The application of an acellular dermal allograft (AlloDerm) for patients with insufficient conjunctiva during evisceration and implantation surgery

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Abstract

Purpose To describe the use of an acellular dermal allograft (AlloDerm) for patients with insufficient conjunctiva during evisceration and implantation surgery.

Patients and methods The medical records of six patients with insufficient conjunctiva during evisceration surgery were reviewed. It was not possible to close the Tenon's capsule and conjunctiva without wound tension in these patients, so AlloDerm was placed over the sclera, and the edges were sutured with adjacent conjunctiva without tension. The size of the bare AlloDerm graft was measured in all patients. The clinical outcome was the incidence of complications, and the percentage of patients needing additional surgery was also recorded.

Results The cause of evisceration was end stage glaucoma (four patients) and endogenous endophthalmitis (two patients). All six eyes of six patients (100%) had a successful outcome showing no complications. Four cases achieved full conjunctivalisation over the bare AlloDerm graft. Two cases had a bare AlloDerm until the last follow-up, but showed no implant exposure. It took a median of 11 weeks for the slow advance of the conjunctival edge to entirely cover the AlloDerm graft.

Conclusions AlloDerm is a promising material for covering sclera and implants in a tension-free manner after evisceration surgery in patients with insufficient conjunctiva.

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Introduction

Blind and painful eyes due to end stage eye diseases, such as intractable glaucoma and endophthalmitis, can be treated surgically by evisceration.^{1,2} The evisceration procedure removes the contents of the eye. The sclera is opened, and the intraocular contents are removed. An implant is placed into the sclera, and the surgeon overlaps the edge of the sclera and closes it with permanent sutures. Then, Tenon's capsule and the conjunctiva are closed. However, exposure occurs if the conjunctiva and Tenon's capsule break down over an implant.

Exposure is a significant complication of porous implants after evisceration or enucleation, and occurs in ~2–10% of patients.^{3–7} Reporting on 802 cases over 15 years who underwent anophthalmic socket surgery (evisceration or enucleation) using hydroxyapatite (HA) orbital implants, Yoon *et al* concluded that the exposure associated with HA orbital implants decreased with improvements in surgical techniques.⁷ Closing the Tenon's capsule and conjunctiva in a tension-free manner is the last surgical step and is very important in the prevention of wound dehiscence and implant exposure.

Yoon *et al*⁷ reported that implant exposure occurred in 2.1% of patients before pegging and 4.0% of patients after pegging, and that the main reason for surgery was trauma (73%). In contrast to trauma, end stage glaucoma or endogenous endophthalmitis can cause damage to the conjunctiva and adjacent normal tissue because of repetitive surgery or the melting process. In these patients, we found that it was impossible

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to close the Tenon's capsule and conjunctiva without wound tension because of insufficient conjunctiva. To avoid the exposure of implants, a smaller implant could be chosen or secondary surgery, such as lower sac reconstruction, could be considered.

In the present study, we described the novel application of AlloDerm (Lifecell, Branchburg, NJ, USA) during evisceration and implantation. In patients with insufficient conjunctiva during surgery, we centrally placed the AlloDerm over the sclera, and the edges were sutured with adjacent conjunctiva. AlloDerm could therefore be used instead of direct closing of the conjunctiva and Tenon's capsule, to cover the implant of patients with insufficient conjunctiva tissue after evisceration.

Materials and methods

A retrospective chart review was conducted of six patients with insufficient conjunctiva during evisceration surgery at Soonchunhyang University Bucheon Hospital, from May 2014 to September 2016, by the same experienced oculoplastic specialist (S.Y.J.). Informed consent was obtained from all subjects. One eye per patient was involved in the surgery. The mean patient age was 63.8 years. Four patients underwent evisceration because of Ahmed glaucoma valve-associated endophthalmitis, and two patients because of endogenous endophthalmitis (Table 1). All six of these patients lacked conjunctiva to cover the MEDPOR implant (Porex Surgical, Newnan, GA, USA) that covered the sclera in a tension-free manner. AlloDerm was therefore used to cover the sclera and implant after evisceration of the eye. The size of the bare AlloDerm graft was measured in all patients. The clinical outcome was the incidence of complications and the percentage of patients needing additional surgery was also recorded.

This study was approved by the Institutional Review Board of Soonchunhyang Bucheon Hospital, Soonchunhyang University College of Medicine, and the study protocol adhered to the tenets of the Declaration of Helsinki.

Surgical techniques

The surgery was performed under general anaesthesia. Facial preparation involved treatment with 10% Betadine and conjunctiva preparation involved treatment with 5% Betadine. A 360° conjunctival peritomy was performed using scissors, and the cornea was removed. Then, the intraocular contents were removed. The control of bleeding involved cauterisation or packing of gauze several times into the intraocular space. A 360° sclerotomy was performed, and a MEDPOR implant was

Table 1 Clinical characteristics of the study subjects

	Sex	Age at the time of the operation	Cause of the operation	Exposed AlloDerm size (mm) (Designed AlloDerm size(mm))	Duration of the full conjunctivalisation	Follow up period
Case 1	M	78	AGV associated endophthalmitis	7 × 7 (14 × 14)	Not fully yet. 4 × 4 mm remained.	3 months
Case 2	M	50	AGV associated endophthalmitis	11 × 4 (20 × 11)	6wk	6 months
Case 3	F	32	PEG associated inflammation	8 × 4 (not recorded)	6wk	10 months
Case 4	F	82	Endogenous endophthalmitis	15 × 5 (not recorded)	Incomplete. 8 × 4 mm remained.	6 months
Case 5	M	71	Endogenous endophthalmitis	12 × 8 (not recorded)	18wk	6 months
Case 6	M	70	AGV associated endophthalmitis	8.5 × 5 (not recorded)	16wk	12 months
Average	–	63.8	–	10.3 × 5.5 (–)	–	7.2 months

Abbreviations: AGV, Ahmed glaucoma valve; F, female; M, male; PEG, polyethylene glycol.

inserted into the intraocular space and positioned. Then, the surgeon overlapped the edge of the sclera and closed it using a 6-0 VICRYL suture. During routine evisceration, the Tenon's capsule is approximated using a 6-0 VICRYL interrupted suture, and the conjunctiva continuously approximated by employing an identical suture. However, in our patients, it was impossible to close the Tenon's capsule and conjunctiva without applying wound tension, because the conjunctiva was damaged and thus insufficient. Therefore, unlike routine evisceration, we placed AlloDerm pads of various sizes in areas that were not approximated because of insufficient conjunctival tissue. Appropriately sized pads were placed centrally over the sclera, and peripherally under the conjunctiva, and the edges were sutured to the adjacent conjunctiva without the application of tension (Figure 1). We minimised the surface area of the bare AlloDerm by pulling the conjunctiva as much as possible in a tension-free manner. Temporary tarsorrhaphy was then performed with the 6-0 VICRYL, followed by monocular patch dressing.

Results

All six eyes of the six patients (100%) who underwent evisceration and implantation experienced successful outcomes; we noted no complications and there was no need for repeat surgery during the follow-up period. The mean follow-up period was 7.2 months. Three patients were followed-up for 6 months, one patient was followed-up for 3 months, one patient was followed-up for 10 months, and one patient was followed-up for 12 months after surgery (Table 1). The clinical characteristics of the patients are listed in Table 1.

The mean size of the bare AlloDerm graft was 10.3 mm (vertical) $\times$ 5.5 mm (horizontal). Four patients showed full conjunctivalisation and two patients showed exposed AlloDerm at the last follow-up. Slow advancement of the conjunctival edge to entirely cover the AlloDerm graft took a median period of 11 weeks. Of two patients with a bare AlloDerm, one patient was followed-up for only 3 months, and required a further follow-up. The other patient was followed-up for 6 months, with an exposed AlloDerm surface area of 8 $\times$ 4 mm seen at 6 months. No inflammation, haemorrhage, exposure of the implant, or discharge was observed, despite the bare AlloDerm. The patient tried an artificial eye for 6 weeks after the surgery, which was tolerable, with no adverse effects or wound dehiscence. Thus, surgery for all six patients was successful.

Cases 2 and 3, who were 50 and 32 years of age, respectively, showed full conjunctivalisation 6 weeks after surgery (Figure 2). Cases 5 and 6, who were 71 and 70 years of age, respectively, showed full conjunctivalisation,

Figure 1 Intraoperation photograph of case 1 with an exposed 7 $\times$ 7 mm AlloDerm graft. The area was not approximated because of insufficient conjunctiva. The AlloDerm graft was designed with a suitable size to be centrally placed over the sclera and peripherally located under the conjunctiva, with the edges sutured with adjacent conjunctiva in a tension-free manner.

18 and 16 weeks after surgery, respectively (Figure 2). Cases 1 and 4, who were 78 and 82 years of age, respectively, showed exposed AlloDerm after 3 and 6 months of follow-up, respectively (Figure 3).

Discussion

AlloDerm is a commercially available acellular matrix derived from human cadaveric skin from which the epidermal layer has been removed, leaving a network of collagen fibres lying on the basement membrane. AlloDerm is used to repair or replace damaged or inadequate integument tissue, and also has other uses. AlloDerm affords the structural support needed for tissue growth and is immunologically inert.⁸ Neovascularisation has been observed in animal models grafted with AlloDerm.⁹ AlloDerm skin grafts have been used to treat burn victims,^{10,11} to support abdominal or parastomal hernias,¹² in breast reconstruction,¹³ to reconstruct long-segment tracheal defects (serving as a conduit)¹⁴ and to reconstruct anterior skull-base defects.¹⁵

In oculoplastic and orbital surgery, we often encountered cases of insufficient orbital and periorbital soft tissue volume. In 1999, Rubin *et al* introduced the use of AlloDerm in a variety of oculoplastic applications.¹⁶ The authors classified the applications of AlloDerm graft into two groups, as follows: (1) barrier/scaffolding (that is, primary and secondary implant coverage, and a lid spacer graft), and (2) volume augmentation (that is, deep superior sulcus and other periorbital soft tissue contour defects).

In the present study, we used an AlloDerm graft as a barrier/scaffolding in patients with insufficient conjunctiva during evisceration and implantation surgery. The basic concept of these applications was

Figure 2 (a) Before full conjunctivalisation of case 2. (b) After full conjunctivalisation of case 2. (c) Before full conjunctivalisation of case 5. (d) After full conjunctivalisation of case 5. (e) Before full conjunctivalisation of case 6. (f) After full conjunctivalisation of case 6.

similar to the secondary implant coverage introduced by Rubin *et al*. Once the orbital implant is exposed, an overlying conjunctival defect should be expected. In such cases, the surrounding conjunctiva is undermined from the anterior implant surface, and the exposed anterior portion of the implant is covered with AlloDerm to reduce any 'pressure point'. The conjunctiva is advanced as much as possible, and the defect is fully closed, if possible. Rubin *et al* reported that the coverage of exposed

orbital implants was successful in four out of seven patients. In the failed cases, the AlloDerm graft appeared to resorb or melt.

In contrast to the report by Rubin *et al*, we used the AlloDerm graft at the time of evisceration, and not at the time of secondary orbital implant exposure. The AlloDerm covered the orbital implant anteriorly over the sclera, and not the orbital implant itself. Our study showed no resorption or melting of AlloDerm.

Figure 3 Case 4 with an exposed 8×4 mm AlloDerm graft at the 6 month follow-up.

We hypothesised that the good surgical outcome resulted from the AlloDerm being exposed to the orbital implant, while being anteriorly covered over the sclera, instead of being directly exposed to the orbital implant.

Kadyan and Sandramouli recently introduced a new application of AlloDerm as a primary patch graft.¹⁷ AlloDerm is usually wrapped around the orbital implant at the time of enucleation, and the anterior surface of the implant is covered completely with AlloDerm, and then the Tenon's capsule and conjunctiva are closed. Kadyan and Sandramouli reported the surgical results of a simple placement using a 2×2 cm patch of AlloDerm with the dermal side facing the implant without any sutures, and with the Tenon's capsule and conjunctiva closed in two layers without any wound tension.

We used the AlloDerm graft as a primary patch graft in patients who underwent evisceration and implantation, and had insufficient conjunctiva tissue. The conjunctiva was insufficient to cover the sclera, so AlloDerm, several mm larger than the defect, was placed between the conjunctiva and the implant over the sclera. The centre of the graft was left bare, and the peripherally located conjunctiva was advanced as much as possible to reduce the area of bare AlloDerm graft. Using this protocol, four out of six cases showed complete conjunctivalisation. Slow advancement of the conjunctival edge to entirely cover the AlloDerm graft took a median period of 11 weeks. The remaining patients were fitted with an artificial eye, and 6 weeks after surgery, the artificial eye was tolerated and the patients showed no adverse effects or wound dehiscence, even though they were treated with a bare AlloDerm graft. Thus, all six cases were successfully treated.

In conclusion, AlloDerm is a promising material for tension-free covering of the sclera and implant during evisceration surgery in patients with insufficient conjunctiva. This procedure allows the surgeon to select the appropriate size of the orbital implant to prevent anophthalmic socket syndrome. Concern about implant exposure or additional surgery, such as lower sac reconstruction, are also eliminated. Thus, this study described the use of AlloDerm as a primary patch graft, and suggested the possibility of widening the applications of AlloDerm in evisceration and implantation surgery.

Summary

What was known before

- In ophthalmic evisceration and implantation surgery, AlloDerm was used to wrap the implant to cover the exposed implant for secondary implant coverage.
- Surgeons often encounter patients whose conjunctiva have been damaged because of end stage glaucoma or endogenous endophthalmitis. In these patients, it might be impossible to approximate Tenon's tissue and conjunctiva in a tension-free manner, leading to an increased risk of implant exposure.

What this study adds

- A novel application of AlloDerm in ophthalmic evisceration and implantation surgery was developed that covered the implant, and wrapped the sclera in a tension-free manner during ophthalmic evisceration surgery in patients lacking conjunctiva tissue.
- The use of AlloDerm for tension-free covering of the implant after ophthalmic evisceration surgery for patients with insufficient conjunctiva tissue had a good outcome and no complications.

Conflict of interest

The authors declare no conflict of interest.

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