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Excimer Laser Trabeculostomy, Laser-Based Minimally Invasive Glaucoma Surgery

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Keywords

• Excimer laser trabeculostomy • Glaucoma • Excimer laser • Trabecular meshwork • Aqueous outflow • Schlemm's canal • MIGS • ELT

Key points

- Excimer laser trabeculostomy (ELT) is the only laser-based minimally invasive glaucoma surgical (MIGS). ELT creates outflow channels which connect the anterior chamber to Schlemm's canal (SC) and concurrently dilates SC and collector channels.
- Nonthermal, UV laser-based ELT, like LASIK, removes tissue while minimizing the healing responses, enabling the long-term lowering of intraocular pressure (IOP), lowering and concurrent reduction of antiglaucoma medications.
- ELT has proven clinically effective as both a stand-alone MIGS procedure and when combined with phacoemulsification.
- ELT is a very low-risk surgical option when compared to more invasive surgeries such as trabeculectomy and tube shunt procedures.

Video content accompanies this article at http://www.advancesinophthalmology.com.

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EXCIMER LASER TRABECULOSTOMY

Introduction

Glaucoma is a chronic, progressive eye disease (Video 1) [1]. The most prevalent form of glaucoma, primary open-angle glaucoma (OAG), is thought to be due to increased intraocular pressure (IOP) originating from outflow obstruction at the juxtacanalicular trabecular meshwork (TM) and the inner wall of the Schlemm canal (SC) [2]. Left untreated, OAG can lead to significant progressive peripheral visual field loss and eventually blindness. Even with proper treatment, 10% of patients continue to experience vision loss, accounting for 9% to 12% of all cases of blindness in the United States [3].

Historically, glaucoma has been treated with medications as well as in-office laser procedures, which act by reducing aqueous fluid production and/or by increasing aqueous fluid outflow. Pressure-reducing antiglaucoma drugs (AGD) are currently the predominant method for treating glaucoma. However, long-term AGD use can lead to adverse side effects. For example, Sherwani and colleagues [4] found that long-term AGD use is associated with structural changes in the conjunctiva, including more advanced stages of metaplasia with an increase in the number of fibroblasts, increased subepithelial collagen deposition, and increased inflammatory infiltrates. In addition, preserved topical AGD use is associated with an increase in dry eye symptoms. Pisella and colleagues [5] have noted that after treatment with preservative-containing beta-blockers, albino rabbits were found to have a significantly lower tear film breakup time compared with albino rabbits treated with preservative-free beta-blockers.

Although preservative-free AGDs are available, they are often more expensive. In addition, nonadherence is a major issue with the efficacy of medications for the treatment of OAG [6]. As a result, alternatives to topical medication are often preferred. One of the earliest outpatient laser procedures, argon laser trabeculoplasty (ALT), was introduced by Wise and Witter in 1979 [7]. Specifically, this treatment uses an argon laser to thermally modify the trabecular meshwork, often improving the outflow of aqueous humor and reducing the IOP over a limited duration [8,9]. However, scarring of TM tissue produced by this treatment hinders successful repetition, thus repeated ALT which loses IOP lowering efficacy over time, is not an ideal alternative [10,11].

A less thermally damaging successor to ALT, selective laser trabeculoplasty (SLT), was introduced by Park and colleagues [12] in 1995 to affect a similar IOP-lowering effect of ALT by targeting pigmented cells in the TM, which results in less thermal damage to adjacent, nonpigmented cells. ALT uses a laser beam with energy of 40 to 70 mJ, whereas SLT requires far less energy (0.6–1.2 mJ) and has demonstrated higher efficacy in treating OAG [13]. Even though SLT uses less power, complications such as iritis and elevated IOP still occur, but with less frequency than following ALT [14]. Nevertheless, antiglaucoma medications are often required following both SLT and ALT, and both have time limited efficacy although SLT, unlike ALT may be repeatable.