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What all ophthalmologists need to know about **anophthalmic sockets**

First submitted: September 28, 2024
Revision accepted: September 29, 2024
Revision submitted: September 29, 2024
Published: Winter 2024
Peer reviewed

Introduction

Patients with an artificial eye typically have appointments with their ocularist every 12 to 18 months and can usually reach out to them if any issues arise with the prosthesis. So why should ophthalmologists in other subspecialties be knowledgeable about artificial eyes and anophthalmic sockets? The reason is that these patients can present to the emergency department or outpatient clinic because of concerns regarding their remaining eye, and may ask for advice regarding socket problems.

The primary concern of an anophthalmic patient is the health of the remaining eye.[1-4] However, the second most pressing issue involves concerns about mucoid discharge, crusting, and symptoms of dryness in the socket.[1-4] Patients may also express worries regarding the cosmetic appearance of the artificial eye.[1,3,4] While giant papillary conjunctivitis is less common among contact lens wearers today, it can still occur as a reaction to wearing an artificial eye, potentially presenting as an uncomfortable socket.[5-7] Additionally, implant exposure and socket contraction are feared complications following anophthalmic surgery. This article will outline how to recognize these situations and suggest initial responses.

Dry anophthalmic socket and mucous discharge

In recent years, an improved understanding of the conjunctival and meibomian gland responses to an artificial eye has led to the definition of dry anophthalmic socket syndrome. The continuous movement of the artificial eye against the conjunctiva induces inflammation, loss of goblet cells, blepharitis, meibomian gland dysfunction, and meibomian gland dropout.[8-11] This creates conditions similar to those in evaporative dry eye disease, characterized by both dry eye symptoms and the formation of occasionally copious amounts of mucous discharge. However, in contrast to previous beliefs, tear secretion from the lacrimal gland is not reduced in the anophthalmic socket.[12]

So, how can we reduce symptoms and assist our patients? Frequent removal and cleaning of the prosthesis seem to increase mucous formation; in contrast, the buildup of protein deposits on the prosthetic surface may also induce mucous formation and inflammation.[13-15] According to Pine et al., the optimal cleaning interval for the prosthesis is between once a month and once every six months.[15] Encourage patients who frequently clean their prosthesis to reduce the frequency of artificial eye removal. Conversely, if the prosthesis has not been cleaned for an extended period and has deposits on the surface or signs of cracking and damage, recommend that the patient contact their ocularist. The preservative benzalkonium chloride modifies levels of matrix metalloproteinase 9 and is considered pro-inflammatory.[11] Therefore, patients should always be advised to use preservative-free artificial tears in the anophthalmic socket, preferably those with high concentrations of long-chained hyaluronic acid. Additionally, assess for signs of blepharitis and provide treatment if detected. Topical steroids administered three times daily can reduce inflammation and decrease mucous formation, and may be trialed for 1-2 weeks with a tapering dose. If symptoms do not respond to the initial treatment, consider referral to an oculoplastic unit.

Giant papillary conjunctivitis

As mentioned, giant papillary conjunctivitis is not an unusual finding in anophthalmic patients (**Figure 1**).[5-7,16,17] The superior tarsal conjunctiva should be examined with the prosthesis in place, as this facilitates the eversion of the upper eyelid. In contrast to contact lens wearers, for whom discontinuation of lens use is recommended,[17] it is not advisable for the patient to remove the prosthesis to reduce symptoms. Topical antihistamines with mast cell stabilizing properties, in combination with high-dose topical steroids, are commonly required. However, the dosage can be adjusted and tapered based on the level of symptoms, as the goal of treatment is symptom management rather than complete elimination of the papillae. Topical tacrolimus and cyclosporine A are alternative treatment options. In refractory cases, long-term treatment with a low dose of topical steroids may be necessary.

Figure 1. Giant papillary conjunctivitis in an anophthalmic patient. Photo Eva Tov. Published with the patient's permission.

Figure 2. The change in shape of artificial eyes for one patient over a 23-year period. Photo Elin Bohman

Cosmetic concerns

A thorough review of surgical options for optimizing the cosmetic appearance of an artificial eye is beyond the scope of this article. However, as the face ages, the anophthalmic socket undergoes remodeling, and periocular changes may cause issues for the patient (**Figure 2**). Many of these problems can be addressed through adjustments to the prosthesis, and an optimally fitted prosthesis also facilitates oculoplastic evaluation if needed. If the patient has not seen an ocularist recently, a referral for prosthesis adjustment is a reasonable first step. If this yields suboptimal results, the ocularist will refer the patient to an oculoplastic surgeon.

Socket contracture

Radiation therapy, chemical or thermal burns, recurrent infections, trauma-related eye loss, and multiple socket surgeries are all known risk factors for anophthalmic socket contraction.[18] Personally, I have observed socket contraction more frequently in patients with rheumatological diseases. Patients often report that the prosthesis feels too large and extrudes easily. In mild cases, only slight entropion of the upper eyelid and difficulty closing the eyelids may be observed. In more advanced cases, shortening of the fornices and reduced horizontal length are noted.[18] There are various surgical techniques for reconstructing a contracted socket, such as mucous membrane grafting and dermis-fat transplantation; however, the cicatricial changes may sometimes be difficult to address.[19-23] If socket contracture is suspected, the patient should be referred to an oculoplastic unit for evaluation.

Implant exposure

Implant exposure is one of the most feared complications of the anophthalmic socket, as it poses a significant risk of implant infection.[24,25] The initial symptoms of implant exposure are similar to those of dry anophthalmic socket syndrome, presenting with irritation and mucous discharge.[18] Therefore, it is essential to remove the artificial eye when examining the anophthalmic socket and to inspect for areas of visible implant (**Figure 3**). Pyogenic granulomas may precede or obscure an exposure, so discovering one in the socket without an apparent cause such as a suture or sharp edge of the prosthesis, should raise suspicion of exposure.[26] If an exposed area of the implant is found, refer the patient to an oculoplastic unit. Very small exposures of porous implants may heal with conservative treatment or patch grafting, but larger defects or infected implants may require removal of the implant.[18]

Summary

Many of the problems experienced by anophthalmic patients can be effectively managed with preservative-free artificial tears, treatment for blepharitis, and topical steroids. If giant papillary conjunctivitis is present, consider adding antihistamines with mast cell stabilizing properties. The patient should contact an ocularist if the prosthesis requires polishing or if there are concerns regarding asymmetrical appearance. A referral to an oculoplastic unit is advised in cases of implant contracture or exposure. However, the greatest contribution that can be made for the patient is ensuring proper care of the remaining eye.

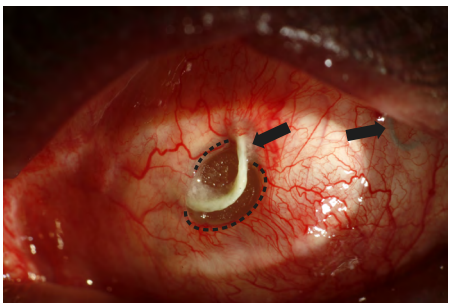

Figure 3. Exposure of a porous implant (dotted line). Remaining Vicryl sutures (arrows). Photo Eva Tov. Published with the patient's permission.

References

1. Pine NS, et al. Depression, Anxiety and Stress Indicators for Prosthetic Eye Wearers. *Clin Ophthalmol* 2020;14:1715-23.
2. Rokohl AC, et al. Concerns of anophthalmic patients-a comparison between cryolite glass and polymethyl methacrylate prosthetic eye wearers. *Graefes Arch Clin Exp Ophthalmol* 2018;256(6):1203-08.
3. Rokohl AC, et al. Concerns of Anophthalmic Patients Wearing Cryolite Glass Prosthetic Eyes. *Ophthalmic Plast Reconstr Surg* 2018;34(4):369-74.
4. Pine K, et al. Concerns of anophthalmic patients wearing artificial eyes. *Clin Exp Ophthalmol* 2011;39(1):47-52.
5. Chang WJ, et al. Conjunctival cytology features of giant papillary conjunctivitis associated with ocular prostheses. *Ophthalmic Plast Reconstr Surg* 2005;21(1):39-45.
6. Meisler DM, et al. An immunopathologic study of giant papillary conjunctivitis associated with an ocular prosthesis. *Am J Ophthalmol* 1981;92(3):368-71.
7. Srinivasan BD, et al. Giant papillary conjunctivitis with ocular prostheses. *Arch Ophthalmol* 1979;97(5):892-5.
8. Rokohl AC, et al. Dry anophthalmic socket syndrome - Standardized clinical evaluation of symptoms and signs. *Ocul Surf* 2020;18(3):453-59.
9. Rokohl AC, et al. Dry anophthalmic socket syndrome - morphological alterations in meibomian glands. *Eye (Lond)* 2021;35(12):3358-66.
10. Rokohl AC, Trester M, Pine KR, et al. How to diagnose dry anophthalmic socket syndrome (DASS) in the clinical routine. *Graefes Arch Clin Exp Ophthalmol* 2023;261(9):2713-15.
11. Rokohl AC, et al. Novel point-of-care biomarkers of the dry anophthalmic socket syndrome: tear film osmolarity and matrix metalloproteinase 9 immunoassay. *Graefes Arch Clin Exp Ophthalmol* 2023;261(3):821-31.
12. Bohman E, et al. Tear secretion is preserved while the area of meibomian glands is reduced in patients with prosthetic eyes, contributing to the symptoms of dry eye. *Br J Ophthalmol* 2024
13. Pine KR, et al. Deposit buildup on prosthetic eye material (in vitro) and its effect on surface wettability. *Clin Ophthalmol* 2013;7:313-9.
14. Pine KR, et al. Deposit buildup on prosthetic eyes and implications for conjunctival inflammation and mucoid discharge. *Clin Ophthalmol* 2012;6:1755-62.
15. Pine KR, et al. A proposed model of the response of the anophthalmic socket to prosthetic eye wear and its application to the management of mucoid discharge. *Med Hypotheses* 2013;81(2):300-5.
16. Akman A, et al. Effect of lodoxamide on tear leukotriene levels in giant papillary conjunctivitis associated with ocular prosthesis. *Ocul Immunol Inflamm* 1998;6(3):179-84.
17. Kenny SE, et al. Giant papillary conjunctivitis: A review. *Ocul Surf* 2020;18(3):396-402.
18. Johnson T.E. [Editor]. *Anophthalmia*. Cham, Switzerland: Springer 2020.
19. Bosniak SL. Reconstruction of the anophthalmic socket: state of the art. *Adv Ophthalmic Plast Reconstr Surg* 1987;7:313-48.
20. Galindo-Ferreiro A, et al. Dermis-fat graft for anophthalmic socket reconstruction: indications and outcomes. *Arq Bras Oftalmol* 2018;81(5):366-70.
21. Jovanovic N, et al. Reconstruction of the Orbit and Anophthalmic Socket Using the Dermis Fat Graft: A Major Review. *Ophthalmic Plast Reconstr Surg* 2020;36(6):529-39.
22. Kim CY, et al. Postoperative outcomes of anophthalmic socket reconstruction using an autologous buccal mucosa graft. *J Craniofac Surg* 2014;25(4):1171-4.
23. Qi Q, et al. A Sandwich-Like Oral Mucosa Graft-Conjunctiva In Situ-Dermis-Fat Graft for Reconstruction of the Anophthalmic Socket with Ocular Infection History. *Ophthalmol Ther* 2022;11(3):1261-71.
24. Jordan DR, et al. An infected porous polyethylene orbital implant. *Ophthalmic Plast Reconstr Surg* 2007;23(5):413-5.
25. Jordan DR, et al. The bioceramic implant: evaluation of implant exposures in 419 implants. *Ophthalmic Plast Reconstr Surg* 2010;26(2):80-2.
26. Jordan DR. Re: "pyogenic granuloma as a presenting sign of hydroxyapatite orbital implant exposure: a clinicopathologic study". *Ophthalmic Plast Reconstr Surg* 2007;23(6):501-2; author reply 02.

Key points:

- The greatest contribution that can be made for the patient is care for the remaining eye.
- In cases of mucous discharge in the socket, consider administering topical steroids, along with appropriate lubricating agents and blepharitis treatment. If this approach does not yield improvement, a referral to an oculoplastic surgeon should be considered.
- If the patient has an old prosthesis, protein deposits on the prosthesis surface, or asymmetry in appearance, advise them to contact their ocularist.
- If there is suspicion of implant exposure or socket contraction, the patient should be referred to an oculoplastic surgeon.

Conflict of interest
none