Complications involving the anterior segment and ocular surface can vary from mild, inconvenient, and self-limiting to serious and vision threatening. This chapter will highlight common and uncommon problems that can be encountered during and after strabismus surgery and will review methods to both prevent complications and treat complications that do occur. The chapter is organized anatomically, with a section on corneal complications, conjunctival complications, scleral complications, and intraocular complications. Anterior segment ischemia is discussed separately in Chap. 20.

19.1 Corneal Complications

Pedersen [1] reported corneal abnormalities in more than half of patients who underwent horizontal rectus muscle surgery. Among 44 patients she studied, dellen developed in four patients while the remaining had less significant abnormalities, including defects in the precorneal tear film, and fluorescein and/or rose bengal staining. Sterile corneal infiltrates were noted in five patients.

19.1.1 Dellen

The term delle (plural dellen) means low ground or pit. Dellen are characterized as shallow, clearly defined excavations at the margin of the cornea. They typically develop within the first 2 weeks after surgery and are generally 1.5–2 mm in diameter and occur following localized evaporation and dehydration of the cornea (Fig. 19.1). Disruption of the tear film and localized evaporation result in increasing compactness of the corneal stromal lamellae. The base of dellen typically appears hazy and dry and is rarely transparent. Fuchs [2] described the histological aspects of a delle. He found thinning of the epithelium peripherally and observed that the epithelium in the center of the lesion showed irregular thinning of the external stromal layer and Bowman’s membrane and noted the presence of leukocytes beneath Bowman’s membrane.

Dellen occur commonly after strabismus surgery, with a reported incidence of between 0.3% and 22.45% [3]. Tessler and Urist [4] retrospectively studied 170 cases of horizontal rectus muscle surgery. Dellen formation occurred in 6.5% of patients operated with a limbal approach compared with 2.2% for those operated using a nonlimbal approach. Dellen probably often go undiagnosed because subjective symptoms may be absent and clinical findings may be subtle. Additionally, strabismus surgery is often performed on small children who cannot be readily examined at a slit lamp. Mai and Yang [3] reported the occurrence of dellen after 22.45% of strabismus surgeries in patients who had undergone a rectus muscle recession or resection. The occurrence of dellen was much more common after rectus muscle resection procedures (47.75%) compared to rectus muscle recession procedures in which this complication occurred in only 5.13% of eyes. These investigators performed rectus muscle recession surgery through a limbal conjunctival incision with recession of the conjunctival flap to the insertion of the rectus muscle. The surgical approach used for rectus muscle resections was not clearly delineated in the report. It has been our experience that dellen are much more likely to occur following the very large resections, while small resections are not likely to be associated with dellen formation.

Mai and Yang [3] related the formation of dellen after strabismus surgery to changes in the tear film breakup time before and after surgery. The average preoperative tear film breakup time was 28.75 seconds (10.96–91.80 s). The breakup time was reduced in all patients postoperatively, regardless of the procedure performed and whether or not a delle formed.

Fig. 19.1. Corneal delle following strabismus surgery
The tear film breakup time in the group that experienced dellen formation was 23.22 s preoperatively and was reduced to 8.61 s postoperatively. In comparison, in the group that did not experience dellen formation, the tear film breakup time for those who had undergone a rectus muscle recession was 30.22 s preoperatively compared to 22.25 s postoperatively. For those without dellen formation who had undergone a rectus muscle resection, the breakup time was 29.71 s preoperatively and 15.83 s postoperatively. They concluded that local corneal dehydration and ultimately dellen formation was caused by reduced tear film breakup time. It has also been our anecdotal experience that dellen formation is more likely following rectus muscle resection surgery compared with rectus muscle resection surgery. Additionally, dellen formation appears to be more common in our experience following strabismus surgery performed through a limbal incision, though we have not formally studied this association. Common to almost all cases of dellen formation is elevation of the bulbar conjunctiva near the limbus adjacent to the lesion. It seems logical that limbal incisions and rectus muscle resection procedures, both of which tend to produce a greater degree of bulbar conjunctival edema and elevation near the limbus, would be associated with an increase in the formation of dellen. While we agree that the relationship between dellen formation and tear film breakup is interesting, we do not advocate the need for assessment of the breakup time prior to strabismus surgery.

We have seen corneal dellen formation following horizontal rectus muscle surgery, but have never seen dellen formation after vertical rectus muscle or oblique muscle surgery. Presumably this is because tear film evaporation and corneal drying are more likely to occur in the middle of the open palpebral fissure compared to the more protected areas superiorly and inferiorly. Though most patients with dellen are asymptomatic, some experience excessive lacrimation. Patients may also complain of mild ocular discomfort, but it has been our impression that dellen rarely produce pain. While usually mild and self-limiting, serious complications have been reported following formation of dellen. Insler and co-workers [5] reported the formation of a descemetocoele in a patient who developed a long-lasting corneal delle following vitrectomy surgery. The patient required a patch graft to the cornea to prevent corneal perforation. Zehl and Snell [6] reported corneal ulceration with dellen-like formation “in a region where there was considerable conjunctival thickening adjacent to the limbus,” in a patient with paralysis of cranial nerves 5, 6, and 7 who underwent strabismus surgery.

Treatment of dellen involves corneal rehydration and measures to reduce limbal conjunctival elevation. We generally prescribe a lubricating ophthalmic ointment three to four times per day to the affected eye. Dellen usually resolve within a few days to a week, accompanied by spontaneous reduction in bulbar conjunctival swelling as postoperative healing progresses. We have occasionally seen corneal dellen and bulbar conjunctival swelling persist for longer periods of time, prompting empirical use of topical steroids three to four times a day in an effort to hasten healing of the conjunctiva, which will translate into improvement of the associated corneal pathology. While we have not experienced serious complications associated with corneal dellen formation, the possibility of a serious complication exists and patients with corneal dellen are monitored more closely than the standard postoperative patient. Patients with an underlying tear film deficiency may be at highest risk and may require closer follow-up.

19.1.2 Corneal Abrasions

Corneal abrasions can occur due to unintentional corneal trauma caused by needles, sutures, and other instrumentation during surgery. Spontaneous corneal epithelial defects may be seen during strabismus surgery in patients with epithelial basement membrane disturbances. Hydration of the cornea during surgery may reduce the occurrence of spontaneous corneal erosion in patients with basement membrane disease. In general, however, we favor minimized application of balanced salt solution and other hydrating solutions during strabismus surgery, because these solutions tend to cause edema of exposed Tenon’s fascia in the operative site. Hydration of Tenon’s fascia can complicate surgery and can make closure more difficult. A corneal abrasion occurring during strabismus surgery should be managed using ordinary measures. If the abrasion is small, we generally do not recommend an eye patch but we do advise patients and/or parents of the presence of the corneal epithelial defect and we follow the patient more closely after surgery until the epithelial defect heals.

19.1.3 Corneal Ulcer

Both infectious and noninfectious corneal ulceration have been reported following strabismus surgery. We are aware of one unpublished case of bilateral pseudomonas microbial keratitis that resulted following strabismus surgery in which the surgeon utilized corneal bridle sutures to position the eyes for surgery. The use of corneal bridle sutures imposes an unnecessary risk of serious ocular infection by disruption of the corneal epithelium and stroma and should be avoided. Positioning of the eye for surgery can be accomplished through other means including placement of bridle sutures through the conjunctiva or use of positioning forceps. Zehl and Snell [6] reported a case of serious corneal complication following strabismus surgery to realign the eyes of a child with a left sixth nerve palsy. The child had a history of a left cerebellar hemisphere astrocytoma and concurrent fifth and seventh nerve palsies. A left lateral rectus muscle resection and left medial rectus muscle free tenotomy were performed. Two weeks after surgery the authors reported that “corneal ulceration had supervened with dellen-like formation temporally, in a region where there was considerable conjunctival thickening adjacent to the limbus.” Additional infiltrative lesions developed 2 weeks later. Supportive therapy with a therapeutic soft contact lens and antimicrobial therapy in the form of topical antibiotics resulted in healing of the corneal lesions and 6 months following surgery the cornea remained stable. The authors believed that extraocular muscle surgery in patients with complete loss of fifth and seventh nerve function