# OPHTHALMOSCOPIC RETINOSCOPY FOR MEASUREMENT OF OCULAR REFRACTIVE ERROR

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**ABSTRACT:**

**AIM**:The aims of this study were

1. To assess the agreement between ophthalmoscopic retinoscopy and neutralization retinoscopy for measurement of refractive error.
2. To develop calibration scale for various commercially available retinoscope (Heine, keeler, Welchallyn) for ophthalmoscopic retinoscopy.

**METHOD:**

In this prospective cross-sectional study the ophthalmoscopic retinoscopy was done on 300 eyes of 150 patients after cycloplegia.

The ophthalmoscopic retinoscopy was followed by standard retinoscopy on all the patients.

For cycloplegiacyclopentolate,tropicamide combination was used.

An accurately calibrated HEINE BETA 200 streak retinoscope was used for all the measurement.

**RESULT:**

Refractive errors obtained by ophthalmoscopic retinoscopy and neutralization retinoscopy had a good level of agreement for mild to moderate hyperopia(ILA:1.9623)followed by mild to moderate hyperopic astigmatism(ILA:1.9897),mild to moderate myopia(ILA:2.347),mild to moderate myopic astigmatism(ILA:2.383),high hyperopic astigmatism(ILA:2.817), high hyperopia(ILA:3.431)& high myopia(ILA: 4.259).

The analysis of this study revealed there is no statistically significant difference in refractive error obtained by ophthalmoscopic retinoscopy and neutralization retinoscopy for different type of refractive error ($P>0.005$) (except for high myopic astigmatism $P<0.005$).

## Conclusion:

Ophthalmoscopic retinoscopy has good level of agreement with neutralization retinoscopy for measurement of mild to moderate amount of hyperopia, myopia and hyperopic astigmatism.

Techniques of ophthalmoscopic retinoscopy may be useful in estimating the amount of refractive error in children who object to loose lenses held close to them.

## Keywords:

Ophthalmoscopicretinoscopy, neutralization retinoscopy, Agreement

## INTRODUCTION:

Ophthalmoscopic retinoscopy is an objective method to estimate the amount of ametropia without the use of lense.

The technique was invented by Jack.C.Copeland the father of streak retinoscope.[1]

Techniques of ophthalmoscopicretinoscopy include sliding the sleeve of retinoscope or moving close or away from the patient until we get fine focused image of the retinoscopic filament on the retina.

The procedure is done without the use of lenses up to most extent.

Amount of refractive error can be finding out by a scale dependent on the brand of the retinoscope and the distance from the corneal plane where we get fine focused image of retinoscopic filament on the retina.

## METHODS AND SUBJECTS:

## SUBJECTS:

One hundred and fifty subject were examined among them one hundred and sixty eyes (38 males, 52 females) were selected. The eyes were divided in to eight groups according to type and magnitude of refractive error.

**Hyperopic refractive error[6]**

- Low : ±0.00D to +3.00D
- Medium : +3.12D to +5.00D
- High : > +5.00D

**Myopic refractive error[7]**

- Mild : -0.50D to -3.00D
- Moderate: - 3.25D to -6.00D
- High : > -6.00D

**Astigmatism [6]**

- Low: ±0.00D to ±2.00D
- High: ±2.00D to ±6.00D
- Very High: >±6.00D

## INCLUSION CRITERIA:

- All the patients between the age group of 4 to 30 years.

## EXCLUSION CRITERIA:

- Mixed astigmatism
- Media opacity

## INSTRUMENTATION

A HEINE BETA 200 Streak retinoscope was used for all measurements.
A scale was created adjacent to the sleeve of the retinoscope by calibrating it with schematic eye and the loose lenses.

## CALIBRATING THE RETINOSCOPE SLEEVE

Perform calibration in a semi darkened examining room with a 20-foot distance from the Vision Drum to the distant wall. Turn on the retinoscope.

### CALIBRATION OF THE CONVERGING BEAM

Bring the sleeve all the way up and place it against a reflecting surface such as the wall. Move away from the wall and observe from the side (not through the peephole) until the streak is in sharp focus on the wall. Now measure the distance between sharp image of retinoscopic filament and retinoscope. The measured distance gives the focal point of retinoscope when the sleeve is all the way up.

The focal points of various commercially available retinoscopes when the sleeve is all the way up are given as below.

HEINE BETA 200: 25CM OR +4.00Dsph.
KEELER PROFESSIONAL: 13CM OR +7.75Dsph.
WELCH ALLYN: 33CM OR +3.OODsph.

### CALIBRATION OF THE PARALLEL BEAM:

Sit in the patient's examination chair and aim the retinoscope towards the distant wall while moving the sleeve up and down. Watch where the finest focused image of the filament is observed. Note the relative position of the bottom of the sleeve with regard to the range of sleeve movement. In that position, the retinoscope beam is as parallel as possible and it has no vergence and thus is focused at infinity. The Heine retinoscope has a mechanical stop (Para Stop) at the parallel beam position that can be engaged to prevent the vergence control from being adjusted to a convergent beam. This position can be used as the Plano calibration.

### CALIBRATION OF THE DIVERGING BEAM

Sit in the patient's examination chair and Aim the retinoscope towards the distant wall. Move the sleeve all the way down and select the trial lens that allows for the sharpest focus. The divergent beam of the retinoscope will be brought to convergence at infinity when you neutralize it with some lens between + 1.50 to + 2.25 D. Different models of retinoscope vary as to where in space light can be focused behind them.

The focal points of various commercially available retinoscopes when the sleeve is all the way down are given as below:-

- HEINE BETA 200: 44CM OR -2.25Dsph.
- KEELER PROFESSIONAL: 50CM OR -2.00Dsph.
- WELCH ALLYN: 50CM OR -2.OODsph.

From the calibration focusing range of different retinoscopes for ophthalmoscopicretinoscopy are determined.

- HEINE BETA 200 Retinoscope has an ophthalmoscopic retinoscopy focusing range of+4.00D Hyperopia to -2.25D Myopia.
- KEELER PROFESSIONAL Retinoscope has an ophthalmoscopicretinoscpy focusing range of +7.75D Hyperopia to -2.00D Myopia.
- WELCH ALLYN Retinoscope has an ophthalmoscopicretinoscpy focusing range of +3.00D Hyperopia to -2.00D Myopia.

After calibration of the sleeve of retinoscope and determined that it has an ophthalmoscopicretinoscopy focusing range of 4.00 D (or 7.75D or 3.00, depending on the model) of hyperopia to 2.25 D (or 2.00 D or 1.50 D, depending on the model) of myopia the second scale was developed.

**PROCEDURE:**

Ophthalmoscopicretinoscopy followed by auto refraction and standard retinoscopy was done in all the patients receiving three drops of 0.5%Cyclopentolate, 1%Tropicamide, and 0.5% Cyclopentolate respectively in every five minutes of interval.

The retinoscopy was performed after a period of at least 30 minutes from the administration of the last eye drop.

## TECHNIQUES OF OPHTHALMOSCOPIC RETINOSCOPY

When performing ophthalmoscopicretinoscopy, the observer begins with the retinoscope 5cm away from the patient’s eye with the sleeve at the Plano position on the adjacent scale. If the patient is Emmetropic you will find the fine focused image of retinoscopic filament at this position. Now rotate the streak 360 degrees by rotating the sleeve of retinoscope. If the streak

image is in focus in all meridians, the patient has no astigmatism and the patient is Emmetropic and the ophthalmoscopicretinoscopy reaches the end point at this stage.

## RESULT:

[**TABLE 1**] *ILA: Interval between the limits of agreement

| OPHTHALMOSCOPICRETINOSCOPY VS. NEUTRALIZATION RETINOSCOPY | MILD TO MOD HYPEROPIA | MILD TO MOD MYOPIA | MILD TO MOD HYPEROPIC ASTIGMATISM | MILD TO MOD MYOPICASTIGMATISM |
|---|---|---|---|---|
| BIAS | -0.175 | -0.0125 | -0.017 | 0.1565 |
| P -VALUE | 0.13451 | 0.92658 | 0.8825 | 0.263749 |
| ILA* | 1.9623 | 2.347 | 1.9897 | 2.383 |

[**TABLE 2**] *ILA: Interval between the limits of agreement

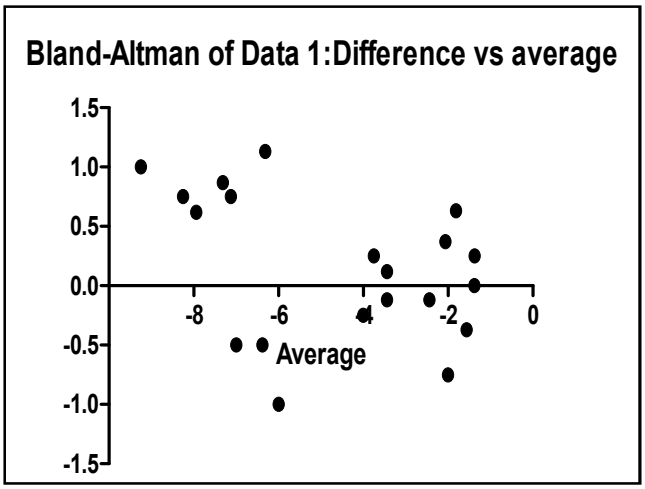
| Ophthalmoscopic retinoscopy vs. Neutralization retinoscopy | HIGH HYPEROPIA | HIGH MYOPIA | HIGH HYPEROPIC ASTIGMATISM | HIGH MYOPICASTIGMATISM |
|---|---|---|---|---|
| BIAS | -0.2375 | -0.125 | 0.1275 | 0.4185 |
| P- VALUE | 0.23986 | 0.707995 | 0.437382 | 0.049578 |
| ILA* | 3.431 | 4.008 | 2.817 | 3.499 |

Table 1&2 provides the data on the level of agreement between the refractive error obtained by ophthalmoscopicretinoscopy& neutralization retinoscopy for different types of refractive error.

The bias of ophthalmoscopicretinoscopy was generally low (less than 0.175D), with the exception of refractive error rendered in case of high myopic astigmatism by ophthalmoscopicretinoscopy (bias = 0.4185).

The analysis of this study revealed there is no statistically significant difference in refractive error obtained by ophthalmoscopicretinoscopy and neutralization retinoscopy for different types of refractive error ($P>0.005$) (except for high myopic astigmatism $P<0.005$).

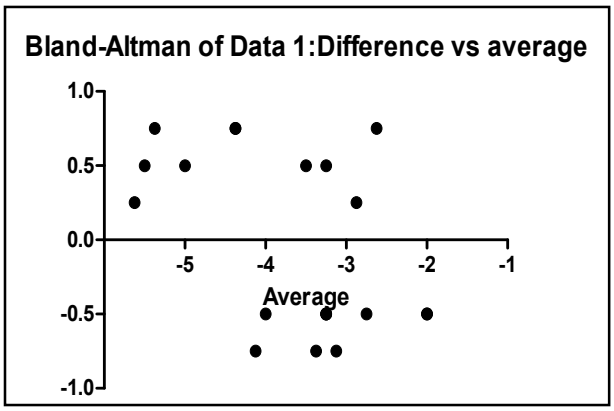
Interval between 95% limits of agreement shows that in case of mild to moderate hyperopia the refractive error obtained by ophthalmoscopicretinoscopy and neutralization retinoscopy had good level of agreement.




Graph-A

- Graph A shows the difference of refractive error obtained by ophthalmoscopicretinoscopy

And neutralization retinoscopy average of refractive error obtained by two methods in case of mild to moderate hyperopia.




Graph-B

- Graph B shows the difference of refractive error obtained by ophthalmoscopicretinoscopy

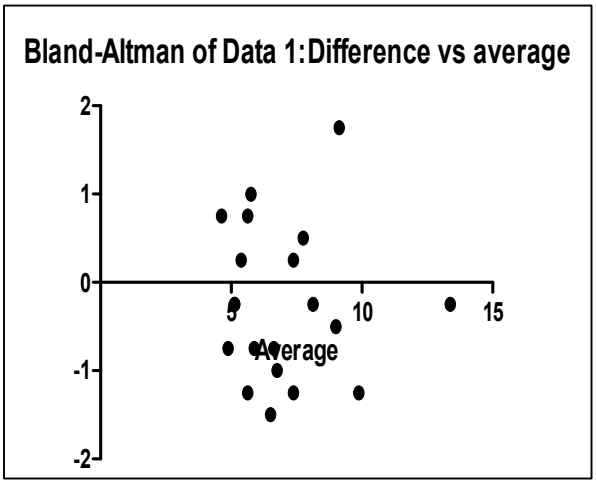
And neutralization retinoscopy average of refractive error obtained by two methods in case of mild to moderate Myopia

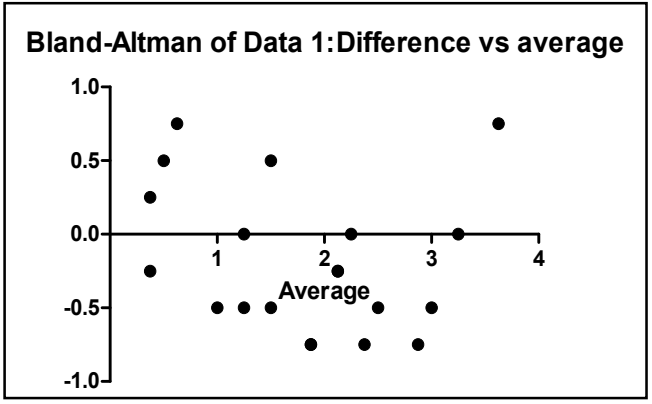
Graph C

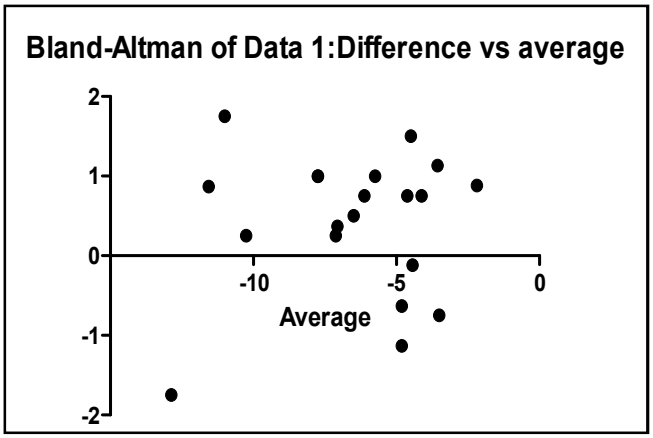
- Graph C shows the difference of refractive error obtained by ophthalmoscopicretinoscopy And neutralization retinoscopy average of refractive error obtained by two methods in case of mild to moderate hyperopic astigmatism.

Graph D

- Graph D shows the difference of refractive error obtained by ophthalmoscopicretinoscopy And neutralization retinoscopy average of refractive error obtained by two methods in case of mild to moderate myopic astigmatism.

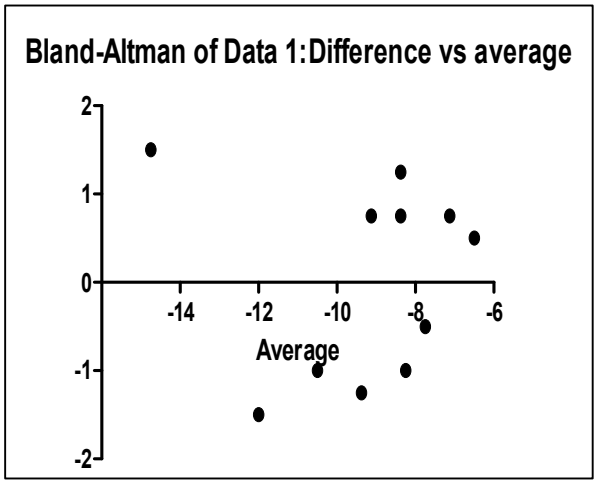




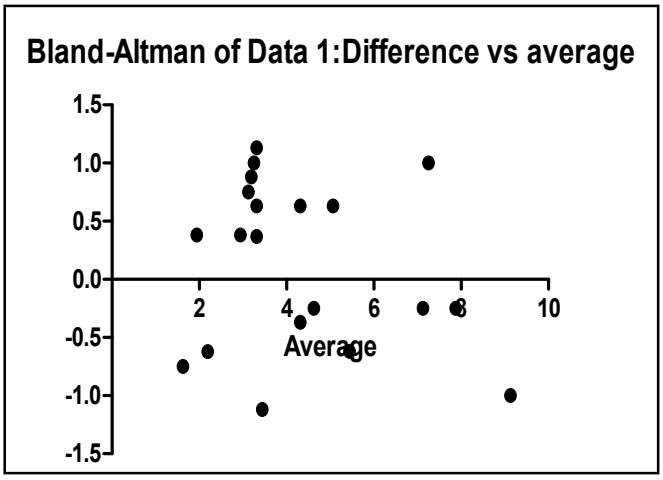

Graph E

- Graph E shows the difference of refractive error obtained by ophthalmoscopicretinoscopy
  And neutralization retinoscopy average of refractive error obtained by two methods in case of high hyperopia.




Graph F

- Graph F shows the difference of refractive error obtained by ophthalmoscopicretinoscopy
  And neutralization retinoscopy average of refractive error obtained by two methods in case of high myopia.




Graph G

- Graph G shows the difference of refractive error obtained by ophthalmoscopicretinoscopy
  And neutralization retinoscopy average of refractive error obtained by two methods in case of high hyperopic astigmatism

Graph H

- Graph H shows the difference of refractive error obtained by ophthalmoscopicretinoscopy And neutralization retinoscopyvs average of refractive error obtained by two methods in case of high myopic astigmatism.

**DISCUSSION:**

The result of the study indicates that there is no statistically significant difference between the refractive error obtained by ophthalmoscopicretinoscopy& neutralization retinoscopy for all the group of refractive error except high myopic astigmatism.

The statistics shows that the level of agreements is higher for mild to moderate hyperopia myopia and hyperopic astigmatism.

Wallace et al concluded in their study that estimation retinoscopy has good accuracy for low level of myopia, hyperopia & astigmatism. While in this study there were good level of agreement in mild to moderate, hyperopia & myopia, myopic astigmatism.

However we cannot compare our result with the study done by Wallace et al as they had used the technique of magnification & enhancement to estimate refractive error. While in this study techniques of ophthalmoscopicretinoscopy was used.

**CONCLUSION:**

From the study it has been concluded that Ophthalmoscopicretinoscopy has good level of agreement with neutralization retinoscopy for measurement of mild to moderate amount of hyperopia, myopia and hyperopic astigmatism.

Techniques of ophthalmoscopicretinoscopy may be useful in estimating the amount of refractive error in children who object to loose lenses held close to them

## LIMITATION

- Refractive error between -2.25D to -3.00D cannot be measured.
- It can measure the error only in the gap on 1D.
- Learning curve

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