Recently there has been an increasing demand for safer surgical glaucoma procedures with low postoperative complication profiles. In general, minimally invasive procedures are not associated with the severe complications that may result from penetrating surgery. The goal of most of these procedures is to enhance the natural outflow system of the trabecular meshwork, rather than creating a new drainage system as in classic trabeculectomy. Some surgeons believe that the newer, less tested, minimally invasive procedures should only be utilised in patients with early stages of disease.

Others maintain that prospective, randomised clinical trials are required to compare minimally invasive procedures to trans-scleral surgeries in order to determine their efficacy. Some experts argue that minimally invasive procedures are appropriate for the treatment of moderate disease and that their safety may even warrant usage in cases of advanced glaucoma as a first-line treatment. Currently there is an increasing armamentarium of new glaucoma devices for minimally invasive procedures, some of which are US-approved, CE-marked or under clinical investigation.

In this article we present a short overview of some new technological advances in the field of glaucoma surgery. Many of these devices are focused on reestablishing physiological outflow. To be concise, this overview does not focus on some of the devices intended for the supra-choroidal space. The following devices are currently under clinical investigation or in the first stages of clinical use:

1. **Canaloplasty**  
   Canaloplasty utilises a microcatheter (iScience®) to place a 10-0 prolene suture circumferentially into Schlemm’s canal, exerting tension on the canal wall and thus reducing the outflow resistance (Figure 1). Three-year follow-up studies have illustrated that canaloplasty can lead to a significant and sustained reduction of intraocular pressure in patients with open angle glaucoma1. The short- and long-term complication rates of canaloplasty are low, thus rendering an excellent safety profile.

2. **The ExPress® mini-shunt (Alcon®)**  
   This device is made of stainless steel and designed for insertion from a scleral lake into the anterior trabecular meshwork (Figure 2). It is made of stainless steel and designed for insertion from a scleral lake into the anterior trabecular meshwork. It has been shown to reduce intraocular pressure effectively in patients with open-angle glaucoma (Figure 3).

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chamber, allowing for device-supported sub-conjunctival filtration (Figure 2). This stent was evaluated in a study by Maris et al.\(^2\), who compared ExPress mini-shunt implantation to classical trabeculectomy. While a similar postoperative intraocular pressure and surgical success rate was achieved, the incidence of early postoperative hypotony and related complications was significantly lower in patients who received the ExPress mini-shunt.

3. The iStent® (Glaukos®)

The iStent (Figure 3) is a surgical grade nonferromagnetic titanium trabecular micro-bypass system. It is inserted ab interno, bypassing the trabecular meshwork, and is placed into Schlemm’s canal. The United States FDA IDE trial compared cataract surgery plus iStent to cataract surgery alone. The study found that 73 per cent of patients who had received an iStent maintained an intraocular pressure of 21 mmHg or lower without medication at 12 months’ post-surgery, compared to only 50 per cent of those who underwent cataract surgery alone\(^3\).

4. The Hydrus® implant (Ivantis®)

This scaffold is made of a nickel titanium shape memory alloy (Figure 4). Suggested advantages of the device include excellent biocompatibility and elasticity. It is designed for insertion into Schlemm’s canal ab interno. Preliminary data are promising thus far, as the results of a small cohort clinical trial indicate significant lowering of intraocular pressure and decreased reliance on glaucoma medications by six months’ post-implant. These results were consistent and were seen both in patients who received only the implant and in patients who received the implant in combination with cataract surgery (Figure 5).

5. The Stegmann® Canal Expander

The Stegmann® implant is made by the Ophthalm® company in Switzerland. The stent is composed of polyimide and has a tube multi-fenestrated skeleton structure designed to expand Schlemm’s canal (Figure 6). Initial data suggest pressure-lowering effects at least similar to the published data of viscocanalostomy.

6. The AqueSys® implant

This is the only biological implant, designed to render minimally invasive surgery for subconjunctival fenestration. The implant is composed of a collagen tube with an inner diameter of around 65mm and can be placed with a special inserter ab interno (Figure 7). Early clinical study data is promising.

**Conclusion**

The field of new glaucoma devices and surgical technology today is rapidly developing and a lot of clinical research is on the way. Hopefully these innovations will help to render safer and more standardised surgical technologies for the cure of the challenging disease of glaucoma.

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**References**

