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<b>Preauthorization</b>	No	<b>Review Dates:</b> 03/10, 03/11, 07/11, 01/12, 09/12, 01/13, 01/14, 11/14, 11/15, 11/16	

**Preauthorization is not required.**

*The following protocol contains medical necessity criteria that apply for this service. The criteria are also applicable to services provided in the local Medicare Advantage operating area for those members, unless separate Medicare Advantage criteria are indicated. If the criteria are not met, reimbursement will be denied and the patient cannot be billed. Please note that payment for covered services is subject to eligibility and the limitations noted in the patient’s contract at the time the services are rendered.*

Populations	Interventions	Comparators	Outcomes
Individuals: • With open-angle glaucoma	Interventions of interest are: • Aqueous shunts	Comparators of interest are: • Ocular medication • Trabeculectomy	Relevant outcomes include: • Change in disease status • Functional outcomes • Medication use • Treatment-related morbidity
Individuals: • With open-angle glaucoma	Interventions of interest are: • Aqueous microstents	Comparators of interest are: • Ocular medication • Trabeculectomy	Relevant outcomes include: • Change in disease status • Functional outcomes • Medication use • Treatment-related morbidity

**Description**

Glaucoma surgery is intended to reduce intraocular pressure (IOP) when the target IOP cannot be reached with medications. Due to complications with established surgical approaches (e.g., trabeculectomy), a variety of shunts are being evaluated as alternative surgical treatments for patients with inadequately controlled glaucoma. Microstents are also being evaluated in patients with mild-to-moderate open-angle glaucoma currently treated with ocular hypotensive medication.

**Summary of Evidence**

The evidence for aqueous shunts in individuals who have open-angle glaucoma includes randomized controlled trials (RCTs). Relevant outcomes are change in disease status, functional outcomes, medication use, and treatment-related morbidity. RCTs assessing U.S. Food and Drug Administration (FDA)–approved shunts have shown that the use of large externally placed shunts leads to slightly less reduction in IOP than standard filtering surgery (trabeculectomy). Reported shunt success rates are as good as trabeculectomy in the long term. FDA-approved shunts have a different adverse effect profile and avoid some of the most problematic complications of trabeculectomy. The evidence is sufficient to determine qualitatively that the technology results in a meaningful improvement in the net health outcome.

The evidence for aqueous microstents in individuals who have open-angle glaucoma includes RCTs. Relevant outcomes are change in disease status, functional outcomes, medication use, and treatment-related morbidity. A microstent has received FDA approval for use in conjunction with cataract surgery for the reduction of IOP in adults with mild-to-moderate open-angle glaucoma currently treated with ocular hypotensive medication. RCTs have been conducted in patients with cataracts and less advanced glaucoma, where IOP is at least partially controlled with medication. Trial results indicate that IOP may be lowered below baseline with decreased need for medication, although the benefit appears to diminish after the first year. One RCT compared a single microstent to multiple microstents. This study reported no difference on the primary outcome (percentage of patients with  $\geq 20\%$  reduction in IOP); secondary outcomes favored the microstent group. The evidence is insufficient to determine the effects of the technology on health outcomes.

### Policy

Insertion of aqueous shunts approved by the U.S. Food and Drug Administration (FDA) may be considered **medically necessary** as a method to reduce intraocular pressure in patients with glaucoma where medical therapy has failed to adequately control intraocular pressure.

Use of an aqueous shunt for all other conditions, including in patients with glaucoma when intraocular pressure is adequately controlled by medications, is considered **investigational**.

Implantation of a single FDA-approved micro-stent in conjunction with cataract surgery may be considered **medically necessary** in patients with mild to moderate open-angle glaucoma currently treated with ocular hypotensive medication.

Use of a micro-stent for all other indications is considered **investigational**.

### Policy Guidelines

Shunts and stents are only able to reduce IOP to the mid-teens, and may be inadequate when very low IOP is needed to reduce glaucoma damage.

### Medicare Advantage

For Medicare Advantage, the above statements apply, except for the following:

An anterior segment aqueous drainage device, without extraocular reservoir, performed with cataract surgery (internal approach) may be **medically necessary** for Medicare Advantage members with mild to moderate glaucoma on medication.

### Background

Surgical procedures for glaucoma aim to reduce IOP resulting from impaired aqueous humor drainage in the trabecular meshwork and/or Schlemm canal. In the primary (conventional) outflow pathway from the eye, aqueous humor passes through the trabecular meshwork, enters a space lined with endothelial cells (Schlemm canal), drains into collector channels, and then into the aqueous veins. Increases in resistance in the trabecular meshwork and/or the inner wall of the Schlemm canal can disrupt the balance of aqueous humor inflow and outflow, resulting in an increase in IOP and glaucoma risk.

Surgical intervention may be indicated in patients with glaucoma when the target IOP cannot be reached pharmacologically. Trabeculectomy (guarded filtration surgery) is the most established surgical procedure for

glaucoma, allowing aqueous humor to directly enter the subconjunctival space. This procedure creates a subconjunctival reservoir, which can effectively reduce IOP, but commonly results in filtering “blebs” on the eye, and is associated with numerous complications (e.g., leaks, bleb-related endophthalmitis) and long-term failure. Other surgical procedures (not addressed herein) include trabecular laser ablation, deep sclerectomy (which removes the outer wall of the Schlemm canal and excises deep sclera and peripheral cornea), and viscocanalostomy (which unroofs and dilates the Schlemm canal without penetrating the trabecular meshwork or anterior chamber) (see the Viscocanalostomy and Canaloplasty Protocol).

More recently the Trabectome, an electrocautery device with irrigation and aspiration, has been used to selectively ablate the trabecular meshwork and inner wall of the Schlemm canal without external access or creation of a subconjunctival bleb. IOP with this ab interno procedure is typically higher than the pressure achieved with standard filtering trabeculectomy. Canaloplasty involves dilation and tension of the Schlemm canal with a suture loop between the inner wall of the canal and the trabecular meshwork. This ab externo procedure uses the iTrack illuminated microcatheter (iScience Interventional) to access and dilate the entire length of the Schlemm canal and to pass the suture loop through the canal (see the Viscocanalostomy and Canaloplasty Protocol).

Aqueous shunts may also be placed in the anterior or posterior chamber to facilitate drainage of aqueous humor. Established shunts include the Ahmed (New World Medical), Baerveldt (Advanced Medical Optics), Molteno (IOP), EX-Press mini-shunt (Alcon), and the SOLX DeepLight Gold Micro-Shunt (SOLX), which shunt aqueous humor between the anterior chamber and the suprachoroidal space. These devices differ by explant surface areas, shape, plate thickness, presence or absence of a valve, and details of surgical installation. Generally, the risk of hypotony (low pressure) is reduced with aqueous shunts compared to trabeculectomy, but IOP outcomes are worse than after standard guarded filtration surgery. Complications of anterior chamber shunts include corneal endothelial failure and erosion of the overlying conjunctiva. The risk of postoperative infection is lower with shunts than with trabeculectomy, and failure rates are similar ( $\approx 10\%$  of devices fail annually). The primary indication for aqueous shunts is for failed medical or surgical therapy, although some ophthalmologists have advocated their use as a primary surgical intervention, particularly for selected conditions such as congenital glaucoma, trauma, chemical burn, or pemphigoid.

Aqueous stents are being developed as minimally penetrating methods to drain aqueous humor from the anterior chamber into the Schlemm canal or the suprachoroidal space. They include the iStent (Glaukos), which is a one mm long stent inserted into the end of the Schlemm canal by an internal approach through the cornea and anterior chamber; the second-generation iStent *inject*; the third-generation iStent *supra*, which is designed for ab interno implantation into the suprachoroidal space; and the CyPass (Transcend Medical) suprachoroidal stent.

Because aqueous humor outflow is pressure-dependent, pressure in the reservoir and venous system is critical for reaching the target IOP. Therefore, some devices may be unable to reduce IOP below the pressure of the distal outflow system used (e.g.,  $< 15$  mm Hg) and are not indicated for patients for whom very low IOP is desired (e.g., those with advanced glaucoma). It has been proposed that stents such as the iStent, CyPass, and Hydrus Microstent may be useful in patients with early-stage glaucoma to reduce the burden of medications and problems with compliance. One area of investigation is patients with glaucoma who require cataract surgery. An advantage of ab interno shunts is that they may be inserted into the same incision and at the same time as cataract surgery. In addition, most devices do not preclude subsequent trabeculectomy if needed. It may also be possible to insert more than one shunt to achieve desired IOP. Therefore, health outcomes of interest are the IOP achieved, reduction in medication use, ability to convert to trabeculectomy, complications, and device durability.

## Regulatory Status

The regulatory status of the various aqueous shunts and microstents is summarized in Table 1. The first-generation Ahmed™ (New World Medical), Baerveldt® (Advanced Medical Optics), Krupin (Eagle Vision), and Molteno® (Molteno Ophthalmic) aqueous shunts were cleared for marketing by the U.S. Food and Drug Administration (FDA) through the 510(k) process between 1989 and 1993; modified Ahmed and Molteno devices were cleared in 2006. They are indicated for use “in patients with intractable glaucoma to reduce intra-ocular pressure where medical and conventional surgical treatments have failed.” The AquaFlow™ Collagen Glaucoma Drainage Device was approved by FDA through the premarket approval process for the maintenance of the subscleral space following nonpenetrating deep sclerectomy. In 2003, the EX-PRESS® Mini Glaucoma Shunt was cleared for marketing by FDA through the 510(k) process. The EX-PRESS® shunt is placed under a partial thickness scleral flap and transports aqueous fluid from the anterior chamber of the eye into a conjunctival filtering bleb.

Table 1. Regulatory Status of Aqueous Shunts and Stents

Device	Manufacturer	Type	FDA Status	Date
AquaFlow™	Staar Surgical	Drainage device	PMA	2001
Trabectome™	NeoMedix	Electrocautery device	510(k)	2006
Ahmed™	New World Medical	Aqueous glaucoma shunt	510(k)	< 1993
Baerveldt®	Advanced Medical Optics	Aqueous glaucoma shunt	510(k)	< 1993
Krupin	Eagle Vision	Aqueous glaucoma shunt	510(k)	< 1993
Molteno®	Molteno Ophthalmic	Aqueous glaucoma shunt	510(k)	< 1993
EX-PRESS®	Alcon	Mini-glaucoma shunt	510(k)	2003
iStent®	Glaukos	Microstent	PMA	2012
CyPass®	Transcend Medical	Suprachoroidal stent	PMA	2016
Hydrus™	Ivantis	Microstent	Not approved	
SOLX® Gold	SOLX	Micro-Shunt	Not approved	
iStent <i>inject</i> ®	Glaukos	Suprachoroidal stent	Not approved	
iStent <i>supra</i> ®	Glaukos	Suprachoroidal stent	Not approved	
XEN Gel Stent	AqueSys	Subconjunctival	Not approved	

FDA: Food and Drug Administration; PMA: premarket approval.

In 2012, the iStent® Trabecular Micro-Bypass Stent (Glaukos) was approved by FDA through the premarket approval process for use in conjunction with cataract surgery for the reduction of IOP in adult patients with mild-to-moderate open-angle glaucoma currently treated with ocular hypotensive medication.

The labeling describes the following precautions:

1. The safety and effectiveness of the iStent Trabecular Micro-Bypass Stent has not been established as an alternative to the primary treatment of glaucoma with medications. The effectiveness of this device has been demonstrated only in patients with mild-to-moderate open-angle glaucoma who are currently treated with ocular hypotensive medication and who are undergoing concurrent cataract surgery for visually significant cataract.
2. The safety and effectiveness of the iStent® Trabecular Micro-Bypass Stent has not been established in patients with the following circumstances or conditions, which were not studied in the pivotal trial:
  - In children
  - In eyes with significant prior trauma
  - In eyes with abnormal anterior segment
  - In eyes with chronic inflammation

- In glaucoma associated with vascular disorders
- In pseudophakic patients with glaucoma
- In uveitic glaucoma
- In patients with prior glaucoma surgery of any type, including argon laser trabeculoplasty
- In patients with medicated IOP greater than 24 mm Hg
- In patients with unmedicated IOP less than 22 mm Hg nor greater than 36 mm Hg after “washout” of medications
- For implantation of more than a single stent
- After complications during cataract surgery, including but not limited to, severe corneal burn, vitreous removal/vitreotomy required, corneal injuries, or complications requiring the placement of an anterior chamber IOL [intraocular lens]
- When implantation has been without concomitant cataract surgery with IOL implantation for visually significant cataract.

Note that use of the iStent® has subsequently been reported for many of the circumstances or conditions listed above; most of the publications are case series.

The SOLX® DeepLight® Gold Micro-Shunt, Hydrus™ Microstent, and XEN Gel Stent are currently in FDA-regulated trials. They have received regulatory approval in Europe, but have not been cleared by FDA for use in the United States.

FDA product codes: OGO, KYF.

### Related Protocol

Viscocanalostomy and Canaloplasty

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Services that are the subject of a clinical trial do not meet our Technology Assessment Protocol criteria and are considered investigational. *For explanation of experimental and investigational, please refer to the Technology Assessment Protocol.*

It is expected that only appropriate and medically necessary services will be rendered. We reserve the right to conduct prepayment and postpayment reviews to assess the medical appropriateness of the above-referenced procedures. **Some of this protocol may not pertain to the patients you provide care to, as it may relate to products that are not available in your geographic area.**

### References

We are not responsible for the continuing viability of web site addresses that may be listed in any references below.

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