

COVID-19 and the Rationale for Primary Selective Laser Trabeculoplasty and Diode Laser Transscleral Cyclophotocoagulation in Africa

Daniel Milad, MD,* David Mikhail, BSc,† Markus Lenzhofer, MD, PhD,‡
Jérémy Agré, MD,§ and Andrew Toren, MD||

Abstract: The recent COVID-19 pandemic has affected ophthalmologists' practices worldwide. Consequent global drug shortages and the limitations of medical glaucoma treatments in sub-Saharan Africa have highlighted the need for innovation in global ophthalmology to provide accessible, affordable, and effective glaucoma care. The role of lasers rather than medications for glaucoma patients in developing nations is emerging. Since lasers are easier to master than glaucoma surgery, it is pertinent to discuss the primary use of lasers in treating glaucoma in such nations. In particular, selective laser trabeculoplasty and diode laser transscleral cyclophotocoagulation seem to present a promising future for the treatment of glaucoma in Africa. In this report, we provide an evidence-based discussion exploring the emerging role of lasers in Africa.

Key Words: COVID-19, glaucoma, selective laser trabeculoplasty, global ophthalmology, developing countries, diode laser

(*J Glaucoma* 2022;31:215–217)

Over the last year, ophthalmologists worldwide have been adapting to the new realities brought forward by COVID-19. With the effects of the pandemic in full effect, many challenges have come forward. To date, some of these challenges include well documented consequent global drug shortages, transportation barriers, and financial challenges affecting large parts of the population, especially in areas like Africa where lockdowns may prevent citizens from maintaining their income.¹ One study conducted in India shows that COVID-19-related stress has actually been found to be a significant barrier in glaucoma medication adherence.² These challenges have sparked a renewed interest in improving existing treatment regimens for glaucoma in areas like Africa, where access to specialized care and expensive medications are scarce. Thus, it is pertinent to

discuss the primary use of lasers rather than medications for glaucoma patients in developing nations.

Africa has the highest prevalence of primary open-angle glaucoma in the world, with 4.2% of adults aged 40 to 80 years affected, compared with 3.5% globally.³ Furthermore, evidence suggests that in sub-Saharan Africa, medical, surgical, and laser treatments are limited. Most people present with advanced glaucoma and the initial treatment is largely medical.⁴ There is a clear need for innovation in global ophthalmology to provide accessible, affordable, and effective glaucoma treatment.

Limitations of medical treatments include cost due to the ongoing expenditure, adherence, and associated side effects.⁵ Access to surgery is difficult, as the high cost of surgery and rarity of surgeons trained to perform and follow-up such cases are limiting. The extremely low acceptance rates (<10%), stemming from poor patient satisfaction, fear of complications and the lengthy postoperative care among glaucoma patients in low- and middle-income countries further limits the surgical intervention's pertinence in Africa.^{6,7}

There remains substantial need for a safe, effective, cost-effective, and easy to access glaucoma treatment for patients in sub-Saharan Africa. Since lasers are easier to master compared with glaucoma surgery, they may present a real opportunity for ophthalmologists (and other ocular health care providers) in sub-Saharan Africa.³ In Nigeria, ophthalmologists reported that laser was an acceptable form of treatment, although equipment and skills in laser treatment need to be expanded.⁸

Selective laser trabeculoplasty (SLT) seems to present a promising future for the treatment of glaucoma in Africa, as it has been shown to be more safe, cost-effective, and less invasive than trabeculectomy.⁸ SLT has shown promising results in studies of the African and Afro-Caribbean patient population, results which can be generalized across patient types.⁸ The recent LiGHT trial has demonstrated that SLT is a safe alternative to medical treatment, providing a stable, drop-free pressure control to 74.2% of patients for at least 3 years, with a reduced need for surgery and lower cost.⁹ Based on this evidence, SLT seems to be the most effective and cost-effective first-line treatment option, at least for open-angle glaucoma and ocular hypertension. The West Indies Glaucoma Laser Study, a multicenter Caribbean SLT study, showed that SLT is safe and effectively repeatable in this population, although another study in Saint Lucia showed that the majority of patients reported photophobia lasting for a few days.^{10,11} Although all cases of photophobia resolved without intervention, this unexpected adverse effect was not reported in prior western SLT studies. The latest published African trial on the topic compared SLT and 0.5% timolol eye drops in Tanzania. SLT was far

Received for publication July 31, 2021; accepted January 19, 2022.

From the *Department of Ophthalmology, Université de Montréal, Montreal; ||Centre Universitaire d'Ophthalmologie, Hôpital du Saint-Sacrement, CHU de Québec, Université Laval, Québec City, QC; †Faculty of Arts and Sciences, McMaster University, Hamilton, ON, Canada; ‡Department of Ophthalmology and Optometry, Paracelsus Medical University Salzburg, Salzburger Landeskliniken, Salzburg, Austria; and §Siloam Ophthalmology Clinic, Abidjan, Ivory Coast.

Disclosure: The authors declare no conflict of interest.

Reprints: Andrew Toren, MD, Department of Ophthalmology, Centre Universitaire d'Ophthalmologie, Hôpital du Saint-Sacrement, CHU de Québec, Université Laval, 1050 Chemin Ste-Foy, Québec, QC, Canada G13 4P2 (e-mail: andrew.toren.1@ulaval.ca).

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DOI: 10.1097/IJG.0000000000001997

superior to timolol, with mean intraocular pressure (IOP) reduction of 6.3 mm Hg (SD = 6.4) in the SLT group and 1.5 (SD = 7.5) mm Hg in the timolol group.¹²

There are currently a few studies underway to identify how we can optimally implement SLT in sub-Saharan Africa. The first is the Glaucoma Laser Versus Incisional Surgery with Trabeculectomy to End Nerve Damage in Africa (GLISTEN Africa), which will compare SLT with surgery in moderate to advanced glaucoma cases. The second study is the African Glaucoma Laser Trial (AGLT) which will compare SLT with medical therapy in early to moderate glaucoma. Although not in sub-Saharan Africa, the Clarifying the Optimal Application of SLT Therapy (COAST) trial is attempting to prove that low energy SLT, repeated annually, may be better than standard energy SLT in eyes with mild to moderate open-angle glaucoma or high-risk ocular hypertension.¹³ If proven correct, this will certainly have an impact on the optimal implementation of SLT in sub-Saharan Africa.

The role of SLT in the management of glaucoma in the developing world is emerging. Currently, the high cost of acquiring an SLT machine has been the major limiting factor with few centers in sub-Saharan Africa actually equipped with the machine.⁴ However, when compared with medical treatment, studies in the United States have shown that at current prices for prostaglandin analogs, SLT is more cost-effective than most proprietary medications within 1 year and cheaper than generic latanoprost and generic timolol after 13 and 40 months, respectively.¹⁴ One US study estimates the projected average cumulative cost at 5 years of SLT and medical treatment at \$4730 and \$6217, respectively.¹⁵ In Tanzania, ocular health facilities would need to treat ~500 eyes per year with SLT to cover the cost of the procedure, which would cost approximately the same as a 1 year supply of timolol drops.¹² The development of affordable lower-cost SLT laser machines adaptable for developing countries has the potential to make glaucoma treatment accessible for larger populations affected by glaucoma.

Another possibility is the use of diode laser transscleral cyclophotocoagulation (TSCPC). Primary TSCPC was evaluated in Ghana, demonstrating the well tolerated procedure's modest and variable lowering of IOP in primary open-angle glaucoma.¹⁶ Since the procedure is quick, easy to learn, and does not require a sterile operating room, it may be of use in sub-Saharan Africa. The laser was shown to be reliable in the tropical heat of Ghana and patient acceptance was excellent since they found the procedure to be less disheartening than an operation. However, the effect of TSCPC on IOP was unpredictable and the side effect of an atonic pupil problematic in a sunny climate. This is in contrast with other studies, showing that TSCPC is an effective and safe method as a primary procedure in the United States and Nigeria.^{17,18} To our knowledge, there were no African cost-analysis studies relating to TSCPC. Controlled cyclophotocoagulation, a modified technique of TSCPC, and the newer micropulse TSCPC offer a potential for first-line intervention; however, limited or no trials have been performed in a non-Caucasian setting.¹⁹ Recently, primary micropulse TSCPC was performed in Taiwan on patients with mild to end-stage primary open-angle glaucoma and showed good outcomes with reduced IOP, reduced IOP-lowering medications and no major complications. The most common adverse effect was transient mydriasis (28.3%).²⁰

Overall, developing nations across the world and particularly within Africa may greatly benefit from the use of laser glaucoma procedures due to their cost-saving measures and capacity to circumvent adherence-related issues. With the current pandemic and the consequent global drug supply chain problems, it is pertinent to consider the primary usage of lasers for the treatment of glaucoma. Further research showing cost-efficiency of SLT and TSCPC within Africa will help tackle this emerging sight-threatening disease.

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