Autologous dermis graft at the time of enucleation or evisceration

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Aim: To present a new technique using autologous dermis graft at the time of enucleation or evisceration to replace the ocular surface area lost when the corneal scleral button is excised.

Methods: A retrospective, interventional, non-comparative case series of patients who had an autologous dermis graft placed to assist in closure of Tenon's capsule and conjunctiva at the time of enucleation or evisceration. Medical records were reviewed and the following variables were recorded: age, sex, history of previous ocular surgery or radiation treatment, indication for surgery, type of surgery, laterality, type of orbital implant, size of implant, length of follow up, and complications.

Results: Nine patients were identified (three male, six female) Five had enucleation with implant placement and four had evisceration with implant placement. Four individuals received unwrapped porous polyethylene spherical implants, three received silicone implants, and two received hydroxylapatite implants. Follow up ranged from 30 to 112 weeks (mean (SD), 61 (28) weeks). No operative or early complications were observed. One patient who had enucleation after two rounds of brachytherapy for uveal melanoma developed subsequent late exposure of the implant. There were no complications involving the graft donor site.

Conclusions: This small series shows that the use of a dermis graft is a safe and effective new technique to facilitate orbital rehabilitation. It is hypothesised that the extra surface area produced with a dermis graft preserves the fornices and allows a larger implant. It may also allow the implant to be placed more anteriorly which assists with both implant and prosthesis motility.

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The desired outcome after an enucleation or evisceration carried out in conjunction with an orbital implant is for optimal cosmesis that maintains orbital volume and prosthesis motility. Surgical strategies to optimise the result are numerous and evolving.^{1–6} Even with implant placement there is a tendency towards enophthalmos; thus most surgeons aim to place the largest possible implant. The size of implant that can be placed is mainly limited by the ability to close Tenon's capsule and the conjunctiva over the implant. Tension placed on these soft tissues may contribute to collapse of the conjunctival fornix and implant extrusion. It is our hypothesis that these interlinked problems may be addressed by using autologous dermis to replace the ocular surface area lost with removal of the globe or excision of the corneoscleral cap.

When an eye is enucleated or eviscerated, an area of ocular surface equal to or greater than the area of the cornea is removed. The loss of the corneoscleral cap decreases the amount of potential surface area for closure. The adult human corneal surface area has been estimated as 132 mm².⁷ The loss of ocular surface area is often exacerbated by previous ocular surgery with associated conjunctival shrinkage and scarring. This prevents the placement of an adequate sized implant or forces the surgeon to place the sphere posterior to the normal position of the globe.⁸ The posterior placement of an orbital implant has deleterious effects on prosthesis motility, as it may decrease implant–prosthesis interaction.

Placement of a secondary dermis graft is an accepted technique for repairing orbital implant exposure when the exposure has resulted from loss of conjunctiva.⁹ We describe our early experience with this new technique whereby the ocular surface area lost with removal of the globe or cornea at the time of enucleation or evisceration is replaced with a dermis graft.

MATERIALS AND METHODS

With institutional review board approval, a search of the ophthalmic plastic surgery disease registry (McCann Medical Matrix; St Louis, MO, USA) was undertaken to identify patients who received dermis grafts at the time of implant placement for enucleation or evisceration. Records were reviewed to assess outcomes. Data collected include age, sex, history of previous ocular surgery or radiation treatment, indication for surgery, type of surgery, laterality, type of orbital implant, size of implant, length of follow up, and complications.

Surgical technique employed is as follows. Two per cent lignocaine (lidocaine) with 1:200 000 adrenaline (epinephrine) was injected into the skin of the anterior suprailiac crest. A 14 mm corneal trephine (Katena; Denville, NJ, USA) was used to make a circular epidermal incision (fig 1). The size of the graft was chosen to be 14 mm as there is usually 25% shrinkage of tissue when it is transplanted. The area of a 14 mm diameter circle, when reduced by 25% approximates to the diameter of the cornea. Westcott scissors were used to excise the epidermis from within the incised area. Care was taken to avoid leaving epithelial islands as this can predispose to keratin deposits on the ocular surface. Next, a circle of dermis was excised with Stevens scissors and the subcutaneous fat was trimmed from the dermis. After achieving haemostasis, the donor site was closed with deep 3–0 chromic gut (Ethicon; Piscataway, NJ, USA) and superficial 5–0 Prolene sutures (Ethicon). A dry dressing was placed over the donor site.

Enucleation

Enucleation was initiated by carrying out a 360° peritomy and then dissecting deep to Tenon's capsule in all four quadrants. The horizontal and vertical rectus muscles were isolated on muscle hooks and released from the surface of the globe. Care

Figure 1 Harvesting the dermis graft. A 14 mm corneal trephine is used to make a circular epidermal incision (A). The epidermis in this area is excised. A circle of dermis is then harvested and the subcutaneous fat is trimmed off (B).

was taken not to disrupt the muscular sheath of the rectus muscles. The oblique muscles were cauterised and divided at their insertion. The globe was removed using enucleation scissors and haemostasis was achieved. A suitable sized orbital implant previously soaked in vancomycin (50 mg/ml) was then placed within Tenon's capsule and the dermis graft was placed over the anterior surface of the implant (epidermal side up). The muscles were not sutured to the implant; rather, they were reapproximated into position by closure of Tenon's capsule to the dermis graft. The graft was sutured with interrupted 5–0 chromic gut (Ethicon) to the edge of Tenon's capsule. The conjunctiva was then sutured to anterior surface of the dermis graft with 6–0 plain gut (Ethicon) in a running purse string

manner. A conformer was placed in the eye, which was then closed with a temporary tarsorrhaphy.

Evisceration

Evisceration was initiated with a 360° peritomy of the conjunctiva. The anterior chamber was entered with a No 11 blade at the limbus. Using Westcott scissors, the cornea was removed by incising the sclera posterior to the surgical limbus in a circumferential manner. The uvea was disinserted from the scleral spur and the ocular contents were delivered with an evisceration spoon. All visible uveal tissues were removed. Bipolar cautery was undertaken to the optic nerve head and vortex veins. Relaxing incisions were made in the sclera at the superolateral and inferomedial quadrants followed by a 360° equatorial scleral incision which divided the sclera into two hemispheres. An orbital implant previously soaked in antibiotic solution was placed between the two hemispheres. The sclera was closed with 4–0 vicryl sutures (Ethicon) in an overlapping manner. The dermis graft was placed over the closed sclera and stitched to the edge of Tenon's capsule with closure of the conjunctiva as described above.

RESULTS

Nine patients were identified who received autologous dermis grafts at the time of enucleation or evisceration (table 1).

The patient group comprised three men and six women with a mean age of 50 years (median 55; range 19 to 72). Indications for surgery were uveal melanoma ($n = 3$), blind painful eyes ($n = 5$), and phthisis after previous penetrating trauma ($n = 1$). The left side was involved in seven cases. There was a history of previous intraocular surgery in four eyes, and of brachytherapy for uveal melanoma in three. Blind painful eyes in two patients were caused by neovascular glaucoma after brachytherapy for uveal melanoma. The other painful eyes had a history of recurrent retinal detachments from proliferative vitreoretinopathy, retinal vascular occlusion, and penetrating trauma. Five patients had enucleation with implant placement and four had evisceration with implant placement. Patients with a history of uveal melanoma were all enucleated.

Four individuals received an unwrapped porous polyethylene spherical implant, three received a silicone implant, and two a hydroxylapatite implant. The size of the implants used ranged from 18 to 22 mm. A 14 mm circle of autologous dermis graft was employed. No patient received a motility coupling past.

Follow up ranged 30 to 112 weeks (mean (SD), 61 (28) weeks). No operative or early complications were observed.

Table 1 Patient characteristics

Case	Age (years)	Sex	Eye	Indication	Previous surgery or treatment	Type of surgery	Type/size of implant	Follow up (weeks)	Complications
1	55	F	OS	Pain, hx PVR/RD	CE/IOL; PKP; PPV $\times 4$	EV	PP/20 mm	43	Enophthalmos requiring hydrogel implants
2	55	M	OS	UM	–	EN	HA/22 mm	100	None
3	68	M	OS	UM	BT, $\times 2$	EN	PP/20 mm	54	Exposure requiring implant exchange and posterior Tenon's flap
4	40	F	OD	Phthisis, hx penetrating trauma	RG repair	EV	PP/18 mm	55	None
5	40	F	OS	Pain, hx retinal vascular occlusion	–	EV	PP/20 mm	58	None
6	72	F	OD	UM	CE/IOL	EN	Silicone/22 mm	64	None
7	19	F	OS	Pain, hx penetrating trauma	PPV $\times 4$, Retrobulbar EtOH $\times$	EV	HA/20 mm	31	Subconjunctival cysts treated with 10% trichloroacetic acid injection
8	33	F	OS	Pain 2° NVG, hx UM	BT, Retrobulbar EtOH	EN	Silicone/20 mm	112	None
9	64	M	OS	Pain 2° NVG, hx UM	BT	EN	Silicone/20 mm	30	None

BT, brachytherapy; CE/IOL, cataract extraction, intraocular lens; EN, enucleation; EtOH, alcohol; EV, evisceration; HA, hydroxylapatite; hx, history; NVG, neovascular glaucoma; OD, right eye; OS, left eye; PKP, penetrating keratoplasty; PP, porous polyethylene; PPV, pars plana vitrectomy; PVR, proliferative vitreoretinopathy; RD, retinal detachment; UM, uveal melanoma.

Figure 2 Postoperative clinical appearance of the dermis graft and imaging of the orbital implant. A 40 year old woman (patient 4) was reviewed at five weeks after evisceration of a right phthisical eye with placement of a dermis graft, showing complete graft vascularisation (A). Long term follow up at 55 weeks shows a healthy appearing socket with good volume replacement (B). Orbital computed axial tomography carried out one year after surgery showed a well positioned right eye implant with anterior placement (C).

Postoperative management of the socket did not differ from that used with a standard enucleation or evisceration. Dermis graft vascularisation occurred within 14 days and by 21 days the graft was covered with conjunctival epithelium (fig 2, panels A and B). Custom impression for prosthesis fitting was typically undertaken at eight weeks in a standard manner and required no additional precautions.

One of the patients (No 3) who underwent enucleation for a large uveal melanoma with a previous history of two sessions of brachytherapy developed exposure of the implant one month after the primary surgery. An implant exchange and posterior Tenon's flap to close the wound was required. A second patient (No 1) who underwent evisceration was found to have inadequate orbital volume and required hydrogel pellet expanders to be placed five months after the initial surgery. A third patient (No 7), who also had an evisceration, developed subconjunctival cysts that were effectively treated three months after the primary surgery with an injection of 10% trichloroacetic acid without complications. There were no implant exposures among the eviscerated patients. In addition, no complications involving the graft donor site were seen.

Figure 3 Comparison of primary closure of Tenon's capsule versus closure with a dermis graft. Closing Tenon's capsule without placement of a dermis graft results in retroplacement of the centre of the implant by 8.6 mm (A). Placement of a dermis graft (green) allows for deeper fornices, more anterior placement of implant, and larger implant selection (B).

DISCUSSION

Exposure is an uncommon complication after orbital implant placement. Rates of exposure for porous polyethylene implants vary widely between 2% and 13% after enucleation, and between 0% and 3.3% after evisceration.^{2-4 6 10-13} Similar rates are noted for hydroxylapatite implants.^{2-4 6 12} The risk of exposure may be increased by previous orbital radiation. While wrapping porous implants is thought to provide an additional tissue layer to prevent exposure, no clear benefit has been defined, and vascularisation of the implant may be compromised.^{3 10 14 15}

Our new technique of using a dermis graft to replace the ocular surface area lost by removal of the globe or corneoscleral cap has several potential advantages. The foremost of these is the potential for a deeper fornix. Deep uncontracted fornices allow for less interaction between the prosthesis and the lid, permitting better prosthesis motility. A larger series of patients would be needed to determine whether employing this technique results in deeper fornices but this is our impression, as well as that of the ophthalmologists fitting the prosthesis.

Another potential advantage is anterior placement of the implant (fig 2C). Implants are often deliberately placed posteriorly to avoid exposure. The retroplacement of the implant is undesirable if the extraocular muscles are to move the prosthesis via their normal fascial pulleys.¹⁶ It is more difficult for a prosthesis to couple with a posteriorly placed implant. If the tissues around the globe are envisaged as an investiture that arises from the posterior orbit, then the removal of a 12 mm diameter disk of this tissue followed by its advancement to fill the defect will retroplace the implant (fig 3). This correlates with the findings presented by Detorakis and colleagues who note that in the enucleated socket the centre of the implant sits an average of 8.6 mm further back than the centre of the normal eye.⁸

A final potential advantage with this technique is that it may allow placement of a larger implant because the size of the implant selected is normally limited by the area of Tenon's capsule and conjunctiva available to cover the implant. If a 20 mm spherical implant is placed, the area of the anterior half of the sphere is 628 mm². Removal of 132 mm² of cornea equates to a reduction of 21% of the surface area for closure. The expansion of the surface area allows for placement of a larger implant without contraction of the fornices. If the implant is larger, it can be matched with a thinner prosthesis

that has less inertia and tends to move better. It is also lighter, resulting in fewer episodes of ectropion repair throughout the patient's life.

Dermis is an ideally suited matrix for conjunctivalisation and has been used in combination with fat in dermis fat grafts for orbital implants or for repair of implant exposures.^{9 17 18} Being autologous, it has neither the risk of rejection nor transfer of infection from cadaveric homologous tissue. Furthermore, in cases of fornix shortening secondary to previous surgery or trauma, such a graft may aid in re-establishing the former anatomy. While the harvesting of autologous grafts may pose additional surgical morbidity and postoperative complications, these are felt to be minimal. A larger surgical cohort is needed to establish whether this technique reduces the incidence of implant related problems including infection, exposure, and extrusion.

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Competing interests: JDMcC is the creator of the McCann Medical Matrix and has a financial interest in the software.

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