GLAUCOMA UPDATE

A review of canaloplasty

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Canaloplasty; Trabeculectomy; Schlemm’s canal; Phacoemulsification

Abstract  Canaloplasty is a method of lowering intraocular pressure (IOP) by which a flexible, bea-
con-tipped microcatheter equipped with an ophthalmic viscosurgical device (OVD) delivery system
is used to catheterize and introduce a suture into Schlemm’s canal. Ligation of this suture provides
tension on the canal and facilitates aqueous outflow. Canaloplasty is designed to be a blebless pro-
cEDURE that requires no antifibrotic agents and has been shown to safely and effectively lower IOP in
patients with open-angle glaucoma (OAG) with minimal complications. Most importantly, no bleb-
related adverse events are associated with this procedure. When contemplating surgical manage-
ment of OAG, canaloplasty may be considered.

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1. Introduction

The mainstay of glaucoma treatment is lowering of IOP. The classic treatment algorithm consists of initial medical management followed by incisional glaucoma surgery if necessary with laser therapy sometimes utilized as bridge therapy. Many variations of this paradigm exist. The most popular glaucoma surgery utilized is the trabeculectomy with the use of Mitomycin C, which redirects aqueous from the anterior chamber to a subconjunctival bleb. This procedure, while very effective at lowering IOP, is associated with multiple risks and complications. Intraoperative and postoperative risks include hypotony, hyphema, choroidal detachment and suprachoroidal hemorrhage. The blebs may be associated with bleb leak, bleb encapsulation, bleb dysesthesia, blebitis and bleb-associated endophthalmitis (Greenfield et al., 1996; Prasad and Latina, 2007; Radhakrishnan et al., 2009; Azuara-Blanco and Katz, 1998; Borisuth et al., 1999).

Such complications have encouraged many glaucoma specialists to seek out a less invasive IOP-lowering surgery. Recently circumferential viscodilation and tensioning of Schlemm’s canal using a flexible microcatheter (canaloplasty) in combination with deep sclerectomy has raised interest for the treatment of OAG in adults. The purpose of this review is to present an update on the current status of this procedure.

2. Surgical procedure

Canaloplasty is a surgery in which Schlemm’s canal is isolated and catheterized using a microcatheter equipped with an optical illuminating beacon at its tip and an OVD delivery system. This microcatheter is used to introduce a suture into Schlemm’s canal, which provides enough circumferential tension to distend the canal with the purpose of increasing outflow and decreasing IOP.

A retrobulbar block achieves anesthesia and akinesia preoperatively. The eye is inferoducted after placement of a clear corneal traction suture near the limbus. This may be accomplished with a traditional single-pass or double-pass technique. During the latter, 6-0 or 7-0 polyglactin (Vicryl, Ethicon, Switzerland) is passed perpendicular to the limbus in an anterior-to-posterior direction exiting near the limbus with the first pass. A second pass occurs approximately 2–3 clock-hours away from the initial pass and enters near and perpendicular to the limbus traversing the cornea in a posterior-to-anterior

Figure 1  Limbal peritomy.

Figure 2  Superficial scleral flap.

Figure 3  Deep scleral flap.
direction. Alternatively, these two passes may be made parallel to the limbus. The exposed Vicryl parallel to the limbus can be used to secure the superficial scleral flap during deep scleral flap creation and canal unroofing.

Canaloplasty begins with a 2–3 clock-hour limbal peritomy followed by exposure of bare sclera accomplished via meticulous dissection of conjunctiva and tenon’s capsule with wetfield cautery used for hemostasis (Fig. 1). Unlike a traditional trabeculectomy procedure, no antifibrotics are necessary. The location of canal entrance may be tailored to fit individual needs. Some surgeons favor a superonasal approach thus sparing the superior and superotemporal conjunctiva should future, more invasive incisional glaucoma surgeries be necessary. Still other surgeons prefer a more conservative inferior approach completely sparing the superior conjunctiva.

Schlemm’s canal can be isolated after dissection of two scleral flaps. The first, superficial flap should be approximately one-third to one-half scleral thickness, and dissection of this flap should be initiated well into clear cornea by approximately one millimeter to allow ample area for creation of the descemet window (Fig. 2). A 5 mm × 5 mm parabolic or triangular flaps are common techniques employed. This superficial scleral flap may be retracted with the double-pass traction suture described above. Next, a deep scleral flap with a parameter one-half to one millimeter smaller than the superficial flap is fashioned within the base of the previous flap with a dissection plane immediately superficial to the choroid (Fig. 3). Choroidal exposure may occur. Anterior dissection of the deep scleral flap unroofs Schlemm’s canal. Cross striations of the scleral spur serve as anatomic landmarks during creation of the deep flap, as Schlemm’s canal is immediately anterior. Locating this landmark ensures correct depth and plane of dissection.

The eye must now be decompressed in order to decrease the risk of anterior chamber perforation. Paracentesis wound formation with subsequent aqueous release lowers the intraocular pressure to mid-to-high single digits, which is optimal for isolating Schlemm’s canal and creating a trabeculo-descemet window (TDW) (Fig. 4). After releasing pressure in the anterior chamber the dissection of the deep flap anteriorly isolates Schlemm’s canal. Further dissection in this plane past Schwalbe’s line creates the descemet window, which should be approximately 500 microns in length (Fig. 5). Aqueous may be seen percolating through the TDW in most but not all cases at this point. Both ostia of the canal are dilated using the iTrack microcatheter (iTrack-250, iScience Interventional, Menlo Park, CA), which is then inserted into one of the ostia. As the microcatheter is inserted into the canal, the lights are dimmed to allow visualization of the illuminating optical fiber beacon through sclera (Fig. 6). If resistance is encountered retract the microcatheter, insert it through the opposite ostium and advance. After successful 360° cannulation of Schlemm’s canal a 9-0 or 10-0 polypropylene suture (Prolene, Ethicon, Switzerland) is tied to the tip of the microcatheter, which is then retracted thus introducing the suture throughout the circumference of the canal (to the authors’ knowledge, no studies have compared 9-0 to 10-0 Prolene; however, it has been reported that 10-0 is more effective at distending Schlemm’s canal and lowering IOP when compared with 6-0 Prolene (Grieshaber et al., 2010c). While retracting the microcatheter ophthalmic viscosurgical device (OVD) is injected into the canal at a rate of 0.5 μL/2 h or 1/8th turn of the OVD injector every 2 clock-hours. The suture is removed from the microcatheter and carefully tied to allow adequate tension on Schlemm’s canal while avoiding inadvertent trabeculotomy. Adequate suture tension is paramount to achieve proper 360° distension of Schlemm’s canal.

The deep scleral flap is excised followed by water-tight closure of the superficial flap with interrupted 10-0 nylon sutures. Alternatively, the superficial flap may be left unsutured if no flow is noted. Tenon’s capsule and conjunctiva are closed with
8.0 Vicryl at the limbus, and the surgery is concluded with injection subconjunctival antibiotics and application of topical antibiotic-steroid ointment.

3. Canaloplasty combined with cataract surgery

Combining cataract and glaucoma surgery is often necessary, as glaucoma surgery can cause cataract progression (AGIS Investigators, 2001). In addition, cataract surgery alone has been shown to lower IOP anywhere from 1 to 5 mmHg (Shingleton et al., 2006; Hayashi et al., 2001; Mathalone et al., 2005). Furthermore, phacoemulsification shows a lower IOP trend than canaloplasty alone (Lewis et al., 2011); therefore, combining the two has gained popularity.

Cataract surgery may be combined with canaloplasty with simple adjustments or steps added during the procedure. Phacoemulsification ensues prior to canaloplasty using the surgeons preferred techniques. A side port incision is made followed by introduction of OVD into the anterior chamber. Size, shape and relative location of clear corneal incisions may vary, but keep in mind that both side port and clear corneal incisions must be placed in a manner as to not intersect the corneal traction suture that will be necessary at the beginning of canaloplasty. When operating on either eye, both incisions may be skewed inferotemporally to avoid such complications. Complete and thorough removal of OVD is key to avoid postoperative IOP spikes, which may be detrimental to glaucoma patients. Finally, the clear corneal incision is sutured in order to maintain anterior chamber stability during canaloplasty, which is then performed using the technique previously described above.

4. Postoperative care

Postoperatively, patients are placed on a low-dose steroid and a third or fourth generation fluoroquinolone drop three-to-four times per day. The steroid drop must be weaned quickly, preferably within two weeks, as we have found a more pronounced steroid response in patients undergoing canaloplasty. This anecdotal data may be at least partially attributed to the OAG patient population who are at higher risk for steroid response (Kersey and Broadway, 2006); however, other factors may be contributing to this phenomenon after the trabeculocanicular outflow system alteration occurs via canaloplasty. Relative incidence and etiology of steroid response post canaloplasty have yet to be fully investigated.

5. Discussion

The most comprehensive evaluation of canaloplasty was performed by Lewis et al. (2011) in their 3-year international multicenter prospective study. Patients were included if they had OAG and a baseline IOP of ≥16 mmHg and a historical IOP of ≥21 mmHg. Angle-closure glaucoma (primary or secondary), uveitic glaucoma and angle recession glaucoma patients were excluded. Patients who underwent more than two laser trabeculoplasties were also excluded. At three years, the mean postoperative IOP for all eyes (n = 157) was decreased from 23.8 ± 5.0 mmHg on 1.8 ± 0.9 medications to 15.2 ± 3.5 mmHg on 0.8 ± 0.9 medications demonstrating a 36.1% IOP decrease from baseline. These patients were divided into subsets for subsequent analysis. Overall, successful suture placement occurred in 84.7% of patients (n = 133). Successful suture placement within Schlemm’s canal after canaloplasty alone was performed in 103 eyes with 36-month data available for 89 eyes. Of this subset, there was a 34% IOP decrease from baseline from 23.5 ± 4.5 mmHg on 1.9 ± 0.8 medications to 15.5 ± 3.5 mmHg on 0.9 ± 0.9 medications at 36 months. Canaloplasty with successful suture placement combined with phacoemulsification was performed in 30 eyes with 36-month data available for 27 eyes. Baseline IOP decreased from 23.5 ± 5.2 mmHg on 1.5 ± 1.0 medications to 13.6 ± 3.6 mmHg on 0.3 ± 0.5 medications at 36 months postoperatively accounting for a 42.1% reduction. There was a trend for lower IOP after phacoemulsification versus canaloplasty, but this difference was not significant (p = 0.95). Intraocular pressure in the low teens has been reported in other studies as well following the combined procedure (Bull et al., 2001; Shingleton et al., 2008). In all groups, the IOP and medication use was significantly decreased at all time intervals compared to baseline (p < 0.001).

Lewis et al. (2009) further delineated response to canaloplasty based on degree of canal distension. Using high-resolution anterior segment ultrasound biomicroscopy (UBM) analyzed before, during and after surgery the investigators were able to develop a grading system of suture tension on Schlemm’s canal. Application of this scale allowed objective evaluation of canal distension and its effect on postoperative IOP reduction in eyes that received canaloplasty alone. These eyes were divided into discernable or no discernable distension with the former showing a 31% IOP decrease and the latter showing a 20% IOP decrease exemplifying a significantly exaggerated IOP-lowering response at 24 months in eyes with effective suture tensioning on Schlemm’s canal (p = 0.018).

Another long-term study investigated the efficacy of canaloplasty and phacoemulsification on European eyes with open-angle glaucoma (Bull et al., 2001). One hundred and nine eyes were included in the study with successful intracanalicular suture tensioning occurring in 98 eyes (89.9%), canaloplasty alone performed in 93 eyes (85.3%) and phacoemulsification performed in 16 eyes (14.7%) with 3-year follow-up data available for 96 eyes (88.1%). In the canaloplasty alone group the mean baseline IOP of 23.0 ± 4.3 mmHg on an average 1.9 ± 0.7 medications was significantly reduced to 15.1 ± 3.1 mmHg on 0.9 ± 0.9 medications while the phacoemulsification group’s mean baseline IOP of 24.3 ± 6.0 mmHg on an average 1.5 ± 1.2 medications was significantly reduced to 13.8 ± 3.2 mmHg on 0.5 ± 0.7 medications (p < 0.00001).

Grieshaber et al. (2011) published a series with similar results. Thirty-two white patients with open angles, IOP > 21 mmHg, glaucomatous optic neuropathy and corresponding visual field defects who underwent canaloplasty were included in this study. Patients were excluded if they received previous ocular surgery or laser. Complete success (IOP reduction without medications) occurred in 93.8% with IOP ≤ 21, 84.4% with IOP ≤ 18, and 74.9% with IOP ≤ 16.12 months postoperatively. Before canaloplasty, the mean IOP and number of medications were 27 ± 5.6 mmHg and 2.7 ± 0.5 medications, respectively. Eighteen months after canaloplasty the mean IOP and number of medications were 13.1 ± 2.2 mmHg and 0.1 ± 0.3 medications, respectively.
While the aforementioned patients were primarily white, canaloplasty appears to be effective in black and Asian populations as well. Grieshaber et al. (2010a) also published long-term data with a mean follow-up of 30.6 ± 8.4 months on canaloplasty performed on black Africans, the majority of which (98%) received canaloplasty as primary glaucoma treatment. In this study, 60 consecutive POAG patients were selected to receive canaloplasty. The mean preoperative IOP was 45.0 ± 12.1 mmHg. At 6, 12, 24, and 36 months postoperatively, the mean IOP without medications was 15.4 ± 5.4 mmHg (n = 57), 15.4 ± 5.2 mmHg (n = 54), 16.3 ± 4.2 mmHg (n = 51), and 13.3 ± 1.7 mmHg (n = 49), respectively. Complete success defined as IOP ≤ 21 mmHg without medications was achieved in 77.5%, and qualified success (IOP ≤ 21 mmHg with or without medications) was seen in 81.6% of patients at 36 months. Ninety-five percent of patients had no deterioration of Snellen visual acuity at 36 months.

A small case series of Japanese patients receiving canaloplasty or phacocanaloplasty is also present in the literature (Fujita et al., 2011). In this study 11 eyes of 9 Japanese patients with POAG underwent canaloplasty (three eyes) or phacocanaloplasty (eight eyes). The mean preoperative IOP was 23.4 ± 5.5 mmHg on 2.8 ± 0.6 medications. At 6, 12, and 24 months the mean IOP was 13.7 ± 2.8 mmHg, 12.8 ± 3.5 mmHg, 14.0 ± 4.4, and 15.0 ± 4.1, respectively. The mean postoperative medications significantly decreased from 6.8 ± 2.9 medications at 12 months to 2.8 ± 2.0 medications at 24 months (p < 0.01). A qualified success rate with and without medications at 6 months was achieved in 81.8, 54.5 and 54.5%, respectively.

6. Adverse events

When compared to trabeculectomy, canaloplasty offers a more favorable side effect profile; however, one must be aware of potential complications encountered during or after this procedure. Intraoperative complications include inability to cannulate Schlemm’s canal, Descemet membrane detachment and improper microcatheter passage (Lewis et al., 2011; Bull et al., 2001; Shingleton et al., 2008; Lewis et al., 2009; Grieshaber et al., 2011; Grieshaber et al., 2010a; Fujita et al., 2011). Successful 360° cannulation of Schlemm's canal with intracanalicular suture placement was seen in 84.7% of eyes in Lewis’s 3-year study and 74.89.9% in other studies (Lewis et al., 2011; Bull et al., 2001; Shingleton et al., 2008). Unsuccessful 360° catheterization was usually attributed to early surgical inexperience or anatomical obstacles (Lewis et al., 2011; Shingleton et al., 2008). All but one eye had successful cannulation and suturing of SC in Grieshaber’s studies (Grieshaber et al., 2011; Grieshaber et al., 2010a). No cannulation issues were reported in Fujita’s case series (Lewis et al., 2009). Descemet membrane detachment rate was uncommon, ranging from 1.6% to 9.1% (Lewis et al., 2011; Bull et al., 2001; Shingleton et al., 2008; Lewis et al., 2009; Grieshaber et al., 2011; Grieshaber et al., 2010a; Fujita et al., 2011) (Fig. 7). One case report described bilateral Descemet membrane detachment in one patient who underwent consecutive canaloplasty in each eye (Palmiero et al., 2010), and another described an intracorneal hematoma following a proposed intraoperative Descemet membrane detachment (Gismondi and Brusini, 2011). In rare settings, the microcatheter could exit SC and violate surrounding structures. This occurred in two patients (3.3%) of Grieshaber’s black Africans receiving canaloplasty. The microcatheter entered the anterior chamber in one patient and the suprachoroidal space in another. In both instances the microcatheter was retracted and successful cannulation ensued. Passage of the microcatheter into the suprachoroidal space created a presumed ‘microcyclodialysis’ with subsequent hypotony that spontaneously resolved. Breaking through the TM into the anterior chamber may have introduced excess OVD with a resultant hypertensive phase, which was successfully treated with a short course of oral acetazolamide (Grieshaber et al., 2010a). Intraoperative trans-TM suture extrusion occurred in one eye (0.8%) in Lewis et al. (2011) study.

Hyphema or microhyphema (defined differently by different authors) were the most common post canaloplasty complications with a wide range of reported events depending on qualifying parameters. Collectively, hyphemmas and microhyphemmas ranged from 6.1% to 70% of eyes. All events were transient and resolved without sequela with most resolving by one week and all resolving by one month in every study (Lewis et al., 2011; Bull et al., 2001; Shingleton et al., 2008; Lewis et al., 2009; Grieshaber et al., 2011; Grieshaber et al., 2010a; Fujita et al., 2011). Another common side effect noted in Lewis's and Bull's 3-year studies was cataract formation with 12.7% and 19.1% developing visually significant cataracts, respectively (Lewis et al., 2011; Bull et al., 2001). Conversely, Grieshaber's 3-year study demonstrated only a temporary decline in VA, which returned to baseline in 95% of patients (Grieshaber et al., 2010a). Some eyes experienced an unexpected increase in pressure. Intraocular pressure elevation ≥30 mmHg occurred in 1.6–18.2% of eyes, which was thought by some authors to be secondary to retained viscoelastic in the anterior chamber. Persistent elevation in IOP requiring laser goniopuncture was necessary in 8.3–18.8% in some studies; however, in other reports no eyes required laser goniopuncture. Other postoperative complications reported in the literature include suture 'cheese-wiring' through the TM (up to 9.1%), wound hemorrhage (up to 2.5%) and hypotony (up to 0.6%) Lewis et al., 2011; Bull et al., 2001; Shingleton et al., 2008; Lewis et al., 2009; Grieshaber et al., 2011; Grieshaber et al., 2010a; Fujita et al., 2011. Bleb formation occurred in only 2.5% of Lewis’s patients and none of Grieshaber’s patients at 36 months (Lewis et al., 2011; Grieshaber et al., 2010a). Of note, no choroidal detachment, suprachoroidal hemorrhage, blebitis or bleb-associated endophthalmitis has been reported in the literature to date.

Figure 7 Descemet membrane detachment with entrapped blood.
7. Contraindications

Contraindications for canaloplasty include patients with chronic angle closure, narrow angles, neovascular glaucoma and in eyes that have undergone previous glaucoma procedures that preclude adequate cannulation of Schlemm’s canal (Godfrey et al., 2009). Chronic angle closure causes increased intraocular pressure by obstructing the trabecular meshwork with the peripheral iris with subsequent development of peripheral anterior synechiae (PAS). Such obstruction is upstream from Schlemm’s canal; therefore, canaloplasty may be ineffective. Similarly neovascular glaucoma covers the TM with a neovascular membrane that eventually contracts leading to the development of PAS and secondary angle closure. Uveitic glaucoma may develop secondary to obstruction of the TM with inflammatory debris or secondary to inflammation-induced PAS formation. Procedures that may prevent adequate cannulation of Schlemm’s canal include (but are not limited to) trabeculectomy, trabeculotomy, goniotomy, argon laser trabeculoplasty (ALT), trabectome (NeoMedix Inc., Tustin, California, USA), iStent® Trabecular Micro-Bypass (Glaukos Corp., Laguna Hills, California, USA), and Eyepass Glaucoma Implant (GMP Companies Inc., Fort Lauderdale, Florida, USA). Trabeculotomy, either ab externo or ab interno, and goniotomy violate the inner wall of Schlemm’s canal; therefore, adequate tension may not be distributed to the canal. Similarly, the trabectome, which uses an electrocautery tip to remove portions of the TM and the inner wall of Schlemm’s canal removes the essential anatomy required in canaloplasty. ALT may cause extensive scarring which can obstruct circumferential cannulation of the canal (Godfrey et al., 2009; Mosaed et al., 2009). The Micro-Bypass implants themselves may block microcatheter advancement. Additionally, success of canaloplasty may be limited if aqueous outflow channels distal to the canal are collapsed or scarred. Some authors have described intraoperative injection of fluorescein into Schlemm’s canal via the microcatheter enabling in vivo visualization of the aqueous outflow system (channelography), which may elucidate the outflow capacity and predict how a patient may respond to canaloplasty (Grieshaber et al., 2009). These implications have yet to be validated.

8. Ideal pt selection

Ideal patient selection is key when considering canaloplasty. Patients with mild-to-moderate open-angle glaucoma with an IOP goal in the low-to-mid teens would benefit greatly from canaloplasty. In addition, advanced glaucoma may be treated with canaloplasty in patients who are not suitable for trabeculectomy. For example, those who cannot adhere to the rigorous postoperative care required after trabeculectomy may undergo canaloplasty instead as the follow-up appointments and postoperative drops are less frequent. In eyes with thin conjunctiva that may be at higher risk for bleb leaks after trabeculectomy with mitomycin C, canaloplasty may be the preferred procedure (Borisuth et al., 1999). Conversely, young black patients with more robust scar formation should undergo canaloplasty if bleb failure secondary to scarring is of concern (Broadway et al., 1994; The Advanced Glaucoma Intervention Study, 2001; Ederer et al., 2004). One may consider combining phacoemulsification with canaloplasty if a visually significant or early visually significant cataract surgery is anticipated in the near future or if a phacomorphic glaucoma component exists. Phacocanaloplasty has also been shown to lower IOP more than canaloplasty alone (Lewis et al., 2011). Due to the low side effect profile and efficacy of canaloplasty, it may be strongly considered in monocular patients with OAG as well thereby sparing the patient the lifelong bleb-related risks. Far less hypotony is seen after canaloplasty as opposed to trabeculectomy (0.6% versus 42.3%), so the former should be considered in young myopic individuals who are at an increased risk for hypotony maculopathy (Fannin et al., 2003).
not all studies had an increase in cataract formation 3 years after canaloplasty. Lewis et al. listed cataract formation as the most common late postoperative complication 3 years after canaloplasty occurring in 12.7%; however, this was not the case in Grieshaber’s 3 year follow-up on black Africans post canaloplasty. Perhaps the increased cataract formation in Lewis’s study can be attributed to age-related changes rather than changes related to the surgery, as Lewis’s patients were on average older than Grieshaber’s black African patients (67 ± 11.6 years versus 49.8 ± 15.7 years) (Lewis et al., 2011; Grieshaber et al., 2010a). Cataract progression after canaloplasty is still less frequent than after trabeculectomy, which has been reported to increase the risk of cataract formation by 47% (AGIS Investigators, 2001). Hypotony after canaloplasty was reported in 0.6% of a predominantly white population (91.7%) (Lewis et al., 2011). This percentage is far more favorable than the incidence of hypotony in whites after trabeculectomy, which has been reported to be as high as 13.8% (Borisuth et al., 1999).

Probably the most significant advances canaloplasty offers are the lack of choroidal detachments, suprachoroidal hemorrhage, blebitis or bleb-related endophthalmitis observed in any eyes treated with canaloplasty or phacocanaloplasty (Lewis et al., 2011; Bull et al., 2001; Singleton et al., 2008; Lewis et al., 2009; Grieshaber et al., 2011; Grieshaber et al., 2010a; Fujita et al., 2011; Khairi, 2009). Canaloplasty is designed to be a blebless procedure, and in fact, only 2.5% of patients developed blebs (Lewis et al., 2011). However, no bleb-related complications resulted. The incidence of bleb-associated endophthalmitis has been reported in 0.2–9.6% of patients after trabeculectomy, which increases to 2.5% per patient-year with the addition of mitomycin C (Greenfield et al., 1996; Prasad and Latina, 2007).

In summary, canaloplasty has become an appealing alternative to traditional incisional glaucoma therapies. It is less invasive, blebless, no mitomycin C is necessary. While canaloplasty is effective in lowering IOP and medication dependence, it still has its limitations. It may be contraindicated in patients with chronic angle closure, narrow angles, angle recession, neovascular glaucoma and in eyes that have undergone previous glaucoma procedures that preclude adequate cannulation of Schlemm’s canal. If pressure lowering below mid-to-low teens is desired then a trabeculectomy with antimiotics or glaucoma drainage implant may be preferred over canaloplasty, which may not be the best option in patients with advanced glaucoma in need of very low IOP. There is a learning curve for successful catheterization of Schlemm’s canal, and certain anatomical variations may prohibit successful catheterization such as the microcatheter tip entering a large collector channel or meeting unknown resistance (Lewis et al., 2011). The pressure-lowering effects and the relatively low side effect profile of canaloplasty appear sound, but this must be weighted against traditional measures. Mosaed et al. (2009) published a literature review comparing trabeculectomy, glaucoma drainage devices, trabeculectomy and canaloplasty claiming trabeculectomy is ‘the most effective IOP-lowering procedure to date’. There was, however, no standardization amongst the different studies analyzed nor were any of the procedures directly compared. Canaloplasty has only been directly compared to viscocanalostomy in a retrospective case series, which determined the former to be more efficacious than the latter (Koerber, 2011). Recently the American Academy of Ophthalmology commissioned the Ophthalmic Technology Assessment Committee Glaucoma Panel to review the available literature on the efficacy of novel glaucoma procedures including canaloplasty. The panel concluded that with the current data it is impossible to state canaloplasty or other novel glaucoma procedures are superior, inferior or equal to traditional glaucoma surgeries or to each other (Francis et al., 2011). Ultimately, randomized clinical trials comparing canaloplasty to traditional and other novel glaucoma procedures with standardized definitions of success and failure, inclusion and exclusion criteria and follow-up period are required to determine its efficacy. Future studies are also needed to explore the long-term effects of canaloplasty on IOP and the remote side effects of this procedure; however, currently canaloplasty appears to be a valuable tool in the armamentarium of glaucoma procedures.

Conflict of interest statement

We have no conflict of interest to declare.

References


