Acta Scientific Ophthalmology (ISSN: 2582-3191)

Volume 5 Issue 6 June 2022

Short Communication

Subjective Measurement of Cylinder Power and Axis on a Two Dimensional Surface With an Adjustable Oval Dyop®

Isiaka Sanni Oluwasegun*

Department of Optometry and Vision Therapy, Makkah Specialist Eye Hospital, Bauchi, Basar International Foundation, Nigeria

***Corresponding Author:** Isiaka Sanni Oluwasegun, Department of Optometry and Vision Therapy, Makkah Specialist Eye Hospital, Bauchi, Basar International Foundation, Nigeria.

Received: May 02, 2022

Published: May 04, 2022

The eye has evolved in most animals to see images on a fourth dimensional basis: height, width, depth, and time (as in displacement from an initial image location).

Static acuity benchmarks were more than adequate in a world where motion was significantly limited and letter-based literacy was the exception. With the advent of technology, most people had gone from the brute strength of being hunter/warriors as a survival skill to the intellectual mastery of precise computerized text.

The refraction process has allowed for the development of glasses and/or lenses to compensate for a less than optimum refractive state of eye. The primary refraction variables for the creation of eye glasses are sphere power, cylinder axis, and cylinder power. A cylinder power at particular axis provide optical compensation for astigmatism.

Traditional Optometry uses the discernment of the smallest row of a line of letters to detect the eye accepted Sphere and/or Cylinder power, and an array of fan-like lines to detect it's Optical Axis on a two-dimensional surface. Hence the selection of lenses (Sphere and/or Cylinder) in a Trial Lens Frame Kit or Phoropter is used to calibrate that needed visual correction.

What has not been previously possible, without precisely calibrated cylinder lenses, was to measure Optical Cylinder on a two-dimensional surface. Being able to measure Optical Cylinder on a two-dimensional surface, without the use of compensating cylinder lenses, might be regarded as the "Allan's Grail" of Optometry.

Allan Hytowitz invented an optotype called Dyop (pronounced "di-op" which is short for dynamic optotype) which is a spinning segmented ring whose minimum angular diameter, where the direction of spinning can be detected, is the acuity endpoint. The demarcation between the acuity endpoint and sub-acuity (where the spin direction cannot be detected) is up to six times as precise as acuity measurement with static visual targets, up to three times as efficient, allows for acuity measurement in color, and allows for acuity measurement without necessitating patient literacy such as with infants or non-verbal individuals.

The Dyop equivalent to Snellen 20/20 (6/6) acuity is a Dyop with an angular width 8 arc minutes. The actual Snellen equivalent to 20/20 (6/6) acuity is 7.6 arc minutes but it was rounded up to 8 arc minutes. Eye Care Professionals and Vision Scientists who wish a more precise acuity measurement can use the Dyop Precision Test which measures acuity in 0.3 diopter increments. A Dyop also has a linear progression as to acuity and diopters of sphere where each addition diopter of power is +/- 6 arc minutes.

However, an additional feature of using a Dyop as a visual target is that it can be used to measure Optical Cylinder on a two-dimensional surface, eliminating the necessity of having an assortment of adjustable cylinder lenses.

One of the properties of Optical Cylinder power is that it tends to add an oval distortion to images, and will make a circular Dyop appear as an oval. The adjustment of that apparent oval to appear to be circular is equivalent to the compensation of using a cylinder lens.

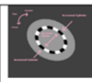
	% Distortion from Circular	110% = 1.50 D 120% = 2.00 D 130% = 2.50 D 140% = 3.00 D 150% = 3.50 D		
Circular Dyop	vs. Diopters of cylinder	% Distortion	Adjustable Dyop	Adjustable Dyop

Figure 1

					
1 diopter Cylinder - 0 degrees Axis	2 diopters Cylinder - 0 degrees Axis	3 diopters Cylinder - 0 degrees Axis	4 diopters Cylinder - 0 degrees Axis	5 diopter Cylinder - 0 degrees Axis	6 diopters Cylinder - 0 degrees Axis

Figure 2

						
3 diopters Cylinder - 0 degrees Axis	3 diopters Cylinder - 15 degrees Axis	3 diopters Cylinder - 30 degrees Axis	3 diopters Cylinder - 45 degrees Axis	3 diopters Cylinder - 60 degrees Axis	3 diopters Cylinder - 75 degrees Axis	3 diopters Cylinder - 90 degrees Axis

Figure 3

Two Dimensional Dyop Refraction Methodology using a Computerized Adjustable Oval Dyop:

- Access the Adjustable Oval Dyop as a Single Dyop (Keystroke S").
- Use the Up/Down arrows, the (+/-) Screen Icons, or a controller device to reduce the Dyop diameter and determine the initial unaided visual acuity. Dyop arc width equivalents to diopter values can easily be determined by realizing that 8 arc minutes is Zero diopters of power and that each additional 6 arc minutes of Dyop diameter is equal to +/- 1 diopter of Optical Spherical power.
- Add 30 arc minutes (the equivalent to 5 diopters of blur) to the unaided acuity endpoint arc width to have a Dyop whose diameter is sufficiently large to determine Optical Axis and Optical Cylinder.
- Adjust the Oval shape (Keystroke "Control+N") of the Single Dyop so that it is 50% of a circular Dyop.
- Adjust the Axis of the Single Dyop to appear as horizontal as possible. (Keystroke "V"). This value is the Optical Axis.
- Then readjust the oval shape (Keystroke "Control+J") of the Single Dyop so that it appears as spherical as possible. This will indicate the Optical Cylinder value.

110% = - 1.50 D 120% = - 2.00 D 130% = - 2.50 D 140% = - 3.00 D 150% = - 3.50 D	90% = + 1.50 D 80% = + 2.00 D 70% = + 2.50 D 60% = + 3.00 D 50% = + 3.50 D
Minus Cylinder Adjustment	Plus Cylinder Adjustment

Figure 4

Once the Single Dyop appears to be as horizontal (Axis) and as circular (cylinder) as possible, reduce the Dyop diameter arc width to the sub-acuity level (where the direction of spin cannot be determined). Then incrementally increase the Dyop diameter so that the spin direction can be determined, which will be the Optical acuity endpoint. The value of the Optical Sphere is the Dyop arc width minus 8 arc minutes as divided by six. Optical Cylinder Adjustment values above 100% of the Oval Adjustment indicate that the Optical Cylinder value is negative or minus. Optical Cylinder Adjustment values below 100% of the Oval Adjustment indicate that the Optical Cylinder value is positive or plus.

For example

- An Optical Cylinder adjustment of 130% with an Optical Sphere 14 arc minutes (minus 8 arc minutes equals 6 arc minutes divided by 6) is +/- 1 diopter of Optical Sphere with 2.50 diopters of Minus Cylinder.
- An Optical Cylinder adjustment of 70% with an Optical Sphere 14 arc minutes (minus 8 arc minutes equals 6 arc minutes divided by 6) is +/- 1 diopter Optical Sphere with 2.50 diopters of Plus Cylinder.

Conclusively, the computerized adjustable oval Dyop may be a potential tool for subjective refractive assessment of Cylinder power and Cylinder axis of the optical correction needed without using trial lenses or phoropter.