

Journal of CONTACT LENS RESEARCH & SCIENCE

Proceedings of the International Forum on Scleral Lens Research

IOP AND GLAUCOMA

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Scleral lenses have steadily gained popularity and their efficacy in managing complex ocular disease is increasingly being recognized. They provide an exciting opportunity to allow us to improve vision and comfort in some of our most challenging patients. However, enthusiasm for the potential benefits of scleral lenses should not overshadow potential complications that could be caused by scleral lens wear. One specific area of concern is the possibility that scleral lenses may cause an increase in intraocular pressure (IOP).¹

Scleral lenses vault over the surface of the cornea and rest on the conjunctiva which overlies the sclera. A wide variety of lens designs and diameters are now available, all of which may have slightly different fitting characteristics. The tendency of scleral lenses to “settle” into conjunctival tissue has been well-established.^{2,3} Questions have been raised regarding the potential for this settling to obstruct the flow of aqueous as it leaves the anterior chamber. Episcleral vasculature could be compressed by the lens haptic, and direct compression of scleral tissue overlying Schlemm’s canal could potentially compromise aqueous outflow through that structure. Several questions regarding the potential effect of scleral lens wear on IOP exist. First, we need to determine if scleral lens wear actually causes changes in ocular tissue involved with aqueous outflow. If physiological changes do occur, we need to assess the impact of those changes on IOP.

While a scleral lens is in place on the eye, it is obviously not possible to measure IOP using any method that requires contact with the cornea. However, alternative methods of measuring IOP do exist. The Diaton tonometer (Ryazan State Instrument-Making

Enterprise; Ryazan, Russia) measures IOP through the eyelid. The pneumatonometer (Reichert Inc, Buffalo, NY) is capable of measuring IOP over the peripheral sclera. Recent advances in imaging technology may also facilitate the development of other ways to monitor aqueous outflow that do not require access to the cornea.

Nau, et al⁴ studied 29 young normal subjects (age 29 ± 6 years (mean \pm SD); no history of eye disease or scleral lens wear) with 2 hours of 15-mm scleral lens wear. A pneumatonometer was used to measure peripheral IOP with the lens in place. Subjects wore a scleral lens in one eye, while their other eye served as a control. IOP measurements with the lens in place were not different peripherally within 5 minutes of lens placement (control eye: 18.3 ± 3.4 mmHg; study eye: 17.6 ± 3.9 mmHg; $P=0.3$, paired t-test), at one hour of lens wear (control eye: 18.0 ± 3.4 mmHg; study eye: 18.4 ± 4.5 mmHg; $P=.2$), or at 2 hours (control eye: 18.1 ± 3.1 mmHg; study eye: 18.7 ± 3.9 mmHg; $P=.2$) of lens wear. Central corneal IOP immediately after lens removal was also not different between eyes (control eye: 13.5 ± 2.2 mmHg; study eye: 13.9 ± 3.1 mmHg; $P=.4$).

Vincent et al⁵ also investigated changes in IOP in small groups of mini-scleral lens wearers. In a group of 7 young healthy subjects with 3 hours of lens wear a difference in IOP before and after lens wear decreased by 1.3 ± 2.0 mmHg. In a second group of 7 young healthy subjects a difference in IOP after 8 hours of lens wear was found to decrease by 0.4 ± 2.4 mmHg. These small samples were not powered to calculate statistical significance.

Conclusions that may be drawn from current studies of the effects of scleral lens wear on IOP are limited due to the fact that they studied relatively small groups of young subjects with healthy eyes, and because changes were studied only with short-term lens wear. Further studies featuring longer term scleral lens wear, different lens designs, and subjects who may be at higher risk for elevation in IOP must be performed before we can definitively draw any conclusions about the risk of elevated IOP with scleral lens wear.

Scleral lens wear in glaucoma patients with a history of filtering bleb surgery or tube shunts may be of particular concern. These patients' vision may be compromised due to their ocular disease even before they are fit with scleral lenses. Close follow-up would certainly be appropriate to identify any signs of worsening disease which could be exacerbated by scleral lens wear. Special lens modifications or designs (such as notching or lifting the scleral lens haptic or considering an impression-based design) may be required for these patients. When fitting patients who have undergone glaucoma surgery, we must be mindful not only of possible outflow obstruction that could be caused by scleral lens wear, but also of the possibility that the edge of a scleral lens may compromise conjunctival tissue overlying a bleb or tube shunt. Nguyen et al⁶ reported 7 cases of scleral lens fits for patients after glaucoma surgery for drainage implants. Of these 7, only 2 patients were fit successfully. Two were unable to be fit due to the post-surgical irregularity of the scleral surface, and 3 were unable to maintain successful lens wear.

As of yet, there are no reports of increased IOP with scleral lenses, so it is possible that the risk of IOP elevation with scleral lens wear is low. In previously unpublished data from the SCOPE (Scleral Lenses in Current Ophthalmic Practice Evaluation) study group, current scleral lens practitioners were asked to report on their most recently examined established scleral lens patient (6 months or more of scleral lens wear; responses were collected between December 13, 2016 and March 13, 2017). Respondents were asked if any patient had experienced an IOP spike with scleral lens wear. Of the 352 respondents, and 522 eyes represented, only one eye was reported to have had a spike in IOP. Average length of scleral lens

wear from those surveyed was 2 ± 2 years (range: 6 months to 16 years), and average age was 44 ± 15 years (range: 9 to 86 years). The patient with the IOP spike was a 59-year-old female, with 6 months of scleral lens use in the right eye only, for dry eye. The patient had glaucoma, with no current glaucoma medications, but she did have a trabeculectomy on the right eye. She was also using a topical steroid drop in that eye. From this survey, the incidence of an IOP spike in a scleral lens wearer was 0.2%, in a high risk (trabeculectomy, topical steroid use) patient.

Scleral lenses can be life-changing for many patients. However, given our current lack of understanding of complications that may occur with scleral lens wear, careful follow-up for all patients is prudent. Rigorous investigation of potential complications of scleral lens wear should certainly be undertaken. Hopefully, future studies will provide clarity on complications of scleral lens wear and may help us to identify patients who are at higher risk for these complications.

ACKNOWLEDGEMENTS

Research to Prevent Blindness, Mayo Clinic, SCOPE Study Team (Jennifer Swingle Fogt OD, Jennifer Harthan OD, Amy Nau OD, Ellen Shorter OD, and Muriel Schornack OD).

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