is applied over a layer of SteriStrips, and the patient is given 5 days of oral co-amoxiclav (providing there is no penicillin allergy). The dressing is removed 1 week following surgery, and the patient is reassessed at 3 and 12 months postoperatively.

50.3 Long Dorsal Onlay Graft for Contouring: Highlighting Dorsal Aesthetic Line

Permacol is ideal to place over the dorsum to smooth out any irregularities. While these are often invisible in the early postoperative period, as the skin thins with age, they may become

Fig. 50.2 (*Upper*) Preoperative patient. (*Lower*) Postoperative following revision rhinoplasty with dorsal onlay of Permacol camouflaging dorsal irregularities under thin skin and restoring dorsal aesthetic lines

apparent many years after the procedure. Some surgeons advocate draping a layer of Permacol over the dorsum and down the lateral wall of the nose. In contrast, the authors have been using a strip of Permacol over the dorsum and have found that this restores the dorsal aesthetic line (Fig. 50.2).

50.4 Use of Permacol to Camouflage Tip Irregularities

A small graft of Permacol (Fig. 50.3) can be used to camouflage irregularities at the tip. This patient underwent an open rhinoplasty, with intradomal suturing and placement of a Permacol shield graft

Fig. 50.3 (*Upper*) Preoperative patient. (*Lower*) Postoperative open rhinoplasty with intradomal suturing and placement of a Permacol shield graft

50.5 Dorsal Augmentation with Rolled Permacol 'Sausage'

When a greater volume of augmentation is desired, the authors use a rolled Permacol graft – the 'sausage roll rhinoplasty'. The graft is made from rolled 5 × 5 cm Permacol, the 'sausage roll'. Sheets, 0.5 mm thick, are used as a standard, but this can be tailored to the volume of augmentation required (Fig. 50.4). The roll is flattened and secured with two or three 5/0 Monocryl sutures, depending on length, trimmed lengthwise to size. It is important to bevel the edges of the layers, particularly at the cephalic end, to prevent a ridge at the top of the implant. The surgery is technically simple – the graft is easy to shape and trim to the required size and volume and can be

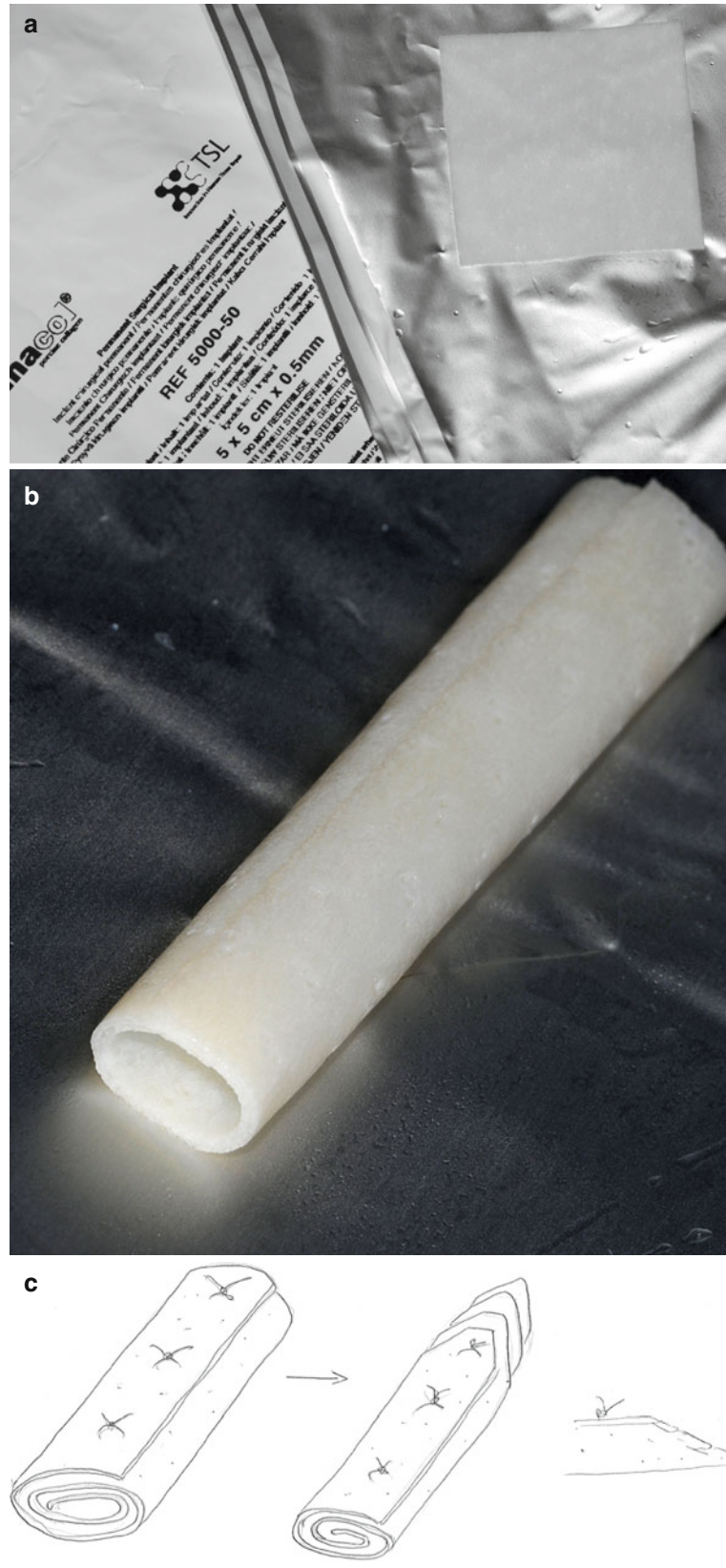

Fig. 50.4 (**a**) 5 × 5 cm sheets of Permacol. (**b**) Rolled Permacol. (**c**) Permacol 'sausage' being positioned via closed approach

Fig. 50.5 (*Left*) Preoperative. (*Right*) Postoperative after Permacol 'sausage' used to correct depressed dorsum after naso-ethmoid fracture

positioned via open or closed approaches. It feels smooth and soft under the skin and recreates pleasing dorsal aesthetic lines.

The technique would be easily reproduced in the hands of any competent rhinoplasty surgeon. Both patient morbidity and operative time have been reduced by the use of an 'off-the-shelf' product. Grafting has been combined with osteotomies, tip suturing and other techniques thought necessary.

Prior to using the 'sausage roll', when larger volume augmentation is required, the authors had used layered Permacol; similarly, use of layered AlloDerm grafts have also been described [6]. We had been unable to achieve sufficient volume augmentation in this manner without the additional use of autologous cartilage. Auricular cartilage may be rolled, but the resulting contour is often irregular. Furthermore, the patients who require greatest volume replacement frequently lack sufficient donor cartilage or are at risk of underlying inflammatory conditions attacking cartilaginous grafts. Rib and calvarial bone grafts may be used when more structural support is required, particularly when associated with an over-rotated tip. However, there is considerable donor site morbidity, and the resulting graft may undergo late distortion and warping.

The use of rolled grafts in rhinoplasty surgery has been previously described. Erol published his technique for 'Turkish delight' grafts – diced cartilage grafts wrapped in rolled Surgice [9]. However, Daniel [10] report unexpected reabsorption of all these Surgicel-wrapped grafts such that they were immediately abandoned. They do report good long-term results using a modified technique of diced cartilage wrapped in temporalis fascia, but this still involves some donor site morbidity and a need to harvest both cartilage and fascia. The rolled appearance of these grafts was the inspiration for the 'sausage roll'.

The authors have used rolled Permacol in ten patients with a minimum of 12 months follow-up, with no extrusions or loss of volume (Figs. 50.5, 50.6, 50.7, 50.8, and 50.9).

Fig. 50.6 (*Upper*) Preoperative. (*Lower*) Postoperative following Permacol 'sausage' used to correct depressed dorsum after naso-ethmoid fracture

50.6 Permacol with Concurrent Cartilaginous Graft

One of the most useful applications of Permacol is in conjunction with cartilaginous grafts, where a layer of Permacol helps to prevent warping and visible irregularities, particularly beneath thin skin. In this case (Fig. 50.10), the saddle was corrected with a caudal extension graft and supratip graft, and the tip was resuspended.

50.7 Permacol Grafts in Patients with Wegener's Syndrome

A diagnosis of vasculitis had been made in six patients in whom Permacol was used, although all was thought be quiescent prior to surgery

Fig. 50.7 (*Left*) Preoperative. (*Right*) Postoperative after Permacol 'sausage' used to augment over-resected, irregular dorsum insertion

Fig. 50.8 (*Upper*) Preoperative. (*Lower*) Postoperative after Permacol 'sausage' sited via open approach in conjunction with domal sutures in revision rhinoplasty. Derotation of tip achieved without additional grafts

Fig. 50.8 (continued)

Fig. 50.9 (*Upper*) Preoperative. (*Lower*) Postoperative following dorsal augmentation with Permacol and cap graft to correct over-resected dorsum and lower laterals

Fig. 50.9 (continued)

(Fig. 50.11). Unfortunately, one patient with a Permacol sausage has had a reactivation of her Wegener's, yet despite this, the graft appears to be stable, with no loss of dorsal height (Fig. 50.12).

50.8 Results

The authors have been using Permacol successfully in augmentation rhinoplasty for 8 years [11] in a series of over 100 patients with layered Permacol grafts and 10 rolled Permacol augmentation patients. Two thirds of the patients had undergone previous surgery (reflecting the tertiary referral nature of the practice of the operating surgeons). In 10% of cases, Permacol was used primarily because of a thin skin envelope. In all other cases, it was used for camouflage and augmentation, in conjunction with cartilaginous grafts, in 50% of the series. Minimum follow-up in all cases has been 6 months, with 40 patients undergoing further review at 12 months and half at 24 months. Longer-term follow-up was thought unnecessary in the absence of complications.

50.9 Complication Rates and Infection Risks/Safety

There was one case of postoperative infection in the authors' series, although it is not clear whether this directly relates to the use of Permacol, which has not required removal. The infection settled with oral antibiotics, although a suboptimal cosmetic outcome resulted. In another case, a sterile cyst formed over the graft 1 year after placement. Interestingly, at the time of surgery to drain the cyst, the graft appeared to have been replaced by fibrous tissue with no change in bulk and no cosmetic defect. In one patient who required revision surgery to the tip (unrelated to the use of Permacol), a biopsy was taken from the site of

Fig. 50.10 (*Upper*) Preoperative. (*Lower*) Postoperative after caudal extension cartilaginous graft with overlying Permacol supratip graft

grafting. Histological comparison with Permacol and the in vivo biopsy taken at 12 months demonstrated that the collagen bundles persist but there is integration with host connective tissue with ingrowth of elastin fibres and incorporation of smooth muscle. This will help prevent late extrusion or loss of volume.

50.10 Limitations of the Technique

As a porcine-based filler, Permacol may not be a universally acceptable material, especially in the Muslim and Jewish communities. There remains some theological discussion as to whether surgical use of porcine material constitutes ingestion,

Fig. 50.11 Vasculitis in a patient following dorsal augmentation with Permacol 'sausage' in patient with saddle deformity secondary to Wegener's granulomatosis. (*Upper*) Preoperative. (*Lower*) Postoperative

but this is beyond the scope of this discussion and should be dealt with by carefully informed consent on a patient-by-patient basis.

If major reconstruction of the nose is required, this technique is unlikely to offer sufficient structural integrity, and other techniques such as rib or calvarial bone grafting will still be required.

Conclusions

The authors believe Permacol to be an ideal graft material and technique to achieve smooth augmentation of the nasal dorsum. It is easily used in the hands of any competent rhinoplasty surgeon and has a very low risk of complications.

Fig. 50.12 Patient with saddle deformity secondary to Wegener's granulomatosis had dorsal augmentation with Permacol 'sausage'. She had a reactivation of her Wegener's, yet despite this, the graft appears to be stable, with no loss of dorsal height. (*Upper*) Preoperative. (*Lower*) Postoperative

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