

# Two-stage rapid exenteration reconstruction to allow early radiation therapy for an aggressive orbital cancer

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## Abstract

**Purpose** Describe a novel two-stage orbital exenteration technique using an INTEGRA dermal regeneration matrix.

**Methods** A 63-year-old Hispanic male presented with multiple invasive right eyelid masses that incisional biopsy revealed was infiltrative basal cell carcinoma. The patient underwent a right orbital exenteration without lid sparing. An INTEGRA graft was sutured in place to cover the defect at the time of surgery and allowed to vascularize for 3 weeks. During this time, frozen section of tumor margins previously read as negative were found to have invasive basal cell carcinoma on permanent section re-evaluation. Three weeks after the initial exenteration, the patient returned to the operating room and the dermal matrix of the INTEGRA graft was found to be well integrated and vascularized. Further resection was performed in the areas which were found to have residual cancer on permanent section evaluation. After preliminary frozen section pathology demonstrated clear margins, full-thickness skin grafts harvested from the right and left supraclavicular regions were thinned, draped, and fixated over the INTEGRA matrix.

**Results** The patient recovered well and experienced no immediate postoperative complications. Adjuvant radiotherapy began 5 weeks after initial exenteration with a fully epithelized exenterated socket. At postoperative week 16, our patient remained with full epithelization after completing radiation. As of postoperative week 47, our patient has had no complications.

**Conclusion** The use of INTEGRA with full-thickness skin grafting for orbital exenteration reconstruction presents several advantages over traditional reconstruction approaches including: quicker recovery, tumor surveillance by re-examining edges of the resection after INTEGRA dermal placement, easier postoperative care, and earlier initiation of radiation therapy.

**Keywords** Orbital exenteration · INTEGRA · Orbital cancer

## Introduction

The goal of reconstruction after orbital exenteration for malignancy includes detection of recurrent disease, restoration of orbital boundaries, optimal aesthetics, and early adjuvant therapy, if warranted. Complications that have been described as a result of this radical procedure include fistulae formation, chronic drainage, tissue necrosis, exposed bone, infection, limitations with respect to eating and speaking, and deep

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orbits limiting the ability wear a prosthesis [1]. Various approaches have been used to attain these reconstructive goals while limiting the number of complications; some of these techniques include spontaneous granulation, various tissue grafts, and myocutaneous flaps, among others [2].

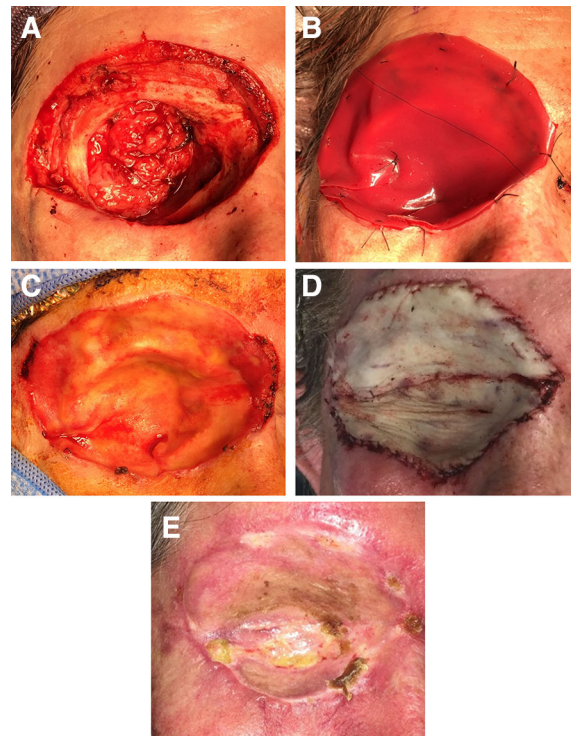
INTEGRA dermal regeneration templates are a synthetic bilayer porous matrix of fibers of cross-linked bovine tendon collagen and glycosaminoglycan covered with a thin polysiloxane that provides a scaffold for blood vessels and dermal skin cells to regrow a neodermis. INTEGRA grafts have been used in patients with thermal injuries, significant scar contractures, and more recently, in reconstruction of defects created by tumor excision; all of which have seen great success in regenerating dermal skin, causing less scarring, and earlier rehabilitation [3]. The authors describe a novel two-stage orbital exenteration technique that takes advantage of the benefits of a INTEGRA dermal regeneration template to allow for quicker healing, re-resection of any positive tumor margins found on permanent section evaluation, easier postoperative care, and early initiation of adjuvant radiation therapy.

## Methods

A 63-year-old Hispanic male presented with multiple invasive right eyelid masses. Ophthalmic exam revealed superior displacement of the right globe by a firm orbital mass along the infratemporal border of the right orbit in addition to the absence of the medial 2/3 of the upper eyelid with necrotic, ulcerated, irregularly shaped borders. An incisional biopsy revealed ulcerated infiltrative basal cell carcinoma requiring an orbital exenteration.

## Technique

After obtaining informed consent, the patient underwent a right extended orbital exenteration without lid sparing (Fig. 1a). During the procedure, an abnormal bone notch was noted along the superotemporal orbital rim which was shaved using a 4-mm round burr until normal appearing bone was visualized. All resection margins and a section of posterior orbital tissue were negative on frozen section evaluation.



**Fig. 1** a Status post-extended orbital exenteration prior to INTEGRA graft placement. b Intraoperative picture after INTEGRA placement during the first-stage surgery. c INTEGRA neodermis integrated and vascularized into orbit after removal of polysiloxane layer during second-stage surgery. d Intraoperative picture after full-thickness skin graft placement. e Postoperative week 16 after full-thickness skin graft placement

An INTEGRA graft with silicone side up was laid over the orbital defect and cut to the approximate shape of the defect. One 4-0 silk suture was used to anchor the center of the graft to the posterior orbital contents with multiple, interrupted cardinal 4-0 silk sutures placed around the graft to surrounding tissue (Fig. 1b). A pressure patch bolster was placed for 1 week in addition to oral antibiotics.

Permanent sections from the orbital exenteration confirmed infiltrative basal cell carcinoma with perineural invasion as well as positive margins nasally and superotemporally, initially read as negative on frozen section evaluation. Three weeks after the first operation, the patient returned to the operating room and the dermal matrix of the INTEGRA graft was well integrated into the soft tissue with a well-vascularized appearance after polysiloxane layer removal (Fig. 1c).

Further resection was performed at the nasal and superotemporal aspects.

Once preliminary pathology demonstrated clear margins, full-thickness skin grafts were harvested from the right and left supraclavicular regions. Each skin graft was thinned and then draped over the INTEGRA neodermis. The skin grafts were fixated with several interrupted 6-0 fast-absorbing gut cardinal sutures and then with a running 6-0 plain gut. Several interrupted 6-0 fast-absorbing gut sutures were placed to join the two skin grafts to each other along the horizontal division between them at the base of the wound (Fig. 1d). A pressure dressing bolster was placed and maintained for 1 week in addition to oral antibiotics.

## Results

The INTEGRA graft quickly integrated with the orbital cavity defect developing a thickened vascular neodermis, allowing for the second-stage surgery to place a full-thickness skin graft 3 weeks after exenteration. This enabled the patient to undergo the first session of adjunct radiation therapy just 5 weeks after exenteration with a fully epithelized exenterated orbital socket. The patient underwent daily image-guided radiation therapy with a curative treatment intent and received a total of 66 Gy fractionated over 33 days. At postoperative week 16 from the initial exenteration with INTEGRA graft, the patient remained fully epithelized after radiation (Fig. 1e). The patient remained without complications or signs of recurrence 47 weeks after the initial exenteration.

## Discussion

The vast majority of orbital exenterations are performed for malignancy, and many of those patients undergo adjuvant radiotherapy. Numerous reconstructive techniques have been described in the literature— healing by spontaneous granulation, myocutaneous free flaps, temporalis muscle transposition, forehead flaps, dermis fat grafts, split thickness skin grafts, and free tissue transplantation [2, 4–7]. Some of these reconstructive techniques are associated with longer operating times, postoperative infection, partial loss of

graft, fistula formation, and graft failure, which are likely to be increased in the setting of adjuvant radiation therapy [2, 4–7].

The authors report a novel two-stage reconstructive orbital exenteration technique that utilizes an INTEGRA graft with full-thickness skin graft. INTEGRA dermal regeneration template was initially FDA approved for the treatment of life-threatening burn injuries and reconstruction of scar contractures. Recently, INTEGRA has been used for reconstructing defects created by tumors of the head and neck, lower extremity, and anterior chest wall with the dermal substitute being shown to do well in the face of radiation therapy [3]. This dermal matrix has begun to find a role in periocular reconstruction—Ozgonul et al. [8] described their experience with INTEGRA for reconstruction of orbital socket following exenteration noting the ease of use and short healing time as well as no postoperative complications. The case described here highlights how these benefits of INTEGRA upheld in the setting of adjuvant radiation.

The patient's postoperative care was minimal, simply entailing oral antibiotics and pressure patching for 1 week after each surgery without any additional packing needed. His postoperative clinic appointments were weekly after the initial orbital exenteration and INTEGRA dermal placement. After the second-stage surgery, the follow-up visits were at 1 week and monthly thereafter post-operation.

Performing the exenteration and reconstruction in two stages allowed for thorough evaluation of all margins before final reconstruction and permitted additional resection before skin grafting, and utilization of full-thickness skin grafting over a vascularized neodermis. Most importantly, the patient was able to undergo radiation therapy as soon as 5 weeks after the initial orbital exenteration surgery with a fully epithelialized socket. He did not have any complications associated with orbital exenteration such as graft failure, fistulae formation, tissue necrosis, exposed bone, infection, or scar contracture, and the graft remained viable in the face of high-dose radiotherapy. This ability for early adjuvant radiation without complications is of particular importance to prevent spread of disease and in this case provide an improved chance for curative treatment for a potentially life-threatening invasive malignancy.

## Conclusion

In this patient with invasive basal cell carcinoma requiring an orbital exenteration, reconstruction of the orbital cavity with the use of INTEGRA in a two-stage surgery allowed for quicker healing, ability for re-resection of margins, easier postoperative maintenance, and earlier initiation of radiation treatment.

## Compliance with ethical standards

**Conflict of interest** All authors declare that they have no conflict of interest.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from the participant included in the study.

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