Aqueous Humor: An Eye’s Best Friend

Of all the attributes available to the ever-changing human being, vision is God’s greatest gift; it is this very sense that allows us to develop perspective, witness life-changing events, and acquire a feeling of eternal gratefulness for living to see the next day. The healthy human takes this complex process for granted, failing to ask what keeps it running and clear of the deviation that we call blindness. The answer to this question can be seen within the physiology of aqueous humor, a fluid that provides proper nourishment, efficient transportation of cellular products, and an equalization of internal pressures within the eye to maintain a homeostatic environment. By understanding the flow of this ocular fluid following production, optometrists will be able to maintain the vision of an individual at a flourishing level as one continues to grow old.

Produced in the ciliary body, aqueous humor is derived from two passive sources that entail diffusion and ultrafiltration and a third source of active secretion which involves cellular activity to attend to its major contribution; these processes are the start of the most important visual concept deemed “the conventional pathway” of aqueous humor (McCaa 1982). Aqueous humor starts in the posterior chamber, flowing through the iris as the papillary dilator muscle enlarges the pupil under sympathetic conditions, and on to the anterior chamber. Fluid has now reached a point between the iris and cornea referred to as the iridocorneal angle; this angle must retain a relatively consistent degree in order to be effective in allowing fluid to pass through it. From there, the outflow of the fluid is mainly dependent upon a gradient of intraocular pressures (IOP’s), which can ultimately cause a closure or widening of the angle if pressures are not
controlled. Flow past the angle relies on components of the trabecular meshwork and Schlemm’s canal. From the meshwork to the canal, a rise in IOP allows for a multitude of one-way valves (often pores and vacuoles) to grow in both diameter and number within Schlemm’s canal; this change is only one of two factors that leads to an increase in efficiency of aqueous humor flow moving forward (Goel 2010). The second factor comes from the ciliary body which has fibers connecting to the trabecular meshwork and Schlemm’s Canal; a rise in IOP has a direct relationship to the contractility of the ciliary body which is innervated by cholinergic nerves, causing a greater influx of fluid through the structures as they expand (Uttio 2015). In order to even out the intraocular pressures, there must also be resistance coming from the opposite direction as seen in the meshwork and extracellular matrix, usually in the form of an osmotic gradient using unique receptors such as glycosaminoglycans or integrins (Uttio 2015); lack of resistance would cause extreme levels of IOP, leading to tragic blockage of the drainage system.

After equalizing pressures are reached, the fluid is advanced to its final destination where it is absorbed into the episcleral veins and drained from the inner eye.

The optimal goal in aqueous humor production and flow is to maintain a homeostatic environment within the human eye, never allowing resistance to overpower flow of this intraocular fluid, or vice versa. If this abnormal situation did arise, intraocular pressures would become out of balance, leading to a change in the iridocorneal angle, inflation of the eyeball, and damage to the optic nerve. This disruption of aqueous humor drainage leads to glaucoma, one of the most overlooked and devastating eye diseases in the world.