

History of the Optometer

Tiffany C Lo, David Kaufman, Ian McAllister

Optometers are instruments used to measure refractive error, they can be considered predecessors to the modern refractors such as the phoropter and automated refractors. There is some debate surrounding the inventor of the optometer. Some believe it was William Porterfield (1683 – 1760) who invented the optometer in 1738.¹ Others believe that it was Thomas Young who invented the optometer.² Thomas Young is well-known for other contributions to ophthalmology on colour vision, astigmatism and accommodation.

Historically, optometers use both objective and subjective methods to measure refractive error. There were two main types of optometers differing in their construction. One type is made with a convex lens and a visual target, the other is based on a Galilean telescope, constructed with a concave and a convex lens.



Above: Simple optometer (c1870) consisting of a single convex lens and a movable target

The single convex lens design optometer uses a tiny near visual target.³ It determines whether the eye is hypermetropic, emmetropic or myopic by the position of the test lens.³ The accuracy of the measurement is affected due to magnification effects, and crystalline lens accommodation (a near visual target causes an accommodation response).³ The Badal optometer is one such type of optometer where a single convex lens is placed at the focal length from the eye and a visual target is adjusted for testing.⁴



Above: International Optometer of Dr Badal (c1880)

The Galilean telescope design of optometer consists of a concave eyepiece lens and a convex objective lens.³ Adjustment of the distance between the two lenses results in a different refractive effect.³ However, the accuracy of the measurement is affected due to magnification.³



Above: Javal Optometer, Giroux (c1860)

Design of optometers have come a long way since the early models. Most modern autorefractors can be considered objective optometers. The construction consists of a fundus illumination beam and a detection-observation beam.⁵ Modern autorefractors differ in their use of measurement methods of the detection-observation beam.

References:

1. Rosenthal JW. Norman Pub.; 1996.
2. Keeler CR. AJO American Journal of Ophthalmology. 2009;148(4):605.
3. Souter WN. The Keystone Publishing Company; 1910.
4. Aldaba M et al Ophthalmic and Physiological Optics. 2017;37(1):88-95.
5. Kaschke M, Donnerhacke K-H, Rill MS. Hoboken: Wiley; 2013