

**Accommodative Facility Behind the Phoropter:**  
**Establishing Normative Data**

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## Accommodative Facility Behind the Phoropter: Establishing Normative

### Data

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#### **Abstract**

Accommodative facility testing was performed on patients with normal binocular vision with the intent of establishing normative data. Testing was performed with the patient's best-corrected vision through the phoropter at a distance of 40cm. Powers of +/-0.75D and +/-1.50D were used. The target population was patients between 13 and 30 years old. This population is the most likely to present with binocular vision complaints. Current normative data is based on testing in free space. This approach will enable testing to be more efficient and reliable for the primary care clinician.

#### **Introduction**

Over the years, there have been many attempts to establish normative data for accommodative facility. All of these studies used slightly different testing techniques and criteria, and many found different, yet similar results. According to Wick et al<sup>1</sup>, Zellers et al<sup>2</sup> is the most often referred source for normative values of accommodative facility (7.72 +/-5.15 cpm for binocular testing with the use of a suppression check). However, Zellers et al did not exclude subjects on the basis of symptoms or accommodative/vergence function. Therefore, this average may have been slightly higher if these patients were excluded from the study. Burge<sup>3</sup> found the average binocular facility to be 10 (+/- 4) cycles per minute and Griffin

et al<sup>4</sup> determined it to be 13 cycles per minute. In response to all of this similar yet conflicting data, Griffin and Grisham<sup>5</sup> recommend using a cutoff for a passing binocular accommodative facility to be 6 cycles per minute, with the use of a suppression check. It should be noted that without the use of a suppression check, the cutoff should be slightly higher.

The source of confliction in the data may be due to the fact that many of these previous attempts failed to exclude subjects with binocular and/or accommodative symptoms. Also none of these attempted to use the same stimulus for accommodation and relaxation. Most other studies have used the standard of +/-2.00 D, or less frequently +/-2.50 D. However, it should be noted that although the demands of the +/-2.00 D has become the accepted standard, this amount appears to be rather arbitrary, as there have been no references to the reason why these powers were selected.

Previous studies to determine normal values for accommodative facility have neglected one key element of testing. The testing must be practical for the primary care optometrist to perform on the average patient with binocular vision complaints. When comparing the results from theoretically based studies to the results within a clinical setting with the average patient in the exam chair, they are likely to differ. Many practitioners do not have time to set up vectograph slides and polaroid lenses, insert trial lenses into a trial lens frame with the manifest best correction, or to dig up flipper bars. They want to know quickly and reliably if accommodative infacility is the source of the patient's complaints, or if they need to investigate further for other possibilities. In response to this, we

have developed a different approach to testing accommodative facility behind the phoropter.

## **Method**

Forty-one test subjects\* included in this study were limited to patients between the ages of 13 and 30, as this age group is the most likely to present with binocular vision complaints. It was also important that the patients were old enough to fully understand the test and follow instructions, yet young enough that a limited amplitude of accommodation did not influence their facility. In order to establish normative data for our testing method, it was imperative to exclude, either by exam or by history, subjects that had any preexisting binocular vision problems.

In order to evaluate binocularity, the patients were first asked if they had a history of binocular vision problems such as diplopia, strabismus, amplyopia, or asthenopia. The patients were then given a near cover test. Patients with heterotropia, and patients with heterophoria greater than 5 prism diopters of esophoria or 10 prism diopters of exophoria were automatically excluded from the sample. The patient's lag of accommodation was measured according to the Nott method. Patients with a lag tighter than +0.25D, or more relaxed than +0.75D were excluded. Then accommodative amplitude was measured by the push-up test and any patient who did not meet expected age norms ( $18-1/3$  age)

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\* Procedures followed for testing in this study were in accordance with the ethical standards of the Human Subjects Review Committee at Ferris State University and with the Helsinki Declaration of 1975, as revised in 1983.

were excluded. Once the above criteria were met, the subject was considered to have normal binocular vision.

Accommodative facility testing using a phoropter proceeded as outlined below.

### Equipment

- Phoropter
- Near Point Rod
- Near Target (near point stick containing letters 1-2 lines larger than the patient's near visual acuity)
- Illumination Source
- Timepiece with second hand

### Set Up

- The patient is positioned behind the phoropter containing the best-corrected visual acuity correction for *distance*.
- The near point rod is inserted into the phoropter with the near point target positioned at 40 cm in good illumination.

### Procedure

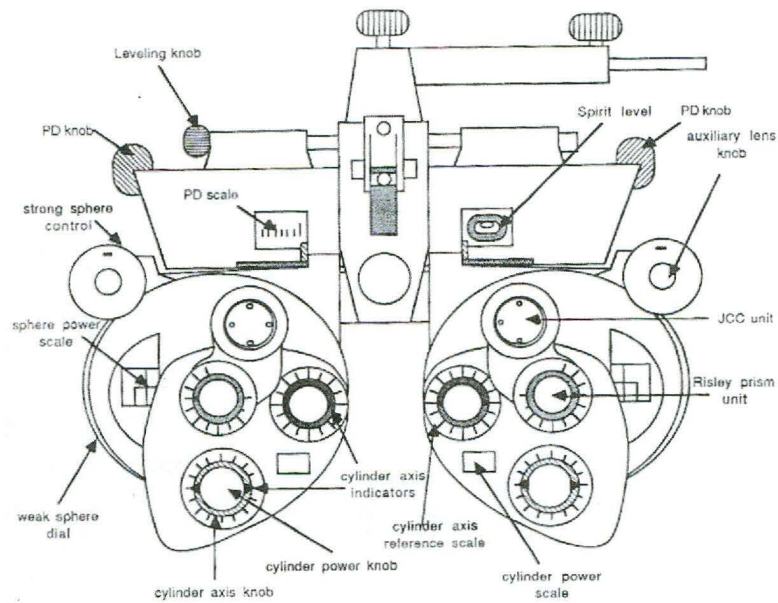
#### +/- 0.75 Diopter Accomodative Facility

1. Ensure that both of the patients' eyes are unoccluded.
2. Dial in 0.75 diopters of minus power using the weak sphere dials OU.
3. Using the Auxilliary Lens Knob/Aperture Control, add 1.50 diopters of plus power OU by turning the knob from the Open position to the Retinoscopy Lens Aperture. Ask the patient to report when the print clears.

4. As soon as the print clears, add 1.50 diopters of minus power OU by turning the knob from the Retinoscopy Lens Aperture to the Open position. Ask the patient to report when the print clears.
5. Steps 3 & 4 constitute 1 cycle. Repeat steps 3 & 4 noting the number of full cycles that the patient completes in 30 seconds.
6. Record the number of cycles completed in 30 seconds.

+/- 1.50 Diopter Accomodative Facility

1. Ensure that both of the patients' eyes are unoccluded.
2. Dial in 1.50 diopters of minus power using the weak sphere dials OU.
3. Using the strong sphere dials, add 3.00 diopters of plus power OU and ask the patient to report when the print clears.
4. As soon as the print clears, add 3.00 diopters of minus power OU using the strong sphere dials and have the patient report when the print clears.
5. Steps 3 & 4 constitute 1 cycle. Repeat steps 3 & 4 noting the number of full cycles that the patient completes in 30 seconds.
6. Record the number of cycles completed in 30 seconds.



**Figure 1-Generic Phoropter 6**

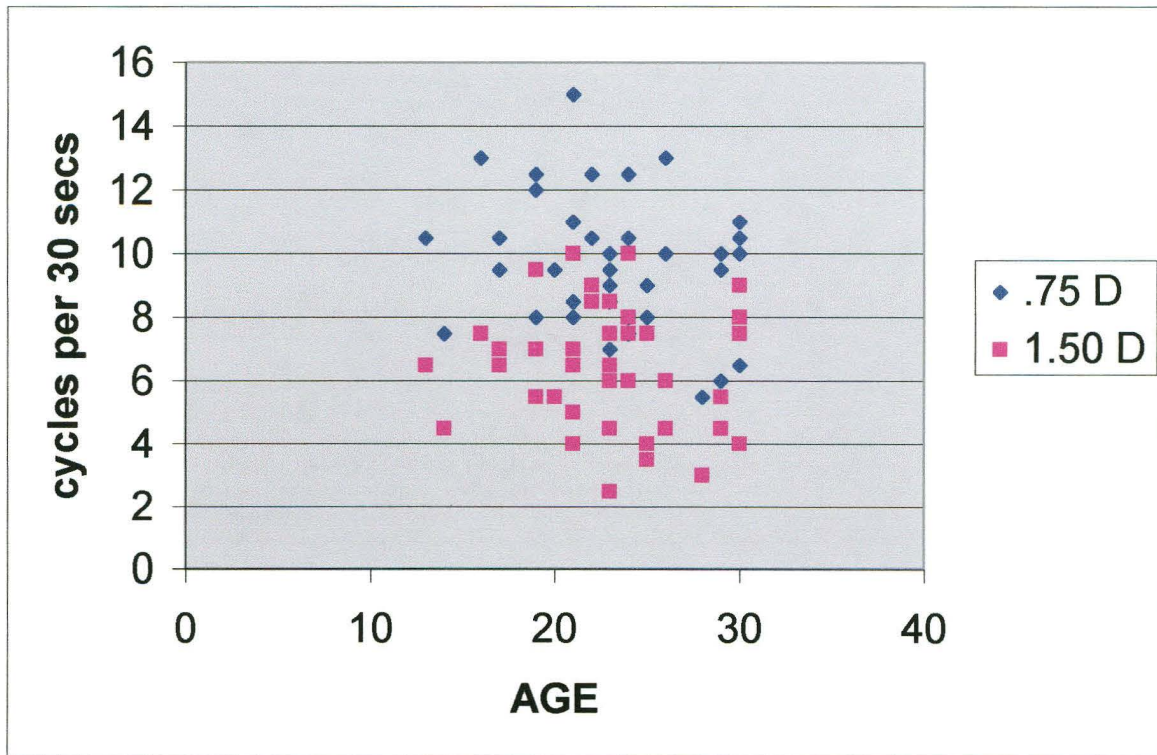
## Results

Forty-one test subjects, ages 13 to 30 were included in this study. Accommodative facility testing with  $\pm 0.75$  D preceded testing with  $\pm 1.50$  D. The results from binocular accommodative facility testing behind the phoropter are as follows:

	Normative Data (cycles per 30 seconds)	Standard Deviation
$\pm 0.75$ D	9.581	$\pm 2.03$
$\pm 1.50$ D	6.351	$\pm 2.00$

The normative data derived from the results is as follows:

	Normative Data (cycles per 30 seconds)	Standard Deviation
$\pm 0.75$ D	9.5	$\pm 2.0$
$\pm 1.50$ D	6.5	$\pm 2.0$



**Figure 2**

### **Discussion**

The accepted standard of stimulus for testing accommodative facility in free space is  $\pm 2.00$  D. As we cannot create a stimulus of this magnitude with the use of a phoropter, we used stimuli of  $\pm 1.50$  D and  $\pm 0.75$  D. We found these powers significant to give the clinician sufficient feedback to determine if a patient possesses normal versus abnormal accommodative facility.

Normative data for accommodative facility is usually reported in cycles per minute (cpm). We chose to test and record normative data as number of cycles in 30 seconds. This decision was made based on the need to streamline testing



for the everyday clinician while still enabling sufficient time to accurately assess the patients' facility.

Testing accommodative facility behind the phoropter allows the clinician to use a fixed testing distance and the patient's most current refractive correction in a manner that is faster and easier to perform than the standard flipper test in free space. In the past, facility was measured as the patient holds a near card at approximately 40cm from the spectacle plane. This distance is typically a very rough estimate, and is rarely measured. Our method enables testing behind the phoropter, in which the near point rod can be used to measure the distance at precisely 40cm. This standardization is likely to increase the reliability of the measurement.

The standard flipper test for accommodative facility is performed in free space while the patient wears his/her habitual spectacles. However, if the patient's refractive error has changed in any way, the accommodative testing may be invalidated. For example, if the patient is over-minused or under-plused, they may have difficulty releasing an overused accommodation system, or they may have trouble accommodating further if the added stimulus takes them closer to or beyond their maximum amplitude. In this case, the clinician would have to put the manifest best correction in a trial frame prior to testing in order to accurately measure accommodative facility. Our method allows for testing behind the phoropter, making it possible to use their manifest refraction with the best-corrected visual acuity and adjusts for any errors in their current spectacle correction.

Many of the other standard accommodative and binocular vision tests are performed just after the manifest refraction, while the patient is still positioned behind the phoropter, such as NRA/PRA, Nott lag, and vergence testing. Our method of testing makes it much easier for the clinician to measure accommodative facility at the same time as these other binocular tests, thus streamlining the exam. This allows for increased accuracy, efficiency and saves the busy clinician valuable chair time. Hopefully clinicians will find this normative useful when attempting to make quick, accurate decisions about their patient's accommodative system.

## References

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