Treatments and Innovations for People with Glaucoma

A History in Time

Glaucoma has long been recognized as a leading cause of blindness.[1] Today, approximately **67 million** people around the world are living with glaucoma,[1] with an estimated **4.5 million** blind from the disease.[2]

As the world's population ages, its prevalence continues to increase.[2] By 2020, nearly **80 million** people worldwide are predicted to have glaucoma, while glaucoma-related blindness is expected to rise to **11.2 million**.[2]

Since the beginning of time, humans have tried to explain the complex process of vision, and understand how to remedy eye diseases, conditions and blindness. The term 'glaucoma' can be traced back to Greek and Byzantine eras, with early references included in the works of Homer, and Greek physician, Hippocrates. Yet medical therapy for glaucoma was delayed for centuries due to a near-complete misunderstanding of what glaucoma actually was. Today, science still does not know what causes glaucoma, so no cure exists; but proper treatment can slow the progression of the disease.

The discovery, diagnosis, and history of treatments and innovations for glaucoma can be divided into three major time periods:

- **400 BC to 1600 AD** – the term "glaucoma" is applied to most blinding conditions of the eye, including cataracts
- **1600 to 1854** – ophthalmologists begin to realize that technology is key to a proper diagnostic, and glaucoma is truly identified
- **1854 to present** – the modern era of surgical and pharmaceutical innovations begins with the introduction of the ophthalmoscope

762 B.C.
Etymology of the term "glaucoma" is derived from the Greek word "glaukos." First appearing in the works of Homer, it is mentioned as "a sparkling silver glare," and later, as a description of the colors sky-blue or green.[3]

350 B.C.
Aristotle, in his work "On Sense and Sensible Objects," refers to the aqueous humor within the eye and helps create the foundation for research into the pathology of the disease.[3]

1622
English ophthalmologist Richard Banister, known as the 'Father of British Ophthalmology,' provides the first, clear description of absolute glaucoma, and establishes the connection between increased tension of the eyeball and glaucoma.[4,7]

1829
Sir William Lawrence, in his "A Treatise of Diseases of the Eye," provides a complete description of glaucoma symptoms and is the first to use the term "acute glaucoma."[5]

1850
German scientist Dr. Hermann von Helmholtz invents the ophthalmoscope, making it possible to diagnose glaucomatous changes within the interior surface of the eye.[6]

Many believe that the invention of the ophthalmoscope signaled the modern era in the definition, diagnosis and treatment of glaucoma.

1858
French ophthalmologist Dr. Louis de Wecker presents the first external filtration procedure, called the Anterior Sclerotomy, as a treatment for chronic glaucoma.[8]

1867
German ophthalmologist Dr. Adolf Weber designs the first Applanation Tonometer, providing a highly defined applanation point without indentation.[10]

1884
Austrian ophthalmologist Carl Koller introduces a drug from the coca plant as a local anesthetic for eye surgery, leading the way to Corneal Impression Tonometry.

Using corneal anesthesia, Corneal Impression Tonometry became the definitive choice for IOP measurement because it offered a well-defined and uniform site of impression.[10]

1905
The first commonly used mechanical tonometer – the Schiotz Tonometer – was invented by the Norwegian ophthalmologist Hjalmar Schiotz.[10]

The Indentation (Schiotz) Tonometry procedure used a weighted plunger to indent the cornea and determined IOP by measuring how much the cornea was indented by a given weight.[10]

1909
English ophthalmologist Dr. Robert Elliot introduces the Sclera-corneal Trephine operation to treat chronic, sub-acute and acute cases of glaucoma to drain aqueous from the anterior chamber of the eye into the sub-conjunctival space.[12]

1924
Count Sir Luigi Preziosi from Malta developed the Thermal Sclerostomy Filtering operation for glaucoma.[14]

The Thermal Sclerostomy Filtering operation was further developed in 1957 by Dr. Harold Scheie, who referred to the procedure as peripheral iridectomy with scleral cautery – it became the standard filtering operation for glaucoma until the development of the Trabeculectomy in 1968.[10]

1936
Dr. Otto Barkan was the first to differentiate angle-closure from open-angle glaucoma, and also established the Goniotonomy procedure for chronic glaucoma for adults.[11]

The Goniotonomy procedure still remains the operation-of-choice for congenital glaucoma.[11]

1955
Dr. Hans Goldmann invents the Goldmann Tonometer, allowing patients, for the first time, to have IOP measurements sitting up.[9]

The Goldmann Tonometer remains the most widely available and commonly used tool in current practice.[9]

1967
The first beta blocker drug on the market, Propranolol, is discovered to lower IOP when administered intravenously.[9]

1972
The first Non-contact, or Air-puff, Tonometer is introduced at the World Optical Fair,[10] allowing optometrists to measure IOP without the need of topical anesthesia.[10]

Rather than touching the eye, the Air-puff Tonometer uses a puff of compressed air to flatten the cornea in order to measure IOP.[10]

1979
Dr. James Wise and Dr. Stanton Witter perform the first Trabeculoplasty by treating the trabecular meshwork with an Argon laser to increase facility flow.[17]

1987
Apraclonidine is first approved for the prevention of increased IOP following anterior segment laser procedures.[13]

1996
The adrenergic agonist Brimonidine is approved for long-term IOP management, and continues to be a preferred topical drug for lowering IOP.[13]

Initially discovered in 1982, Latanoprost becomes the first prostaglandin analogue approved for the treatment of elevated IOP.[9]

2001
Alcon introduces Travoprost, a prostaglandin analogue drug marketed as TRAVATAN® solution.

The Selective Laser Trabeculoplasty procedure is approved to address a key problem in open-angle glaucoma: decreased trabecular outflow facility.[18]

2006
Alcon expands its high IOP treatment options with the introduction of TRAVATAN Z®, solution, a Travoprost formulation without the preservative BAK.

2010
Alcon enters into the surgical glaucoma market through the acquisition of Optonol, a medical device company that develops surgical implants to lower IOP in glaucoma patients, including the EX-PRESS® Glaucoma Filtration Device – a miniature stainless-steel filtration device developed as an alternative to trabeculectomy filtration surgery.

400 BC to 1600 AD

400 B.C.
Hippocrates, famous Greek physician and Father of Medicine, uses the term "glaucosis" in his work "Aphorisms"[3] to describe conditions correlated with the dimming of vision; applying it to most blinding conditions of the eye that occur most commonly in the elderly.[4]

1st Century A.D.
The term "glaucoma" is regularly used to describe what is now known as a cataract.[3]

1600 to 1854

1709
French physician Dr. Pierre Brisseau publishes "Traité de la Cataracte et du Glaucome" ("Treatise on Cataracts and Glaucoma), in which he describes glaucoma as a disease of the vitreous humor; unlike a cataract, which he says is a disease of the lens.[3]

1830
Scottish ophthalmologist Dr. William Mackenzie offered the first full and clear account of glaucoma[4], and firmly established the role of intraocular pressure in 'A Practical Treatise on the Diseases of the Eye." The condition became part of all future ophthalmic teaching practices.[7]

1854 to present

1856
The first effective surgical treatment to reduce aqueous production in angle-closure glaucoma, called an Iridectomy, was performed by German ophthalmologist Dr. Albrecht von Graefe.[4,8]

1862
Sir Thomas Fraser introduces the first IOP-lowering medication: the calabar bean, a potent miotic that causes constriction of the pupil of the eye.[4]

1875
The miotic drug, Pilocarpine, is discovered, which has been used in the treatment of chronic open-angle glaucoma and acute angle-closure glaucoma as an adjunctive therapy for over 100 years.[4]

1901
The second class of IOP-lowering drugs, the adrenergic agonists, debuts with Epinephrine.[4]

The combination of Pilocarpine and Epinephrine eventually became the first commercially available, fixed-combination drug for glaucoma.[4]

1906
A common filtering operation used until 1957 for chronic glaucoma to lower eye pressure, Iridencleisis, is introduced by Norwegian ophthalmologist Soren Holth.[11]

1911
Swedish ophthalmologist Allvar Gullstrand invents the Slit Lamp to illuminate the anterior of the eye.[14]

1932
The procedure known as Cliodestruction is introduced to lower IOP through the reduction of aqueous production.[13]

Cliodestruction, or Cyclodiathermy, is one of the four approaches to surgical glaucoma treatment still used today.[13]

1954
Acetazolamide, initially used as a diuretic in congestive heart failure, is reported as an effective IOP-lowering medicine when used orally.[11]

1966
Professor Anthony Molteno develops the first glaucoma drainage device that shunts aqueous from the anterior chamber into a maintained episcleral reservoir.[11]

1968
The Trabeculectomy procedure was introduced by J.E. Cairns as a surgical treatment for glaucoma, marking a major improvement to then-available surgical treatment options.[15]

With some improvements and modifications over the years, the Trabeculectomy procedure is still performed today.[16]

1978
The beta blocker Timolol is approved as the first topical drug for lowering IOP.[13]

Timolol and other beta blockers continue to be commonly used options for lowering IOP.[13]

1985
Alcon receives approval for the cardioselective beta blocker, Betaxolol,[4] called BETOPTIC S® suspension, for the treatment of elevated IOP.

1995
The first topical carbonic anhydrase inhibitor, Dorzolamide, is approved for use.[9]

1998
Alcon introduces the topical carbonic anhydrase inhibitor called Brinzolamide, marketed as AZOPT® suspension.

2004
The Dynamic Contour Tonometer is introduced, which uses the principle of contour matching rather than applanation[3] to eliminate the systematic errors inherent in previous tonometers, providing a more precise IOP measurement.[19]

The Trabectome surgical device is cleared for the treatment of adult and juvenile open-angle glaucoma.[20]

2008
The procedure known as Canaloplasty is introduced to lower IOP in patients with open-angle, pseudoexfoliative or pigmentary glaucoma.[20]

2013
Alcon introduces SIMBRINZA™ suspension, the first fixed dose combination product for lowering IOP that does not include a beta-blocker.

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