EDITORIAL

Transscleral Cyclophotocoagulation: New Perspectives for Uncontrolled Glaucoma Management

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Glaucoma is still the leading cause of irreversible blindness despite several new diagnostic tools, surgical techniques, and devices.[1] When intraocular pressure (IOP) is not controlled with topical antiglaucoma medications, laser or surgical procedures may be required to preserve the optic nerve.[2] In cases in which topical antiglaucoma medications, selective laser trabeculoplasty, minimally invasive glaucoma surgeries, and conventional filtering procedures fail to adequately control IOP, glaucoma is usually classified as refractory. These cases often have a worse prognosis, and their management relies on more invasive procedures such as glaucoma drainage devices (GDD) or on procedures that reduce aqueous humor production.[3] It is a challenge to choose the most suitable glaucoma surgical procedure.

Although cyclodestructive procedures have been used for a long time, their indication has been limited due to their relatively unpredictable results and unsatisfactory safety profile. Possible side effects included ocular inflammation, hypotony, or rarely, ocular phthisis, with a significant negative impact on visual acuity (VA) in some cases.[4] The American Academy of Ophthalmology recommendations (2010), continuous diode transscleral laser cyclophotocoagulation (TSCPC) was indicated in cases with a high risk of previous conventional filtering surgery or GDD failure. In this scenario, the most common indications used to be cases with poor conjunctival conditions and excessive fibrosis and silicone oil-induced glaucoma following retinal surgery,[5,6] neovascular glaucoma or cases with uncontrolled IOP, and ocular pain with poor visual prognosis. Similarly, in 2017, the European Glaucoma Society Guidelines recommended CPC when conventional filtration surgery or GDD are not feasible or likely to fail. In this context, many studies have been published demonstrating TSCPC benefits on IOP control in refractory glaucomatous eyes.[3,6,7]

When it comes to usual laser settings for continuous TSCPC, it is recommended an initial power of 1.75 W and a 2.0-second duration as initial standard parameters. Laser energy is adjusted at the minimum power required to produce a "pop." More recently, with the advent of the slow-coagulation protocol,[7,8] laser settings have been changed and adjusted according to iris pigmentation. Less energy is applied for light brown or dark iris—1.25 W and a 4-second duration, while the other iris pigmentation receives slightly higher energy—1.5 W and a 3.5–4-second duration treatment.[7,8] These initial results found similar IOP outcomes with fewer complications in slow-coagulation TSCPC when compared to conventional TSCPC in the treatment of glaucomatous eyes. Incorporating these initially published data into our clinical experience with both techniques of continuous TSCPC, prolonged postoperative inflammation and risk of phthisis is much less frequent in the slow-coagulation technique. In this context, in a recent review article regarding slow-coagulation TSCPC outcomes, Khodeiry et al. stated that it could be used in a safe, efficient and reproducible way in a wide range of glaucoma types, including those with no history of incisional surgeries, good VA, and medically refractory glaucomas.[8]

Although physicians have always recognized continuous TSCPC as an effective alternative for IOP reduction, its unpredictable safety profile has always been an issue, limiting its indication, especially in eyes with good visual prognosis. In an attempt to overcome this issue, researchers have introduced a new technique to deliver the laser energy at the ciliary body, micropulse TSCPC (MP3), using an 810 nm infrared diode laser and a novel probe design. In this technique, the laser application delivers short pulses of energy with rest intervals in between. Theoretically, this "on/off" cycle reduces tissue damage avoiding ciliary body destruction and anatomic preservation.[9]

Many recent studies have reported promising outcomes with MP3 for IOP control in glaucoma patients.[10–17] In some cases, such as in the study published by Magacho et al.[16] using a double-session protocol, MP3 was indicated as a primary surgical

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procedure. Overall, short-term success rates vary between 70 and 85%, depending on the criterion adopted and patients' (eye) characteristics. However, it should be noted there are several differences regarding patients' baseline characteristics and reported outcomes between studies. When it comes to possible MP3-related side effects, for instance, there is no analysis of central retinal thickness rates of macular edema, inflammation, or uveitis. Furthermore, the studies have different protocols and groups, with no consensus on optimal settings. Laser power usually varies from 1600 to 3000 mW, whether treatment ranges between 120 and 420 seconds.[10–14] Recently, Sanchez et al.[15] suggested that a good balance between efficacy and safety would result in a total amount of laser energy of approximately 112–150 J. This would allow an adequate IOP decrease with fewer postoperative complications, opening the possibility of indicating the laser to less compromised eyes, using low total energy and more refractory glaucomatous eyes, using higher total energy.

We believe that the relatively good safety profile of MP3 seems to be efficient and safe when comparing it with other glaucoma surgical procedures. The reported 1-year rate of VA loss (≥2 lines) of approximately 20% is less than found in conventional TSCPC, in which up to 33% of the patients lost ≥2 lines.[18,19] This MP3 rate of VA loss is also less than trabeculectomy or GDD, 33–32%, respectively, at 1 year of follow-up.[18] In this context, in a recent study, Varikuti et al.[20] concluded that while most studies have reserved MP3 for eyes with poor visual potential, their results support the adoption of MP3 as a safe procedure in patients with initial glaucoma and good VA, and could be indicated earlier, especially for pseudophakic patients. The reduction in glaucoma medication use and IOP, slight vision loss, and rare vision-threatening complications suggest MP3 could be offered as an alternative to incisional glaucoma surgeries in many cases.

In conclusion, we are currently experiencing an increase in clinical evidence that will likely lead to a paradigm shift in TSCPC indication. As both micropulse and slow coagulation modalities seem to cause fewer side effects than conventional continuous laser application, physicians may consider an earlier and broader indication of TSCPC. In addition, some specific ocular conditions, such as high myopia and postvitrectomy eyes, in which filtration surgery is challenging, will most likely benefit from these non-incisional (laser) treatment alternatives. As future directions, these initial results (mostly based on retrospective data) certainly warrant confirmation through randomized clinical trials. More specifically, we not only need a comparison of safety and effectiveness between these two different laser application protocols, but it's also necessary to make a straight prospective comparison between them and conventional filtration surgery for primary surgical glaucoma management.

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