

Correction of Orbital Implant Exposure Using A Supra-Brow Island Flap Pedicled with Orbicularis Oculi Muscle.

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Research Article

Keywords: Orbit implant exposure, Orbicularis oculi muscle, Flap

Posted Date: January 31st, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1034194/v1>

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Abstract

Purpose: To describe our experience of the supra-brow island flap pedicled with orbicularis oculi muscle technique for correcting orbit implant exposure.

Materials and methods: This retrospective study reviewed 32 patients underwent orbit implant exposure surgery using a supra-brow island flap pedicled with orbicularis oculi muscle autograft. All data were reviewed from patients in Eye & ENT Hospital of Fudan University, Shanghai during 2018.1-2020.7. Patient demographics, the original etiology, surgical procedures, implant types, and follow-up interval were recorded. Main outcome was the long-term coverage of implant after a supra-brow island flap pedicled with orbicularis oculi muscle autograft; the rate of post-surgical complications and management were secondary outcome.

Results: 28 eyes of 32 patients had functional results and satisfactory cosmetic at final follow up(range, 9-29 months). In 4 patients, recurrence of exposure was recorded during follow-up and in two of these patients using DFG was performed, one patient was treated conservatively, one patient refused treatment. There were no clinically significant complications.

Conclusions: A supra-brow island flap pedicled with orbicularis oculi muscle autograft could be a reliable technique to manage or to prevent orbital implant exposure irrespective of primary surgery, exposed area, and implant material.

Key Message

1. A new method to correct orbital implant exposure.
2. The supra-brow island flap pedicled with orbicularis oculi muscle technique is a reliable choice for patients presenting orbital implant exposure defects larger than 4mm².

Introduction

The most serious complication of orbital implant is exposure following the enucleation, evisceration or secondary socket reconstruction surgery[1–6], which may appear following: superficial placement of the implant, lack of suture, poor prosthetic fit, too tight sutures of the tenon fascia and conjunctiva, infection, trauma, antimetabolite use or radiation therapy[3], however, it is reported that wrapping of implants was associated with lower exposure rates[4].

Therapy of exposed implant may be either conservative or surgical. Conservative management consists of antibiotics with or without topical steroids, and small exposures may spontaneously heal, if not resolved within 8 weeks, surgical intervention is suggested resolving with a graft, as a scaffold for epithelial tissue ingrowth from the conjunctival edges, including scleral patch grafts[5, 6], conjunctival pedicle grafts[7], amniotic membrane[8], temporalis fascia[9], autogenous retroauricular myoperiosteal graft[10–12] and dermis fat grafts[13].

Here, we describe our experience with a supra-brow island flap pedicled with orbicularis oculi muscle autograft for treatment of exposure of varying implant types.

Materials And Methods

We retrospectively reviewed the medical records of 32 patients (32 eyes) who had anophthalmic socket presenting with an exposure of the orbital implant in Eye&ENT Hospital of Fudan University, Shanghai, China during 2018.1-2020.7. The study was adhered to the tenets of the Declaration of Helsinki. The written consent given by the patients or by the next of kin, guardians, or caretakers on the behalf of the minors/children participants for their information to be stored in the hospital database and used for research. Informed consent was obtained from parents. The patients were operated on between 2018.1 and 2020.7, operations were carried out by one oculoplastic surgeon. Follow-up examinations were scheduled after surgery.

Demographics and clinical data were: age, sex, date of enucleation or evisceration, reason for surgery, type of orbital implant, time between surgery and orbital implant exposure, duration of the follow-up, success and failure at the end of the follow-up duration.

Surgical Techniques

Under general anesthesia, to prepare the recipient bed, the margins of the conjunctiva and Tenon's capsule around the exposed area were freed and lifted, as shown in Figure 1A. Then the implant was smoothed on the exposed area with antibiotic solution irrigation, to rule out infection and make the implant less convex. The required area of conjunctiva and supra-brow island flap to fill the defect was measured and marked, the size of flap is usually less than 20mm*10mm as shown in Figure 1B.

Supra-brow incisions were performed along the marked lines and deep to fat tissue, the incisions close to the eyebrow parallel to hair follicles, to avoid injury to the eyebrow hair follicles. As shown in Figure 1C, the composite flap pedicled with orbicularis oculi muscle were dissected and removed above the muscle layer from the nasal end to the lateral end. Through the laterosuperior fornix of conjunctival sac, this flap was applied above the exposed implant area with the skin surface facing outward, and the margins were sutured using 5-0 absorbable interrupted stitches as shown in Figure 1D.

The eyebrow was fixed to grasp the periosteum with 5-0 absorbable sutures. The desired eyebrow position were fixed, then the wound was closed. Subcutaneous layer was closed using 5-0 absorbable sutures and the skin was closed by 6-0 nylon as shown in Figure 1E. A conformer and antibiotic ointment was applied to conjunctival sac at the end of surgery. The eye was patched with gauze for three days.

Data analysis

All statistical tests were performed using the Prism 6.0 package(GraphPad Software). All data are expressed as the mean+standard deviation and ranges.

Results

Detailed demographic data were summarized in Table 1. 32 eyes of 32 patients were managed using the procedure(9females, 23males). Medium age was 36.4 years(1.5 to 70years). The average follow-up was 19.3months(9 to 29months). 13(40.6%) patients had undergone an evisceration: for trauma in 7eyes(21.9%), infection in 3eyes(9.4%), and glaucoma in 2eyes(6.3%), unknown indication in 1 eye(3.1%) and 19(59.4%) patient an enucleation for malignant tumour. Primary implant surgery had been carried out by a number of surgeons at different institutions.

25(78.1%) eyes of 25 patients had been implanted primarily with hydroxyapatite(HA) implants and 7(21.9%) eyes of 7 patients with porous polyethylene. Orbit implant exposure occurred on average at 18 ± 15.1 months after implantation. Of the 32 autografts performed, 4(12.5%) eyes of 4 patients occurred implant re-exposure during the follow-up period, and then 3 patients managed with the management of impair surgery.

28(87.5%) eyes of 28 patients with successful supra-brow island flap autografts, no re-exposure or other complications were encountered during follow-up. Every patient was fitted with a prosthetic device successfully.

The management of cases of re-exposure are shown in Table 2. Case 1 had removal of porous polyethylene implant, not removed with the original implant at the time of the primary replacement surgery, causing a medial and inferior defect in the flap. Case 2 had also resuturing of a medial and inferior defect in the DFG which did not heal spontaneously following over a few weeks. The both patient had a DFG placed for repair re-reposure successfully. Case 3 had exposure occurring a small medial and inferior defect in the flap and was treated conservatively with topical lubricant and prophylactic antibiotics, and heal spontaneously. Case 4 occurred in a HA implant, had exposure in central defect in the flap, refused the repair management.

Clinical Report:

Patient 1.

A 5-year-old female received porous polyethylene implant after evisceration. Small implant exposure area was noted 4 months later. We covered the exposure area with banked sclera graft, then the sclera melted 1 month later. We used a supra-brow island flap pedicled with orbicularis oculi muscle autograft to cover the exposure area and it was successfully treated as shown in Figure2.

Patient 2.

The left eye of a 4-year-old girl was enucleated due to retinoblastoma. She was referred for exposure found during follow-up. We successfully treated the exposure by using supra-brow island flap pedicled with orbicularis oculi muscle autograft as shown in Figure 3.

Discussion

In this study, we examined 32 cases of implant exposure managed using a supra-brow island flap pedicled with orbicularis oculi muscle autograft. In 28 of the participants, the exposure was successfully repaired with no complications, while in 4 subjects, a second procedure for re-exposure was required. This is the first time using this technique as the wrapping material of orbital implant.

Implant exposure is a common complication after evisceration, enucleation or socket surgery. It is reported that the exposure rate of acrylic or silicone implants is higher than that of hydroxyapatite implants [7, 14]. Some factors are associated with a higher risk of implant exposure or graft failure, such as wound healing problems, infection, previous radiation history or improper surgical operation [15]. In order to avoid this complication, the appropriate size of the implant should be accurately evaluated before implantation, and the Tenon sac and conjunctiva on the surface of implant should be accurately closed without tension [1–3].

Several factors, such as the size of the defect, the presence of infection, and implant vascularity determine the management of implant exposure. Spontaneous healing of exposure of small orbital implants with an area less than 4mm² can be observed with or without antibiotics [16–17], while for large exposures, surgical treatment is recommended, or the exposure is not resolved in 8 weeks after conservative treatment [3, 8, 18]. Implants with good vascularization can be treated with antibiotics, and implants with poor vascularization should be replaced [16].

The ideal graft material should be adaptable to the socket surface, resistant to infection and easily epithelializing, provide scaffold to prosthetic eye. Previously described materials for management of exposed orbital implants include: dermis fat, temporalis fascia graft, frontal periosteum graft, tarsal patch flap, amniotic membrane graft, retroauricular myoperiosteal graft or biosynthetic material patch graft as described by Enduragen [19, 20].

We report a technique to repair an exposed orbital implant using a supra-brow island flap pedicled with orbicularis oculi muscle autograft. The supra-brow island flap pedicled with orbicularis oculi muscle autograft is an autogenous graft from the homolateral upper eyelid with easy donor site access and reducing the incidence of immune rejection or infection. It is well known that good vascular supply is essential for graft survival. For our supra-brow island flap pedicled with orbicularis oculi muscle graft, the surrounding subconjunctival tissue and the orbicularis oculi muscle provide a good vascular supply.

Failure of final coverage or persistent infection is a major risk factor of treatment for orbital implant exposure, especially in acrylic implants and ocular cancer cases [21, 22], where removal of implants and autologous dermis fat transplantation seems preferable [23]. The main disadvantage of the island flap

pedicled with orbicularis oculi muscle technique is the scar on the upper eyebrow, there are also theoretical risks such as ptosis, fornix shortening, palpebral retraction or hemorrhages, however, there was no complication in our subjects. Further studies comparing this technique with other operative techniques are needed to assess the use of this flap for manage orbital plant exposure.

The island flap pedicled with orbicularis oculi muscle is located in the adjacent surgical area because most ophthalmic surgeons have some knowledge of the anatomy of the area. We recommend that this autograft be used to manage orbital plant exposure, especially in patients larger than 4mm², without orbital radiotherapy or fornix injury. However, in the case of chronic inflammation or recurrent infection, orbital implants need to be removed and replaced with a dermal fat graft. The supra-brow island flap pedicled with orbicularis oculi muscle is a reliable technique with high success rate, which can retain the implant and easy to use a new prosthesis.

Declarations

Consent for publication

Written informed consent was obtained from the patients for publication of this article and any accompanying images, written informed consent was also obtained from the patients on the figures to publish their face photos. The parents or guardians of the study participants who were minors at the time of study gave written consent for their personal or clinical details along with any identifying images to be published in this study. Informed consent was obtained from parents.

Ethics approval and consent to participate

This study was performed in accordance with the declaration of Helsinki and was approved by the Ethics Committee of the Eye&ENT Hospital of Fudan University, Shanghai, China. Written informed consent was obtained from all subjects after the aims and nature of the study were explained to the participants. The parents or guardians of the study participants who were minors at the time of study gave written consent for their particular children to be involved in the study.

Competing interests

The authors declare no conflict of interest.

Funding information:

This work was supported by the Science and Technology Development Fund project of Shanghai Science and Technology Commission(Grant No. 18411969300; Xinhai Ye).

Disclosure of interest:

The authors declare that they have no conflict of interest concerning this article.

Availability of data and materials

The datasets used and/or analysed during the current study available from the corresponding author Pro. Xinhai Ye on reasonable request.

Author Contributions

Conceived and designed the experiments: Xinhai Ye. Performed the experiments: Zhenzhen Zhang. Analyzed the data: Zhenzhen Zhang. Contributed reagents/materials/analysis tools: Xinhai Ye. Wrote the paper: Zhenzhen Zhang.

Acknowledgements

Not applicable.

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Tables

TABLE 1. Demographic and clinical data for the patients with implant exposure and repair

Number of patients	32	
Gender		
Male	23	71.9 %
Female	9	28.1%
Mean age(years)	36.4	
Age range(years)	1.5-70	
Indication for eye removal		
Trauma	7	21.9%
Infection	3	9.4%
Glaucoma	2	6.3%
Tumour	19	59.4%
Unknown	1	3.1%
Eye removal		
Enucleation	19	59.4%
Evisceration	13	40.6%
Implant material		
Hydroxypatite	25	78.1%
Porous polyethylene	7	21.9%
Mean area of exposure(mm ²)	35	
Mean time to exposure(months)	18 _{+15.1}	
Prior socket surgery	3	9.4%
Mean follow-up(months)	19.3 _{+10.4}	
Range follow-up(months)	9-29	
Number of implant re-exposure	4	12.5%

Data presented as mean+SD(range)or n(%)

Table 2 Characteristics of cases of re-exposed orbital implant.

Case	Gender	Indication for eye removal	Primary eye removal	Age at time of explantation	Time to exposure (months)	Signs of infection	Material explanted implant	Diabetes	Time to reposure(m)	Management to re-reposure
1	F	Tumour	Enucleation	43	113	Y	porous polyethylene	N	19	DFG
2	M	Tumour	Enucleation	37	56	Y	porous polyethylene	N	4	DFG
3	M	Endophthalmitis	Evisceration	18	6	N	HA	N	56	Debridement and spontaneously heal
4	M	Unknown	Evisceration	56	17	N	HA	Y	16	refusal

Figures



Figure 1

A: Carefully dissect along the subtenon and orbital implant, check the extension of exposure area.

B: Design of the flap.

C: Dissection of the flap.

D: Placement of the island flap through superior fornix of conjunctival sac to the recipient bed.

E: Sutures of the supra-brow incision and recipient bed.

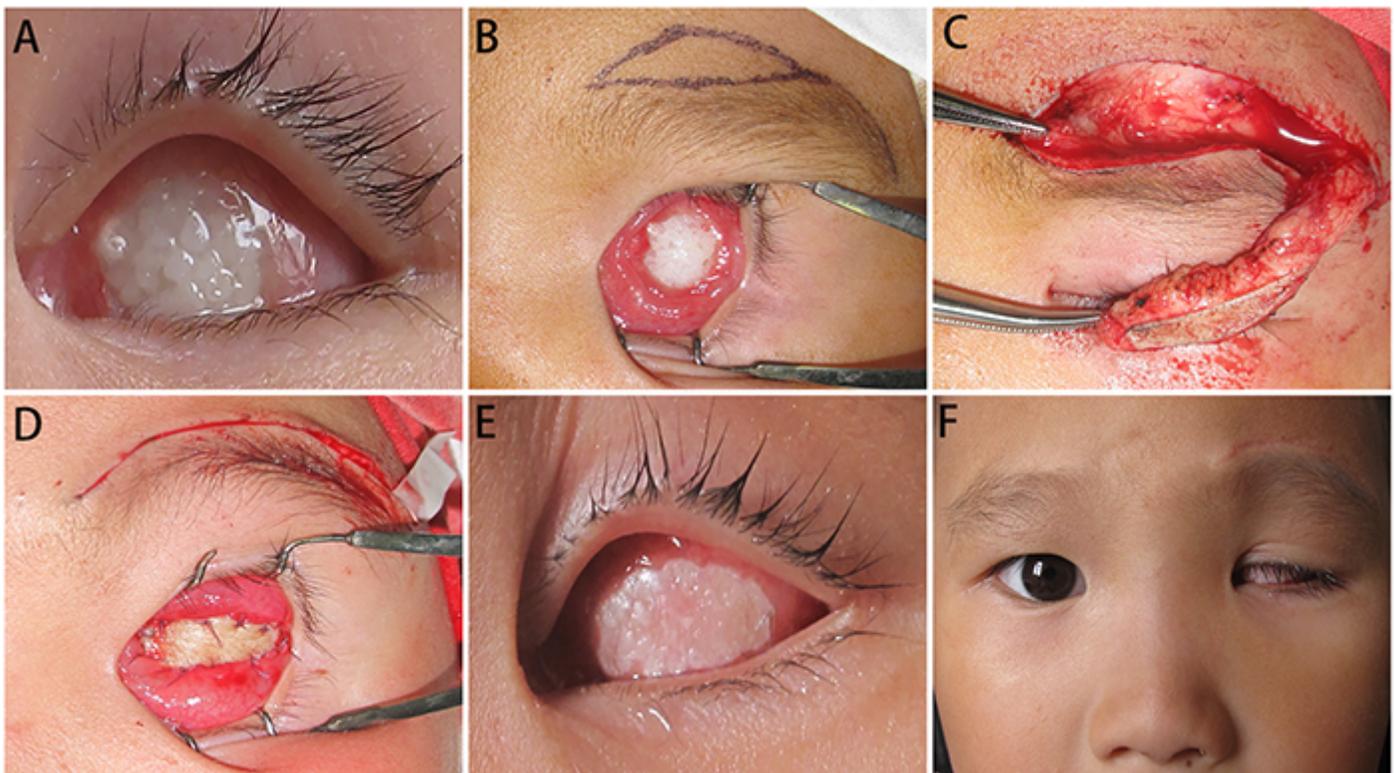


Figure 2

A: A 6 year-old patient, exposed porous polyethylene implant before surgery

B: Carefully dissect along the subtenon and orbital implant, check the extension of exposure area and design of the flap.

C: Dissection of the flap.

D: Sutures on the recipient bed.

E: Socket 90 days after surgery.

F: 90 days post-operative result.

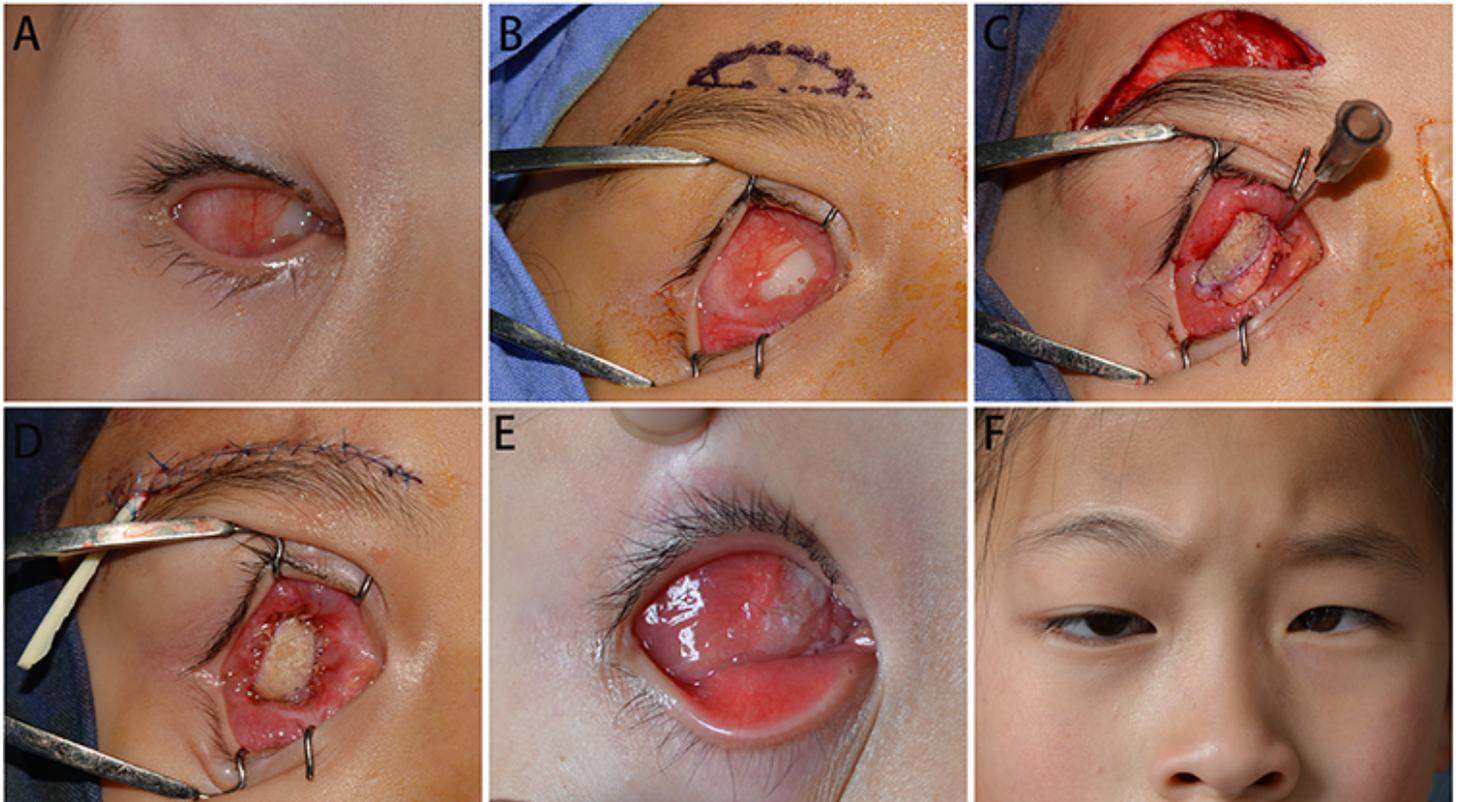


Figure 3

A: A 8 year-old patient, exposed porous polyethylene implant before surgery.

B: Drill of the exposed area and design of the flap.

C: Dissection of the flap.

D: Sutures on the recipient bed.

E: Socket 60 days after surgery.

F: 60 days post-operative result.