

Trichiasis: Characteristics and Management Options

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Learning Objectives:

1. Name three common symptoms of trichiasis
2. Describe underlying causes of trichiasis
3. Compare current treatment modalities for trichiasis

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Summary

Trichiasis is a common disorder in which eyelashes or cilia arising from their normal position are misdirected toward the ocular surface. This condition frequently causes ocular surface irritation and commonly results from eyelid inflammation and scarring which disrupts the direction of growth of cilia follicles. The knowledge of eyelid and cilia anatomy is important to the success of the treatment. Management options include epilation, electrolysis, radiofrequency ablation, laser photoablation, cryotherapy and surgical removal of the offending cilia. Treatment is made by the clinician based upon the number, distribution and severity of the trichiasis. Recognition and management of the underlying cause of the trichiasis should also be addressed. Nevertheless, recalcitrant or recurrent cilia are not unusual despite a systematic approach to this condition. This article will briefly discuss trichiasis and the relevant eyelid and cilia anatomy. Subsequently, the current treatment modalities for trichiasis and their complications will be described.

Introduction

Trichiasis is a condition in which the eyelashes (cilia) are abnormally misdirected toward the ocular surface. The cause of trichiasis can range from idiopathic to chronic eyelid margin inflammation (e.g., posterior blepharitis), eyelid margin scarring (e.g., trauma, surgery) and conjunctival scarring (e.g., burns, cicatricial disease).¹ Trichiasis may be classified according to the amount of misdirected eyelashes: *minor* trichiasis affects fewer than 5 cilia (*Figure 1*) and *major* trichiasis affects 5 or more cilia (*Figure 2*).¹

Minor trichiasis is relatively common, although the frequency is unknown, as a number of patients attending for ophthalmic care are unreported. The majority of patients are symptomatic, as the cilia rub against the ocular surface causing a foreign body sensation. Other frequent complaints are photophobia, tearing, discharge, dry eye sensation, burning, pain, blepharospasm and conjunctival congestion.¹ Ocular examination with slit-lamp biomicroscopy can show one or more misdirected cilia, superficial punctate keratopathy, corneal abrasion, infection, vascularization, opacities and loss of vision.

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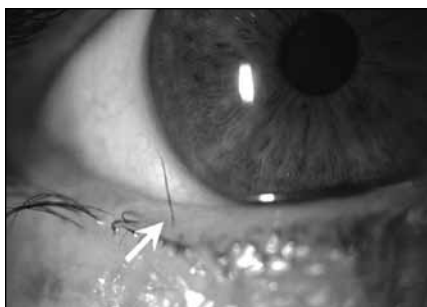


Figure 1: Minor trichiasis of the right lower lid (arrow)

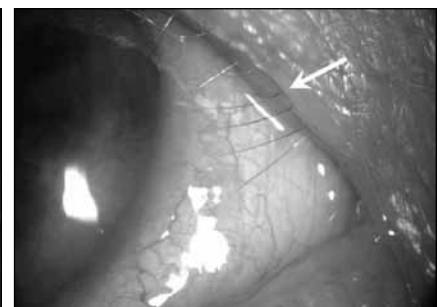


Figure 2: Major trichiasis in the lateral aspect of left upper lid (arrow)

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Trachoma is a chronic, keratoconjunctivitis caused by the obligate intracellular bacteria *Chlamydia trachomatis* and remains a prominent cause of major trichiasis development.² Trachoma is currently estimated to affect approximately 10 million people.³ Other cilia disorders that may result in ocular surface damage include distichiasis, a congenital (and often autosomal dominant) or acquired condition in which an extra row of lashes is seen emerging from the ducts of the meibomian glands.⁴ Anomalous cilia can also be noted behind the orifices of the meibomian glands due to the metaplasia of the tarsal glands following conjunctival scarring. Entropion occurs when the eyelid margin turns inward, causing the cilia to touch the ocular surface. Epiblepharon is a condition where an extra horizontal fold of skin inferiorly redirects the lashes toward the ocular surface.⁵

Several treatment modalities are available for patients with trichiasis. The treatment aims to remove the aberrant cilia and reduce the patient's symptoms. Treatments range from simple methods such as epilation to electrolysis, laser and surgery. Success rates vary with each treatment option and commonly the option employed is in conjunction with management of any underlying mechanism by which the trichiasis has occurred. It is important for ophthalmic nurses and technicians to be aware of the various treatment options available along with their success rate. This article will briefly discuss trichiasis, present the related anatomy of the eyelids and cilia, and then discuss the various management options for trichiasis.

Relevant anatomy

The role of the eyelids is for ocular protection, production and distribution of the tear film, and to allow drainage of tear film through the nasolacrimal system. The cilia also provide a protective mechanism by catching airborne debris before it touches the ocular surface. An understanding of the eyelid and cilia anatomy is required when examining the eye and periorbital area. The eyelid margins are the surfaces of the lids that oppose each other during closure and are approximately 30 mm in length and 2 mm thick.⁶ The anatomical features of the eyelids can be separated into anterior and posterior lamellae. The anterior lamella is comprised of skin, cilia, muscle and glands, whilst the posterior lamella is composed of the tarsal plate, conjunctiva and glands (*Figure 3*). In the central aspect of the eyelid margin is the sulcus intermarginalis of Graefe, more commonly known as the grey line.⁷ The grey line is an important landmark for eyelid surgery.

The eyelid skin is amongst the thinnest in the body and receives its sensory innervation from the first and second divisions of the trigeminal nerve (cranial nerve V). Human eyelid movements

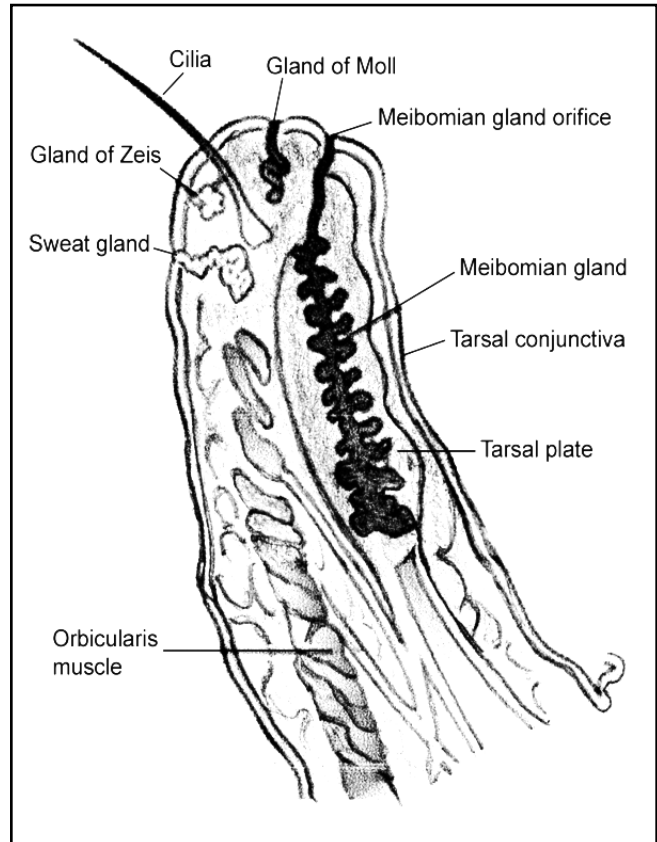


Figure 3: Schematic section of the lower lid

are mediated by the orbicularis oculi and levator palpebrae muscles. A distinguishing feature of the anterior lamella is the cilia. The upper lid contains five or six rows of cilia, whereas the lower lid contains three to four.⁸ Approximately 100 to 150 cilia are found in the upper eyelid, and approximately 50 to 75 cilia are in the lower eyelid.⁸ A loss of cilia (madarosis) may be an indication of an eyelid neoplasm. Cilia are usually darker than other hairs and are not permanent structures. Each cilium lasts for approximately five months, then is shed from its follicle.⁹ Unless the follicle is destroyed, a new cilium will begin to generate as soon as the old one is shed.¹⁰ Cilia do not turn grey with age.⁸ Acquired whitening of lashes (poliosis) may be a sign of blepharitis or conditions such as Vogt-Koyanagi-Harada syndrome.¹¹

The superior cilia curl outward and up while the lower curl outward and down, to avoid interlacing when blinking. Lash ptosis is a condition where the cilia point inferiorly instead of curling outward and up from the upper lid. Lid cilia, unlike the skin, are free of an arrector pili muscle and their length varies

between 8 to 12 mm in the upper lid and from 6 to 8 mm in the lower lid.⁸ Similar to hair on the body, cilia grow from follicles below the skin surface. Follicles are pockets of specialized cells able to synthesize proteins to form cilia. All human hair demonstrates three stages of growth that continue in a cyclic fashion. The anagen, or growth phase, leads to the catagen or transition phase.¹² The telogen, or resting phase, follows just prior to the resumption of the anagen phase.¹² The cilia fibre is shorter than scalp hair due to a shorter anagen phase and its being rooted approximately 2 mm below the skin.⁸ The reported growth rate of cilia is approximately 120–130 μm daily.⁸ The anagen phase ranges from 20–55 days, with the complete cycle being recorded at around three months.⁸

Various glands are located in the eyelids. The meibomian glands are sebaceous glands located in the upper and lower lid tarsal plates. The orifices for the meibomian glands are located on the lid margin posterior to the grey line. Meibomian glands contribute to the lipid layer of the tear film. Low-grade inflammation of these glands and eyelid margin is called posterior blepharitis. Sebaceous glands of Zeis open into each follicle.⁶ Behind and between the follicles, modified sweat glands, ciliary glands of Moll, open into the follicles or onto the eyelid margin.⁶ Occlusion of their orifices can lead to hordeola, or styes. Furthermore, they may be the site of sebaceous cell carcinoma.

Management options

SIMPLE TREATMENT

Cilia removal with forceps (epilation) is a straightforward and inexpensive procedure; however, recurrence is frequently encountered after four to six weeks.¹ Epilation is best performed with slit-lamp biomicroscopy, grasping the cilia with forceps close to the eyelid skin, ensuring the root of the cilia is removed intact. A sharp barb may result if the cilia are broken on removal, causing more ocular irritation. Other short-term, simple treatment regimes, including ocular lubricants, bandage contact lens and taping back the eyelids, may be used to reduce symptoms and protect the ocular surface from progressive damage.

ELECTROLYSIS

Electrolysis can be used to treat minor trichiasis. It involves an electric current being passed through an ultrafine needle inserted into the anesthetised skin and destroying the hair follicle. An electrolysis needle must contact 95% of the cilia follicle to destroy it.⁵ This requires the needle to be inserted to a depth of 1.4 mm in the lower lid and 2.4 mm in the top lid.⁵ When the cilia bulb is destroyed, the cilia can be easily removed using forceps.

Electrolysis does have a high reported recurrence rate of approximately 50%.¹³ The recurrence rate may be associated with a blind insertion of the needle and not enough follicle being

destroyed. Success rate may improve with successive treatments. More recently, an ultrafine needle of 55 μm thickness was shown to have a success rate of approximately 67% after one treatment and a 100% success rate after two or three additional treatments.¹⁴ Complications of electrolysis include eyelid inflammation, hyperpigmentation or hypopigmentation, eyelid notching and eyelid scarring.

RADIOFREQUENCY ABLATION

A recent study reported the efficacy of radiofrequency ablation of minor trichiasis.¹⁵ The treatment technique is comparable to electrolysis and the current is applied until bubbling or frothing is seen at the base of the eyelash. The treatment selectively destroys the follicles and approximately 0.5 mm of adjacent tissue.¹⁵ The success rate of the treatment was approximately 65% after one treatment and 100% after two or three additional treatments. The complications included eyelid edema, erythema and thickening of the lid margin.

LASER

Laser photoablation has been advocated to treat minor and major trichiasis or as an adjunctive therapy following surgery for major trichiasis.¹ Cilia are destroyed by photothermolysis—a process where thermal injury is confined to a target containing a light-absorbing molecule called a chromophore.¹⁶ In cilia, the primary target chromophore is the melanin in the follicle. Lasers that destroy cilia photothermally include argon (514 nm), ruby (694 nm), alexandrite (755 nm), diode (810 nm) and neodymium:yttrium-aluminum-garnet (Nd:YAG) (1064 nm).^{1,16}

Argon laser has been used to treat trichiasis since 1979.¹⁷ Reported studies demonstrate a considerable difference in success rate after one treatment, ranging from 33% to 100%, with an average of approximately 70%.^{18,19} Success rate increases with subsequent treatments. Variations in success rate between studies are largely due to application of different laser settings (i.e., laser spot size, time of application, laser power) and to differences in the clinician's technique.

The procedure can be performed after subcutaneous infiltration or topical anesthesia. The lid is everted so that the cilia root is coaxial to the laser beam. Sequential shots are applied until the follicle has been destroyed, and a burn depth of at least 1.4 mm for the lower lid and 2.4 mm for the upper lid is required for cilia bulb destruction.¹ Complications of laser treatment include lid notching and areas of hypopigmentation and scarring. Laser treatment is not effective with non-pigmented cilia and the application of ink or blood to the cilia prior to treatment increases the success rate.²⁰

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Alternative laser therapies to treat trichiasis have been demonstrated with ruby and diode lasers. These lasers have been described as having better penetration ability and more specific absorption than argon laser. Ruby laser has recently been shown to be a well-tolerated and effective treatment of trichiasis in a small group of patients.²⁰ Diode laser applied with a direct-contact probe has been shown to have a success rate of 72% after one treatment and 94% after three treatments.²¹ The probe offers the advantage of allowing different orientations to enhance the laser energy along the shaft of the cilia. No complications of lid notching, hypopigmentation or scarring were reported in either study.

CRYOTHERAPY

Cryotherapy can be used to treat segmental and diffuse trichiasis. Cilia and pigmented cells are more sensitive to the effects of freezing than are other epithelial cells, blood vessels and connective tissues.²² A double freeze-thaw cycle with a cryoprobe is recommended, encompassing a rapid freeze to -20°C , followed by a slow thaw, then the lashes are epilated.¹ The double rapid-freeze and slow thaw produces ice crystals, which disrupt cell membranes and cellular destruction.²³ Thawing also increases the concentration of intracellular electrolytes, leading to cellular necrosis.²³ Liquid nitrogen or nitrous oxide probes can be used to achieve the rapid level of freezing required.²⁴ A thermocouple can be used to monitor tissue temperatures and to ensure freezing to the -20°C level. The procedure is performed under local anesthetic with epinephrine. The cryoprobe is placed on the offending cilia or the tarsal conjunctiva and the globe is protected with a corneoscleral shell. An eyelid reaction consisting of mainly edema and erythema can be expected for one or two weeks post-operatively.

Overall, the reported success rate of cryotherapy after a single treatment ranges from 56%–90%, with increased success rate following successive treatments.^{25,26} However, cryotherapy induces more loss of normal adjacent lashes than other non-surgical treatment modalities and presents more possible complications such as lid notching and thinning, meibomian gland dysfunction, necrosis, skin depigmentation, symblepharon, entropion and trichiasis recurrence.¹ Skin depigmentation may be a cosmetic problem in dark-skinned patients. Cryotherapy is not effective in the treatment of fine, non-pigmented or lanugo-like cilia.

SURGERY

Surgical procedures are available for minor and major trichiasis. Folliclelectomy and cilia trephination are short and inexpensive

procedures. Both procedures specifically target and manually remove the offending cilia with success rates being reported at approximately 70% for folliclelectomy and 62% for trephination after the primary procedure.^{27,28} Both procedures also appear to have low complication rates.

Segmental areas of trichiasis can be treated by a full-thickness wedge resection, which will remove the anomalous cilia and has the advantage of good cosmesis and few complications.¹ An option of using a mucocutaneous graft from either the lip or eyelid to form a barrier between the offending lashes and the ocular surface has been described.¹ An alternative procedure for segmental or more extensive trichiasis is anterior lamellar splitting surgery with either allowing the bare tarsal plate to granulate spontaneously²⁹ or advancing the anterior lamellar tissue and suturing it to the tarsus.³⁰

Surgical eversion of the eyelid through tarsal rotation can be employed. With the lamellar tarsal rotation procedures (e.g., Trabut and Wies techniques) a small, horizontal lid incision is made approximately 4 mm from the eyelid margin through the tarsal plate and conjunctiva.^{1,31} The margin is then rotated outward with an everting suture. The World Health Organization (WHO) recommends the bilamellar tarsal rotation for trichiasis from trachoma.³² This procedure involves a large, full-thickness, horizontal incision through the upper lid at 3 mm from the eyelid margin.³³ Everting sutures are then placed through all layers of the lid. In a randomized controlled trial, the bilamellar tarsal rotation showed an initial success rate of 77%; however, long-term results have shown recurrence rates of over 50% after three years.^{33,34} A single dose of azithromycin post-surgery has been shown to reduce the recurrence of trachoma trichiasis.³⁵ If entropion is associated with trichiasis, the procedure of choice is the horizontal fracture of the tarsal plate and eyelid margin rotation.¹

Conclusion

Trichiasis is a common clinical disorder in which eyelashes or cilia arising from their normal anterior lamellar position are misdirected toward the ocular surface. This condition may be overlooked by primary health care providers but can be observed by ophthalmic practitioners with slit-lamp biomicroscopy. Although many treatments are available to resolve trichiasis, a definitive treatment has not been established. Successful treatment improves patient symptoms and reduces the risk of ocular surface complications. However, recalcitrant or recurrent cilia are not unusual, despite a systematic approach to this condition, proving to be a challenge for the clinician. Initial consideration determines the etiology of trichiasis, which is more commonly

associated with inflammatory disruption and scarring of the cilia follicles. Treatment is usually based upon the number, distribution and severity of the trichiasis. Options range from epilation to laser photoablation, cryotherapy and surgical removal of the offending cilia.

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