Retinoscopy Measurement Differences as a Variable of Technique

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ABSTRACT

A study was made to check the reliability of dynamic retinoscopy findings in a modification of the bell retinoscopy technique. The study was to compare findings between two examiners, the authors. Selected subjects in the test sample were retested to determine if the retinoscopy techniques were a variable. One examiner was measuring the light shadow edge of the beam with rather large sweeps of the instrument. The other was measuring the very center of the beam with very small, rapid sweeps of the instrument. The retest data confirm that the technique differences could account for at least 3.50 D difference at the 40 cm test distance.

Retinoscopy is one of the basic optometric test procedures for objectively evaluating the optical status of a patient. All of the optometry schools in the United States emphasize both the theoretical and applied aspects of this test procedure in their curricula. Yet some men in optometric practices view retinoscopy findings with doubts and reservation.

Many optometrists express a lack of confidence in their ability to interpret the results of dynamic skiametry, particularly the techniques commonly referred to as “book retinoscopy” and “dangle bell retinoscopy.” They question the reliability of these techniques. One of the more disturbing elements of these private“confessions” is that the doubters are often the most competent and thorough clinicians.

The present study was carried out to determine the reliability of modified bell retinoscopy findings. We tested the same subjects, using presumably the same procedures and identical instruments, under the same conditions. The tests were modifications of the bell retinoscopy procedure.

The data revealed that the findings of the two optometrists were not the same, despite the standard conditions. It was then hypothesized that the different results were due to variation of retinoscopy procedures of the examiners.

Additional testing did show that there were two significant test factors not initially recognized. These were: 1) what area of the reflex examiner was looking at during the administration; 2) how he moved his instrument during the procedure.

Test Description

The test target was a chrome-plated sphere, one-half inch in diameter. It was attached to an anodized aluminum rod, 3/16” in diameter. This target works well for two reasons. First it enables the subject to report clarity, while maintaining its desired three-dimensionality. Second, a sphere maintains a constancy of shape when seen from any vantage point. Therefore, the spherical target allows the subject to be more aware of the spatial changes directly related to the retinoscopy procedure. The subject, then, is not distracted by any change in target shape.

Fig. 1 presents the equipment diagram. The test target (T) was suspended in a clamp holder so that it moved parallel to the carrier track and floor, and could be adjusted to the subject’s eye level. The
carrier track extended beyond both the subject’s (S) and the examiner’s (E) positions. A forehead rest was mounted on the underside of the carrier track so that the subject’s position could be controlled. A loop which was adjustable for different test distances extended below the track on the examiner’s end. This loop was designed to accept the forehead rest of the American Optical spot retinoscope. In this way the desired retinoscopy distance could be maintained.

The target clamp was free to move on the overhead track from the retinoscope towards the subject. A continuous cord belt (B) allowed the examiner to move the target by reaching up and pulling the cord. In this way, there was no need for him to touch the target or the target holder.

The subject was seated on a flat-top school desk with an appropriate foot rest. The carrier track was adjustable in height so that the subject’s forehead rest could be positioned for comfortably straight sitting posture.

**First Experiment Test Procedure**

The tests were administered in a large utility room of a public school. Each optometrist tested each child separately. When one examiner completed his work with a particular subject, the other optometrist examined the child. The examining optometrist was neither aided nor observed by the unoccupied one. One-half of the subjects were first tested by Examiner 1 and the other half first by Examiner 2.

Testing was done at three retinoscopy distances: 67 cms, 50 cms, and 40 cms. These distances were used in the same order for all subjects. The procedure was as follows: The retinoscope was placed at the first test distance (67 cms). The test target was positioned at the same distance from the subject, at a height just above the light source of the retinoscope. While the examiner scanned the reflex of the subject’s eyes, the test target was moved slowly towards the subject. It was stopped when the first persistent against motion was observed by the examiner. This distance was measured from the subject’s head rest, in the nearest centimeter units. The distance closely corresponded to the corneal plane of the subject. Reflex change measurements were made in the two principle meridians: 180˚ and 90˚. The same procedure was repeated for 50 cm and 40 cm test distances.

The subjects were nine third-grade students in the Doolittle School, Cheshire, Connecticut. The children were selected from a group of subjects who had participated in visual testing projects for two years. They were all known to measure standard acuity and have a static retinoscopy within the range of -0.25 to +1.25 D at 6 M. Subjects were limited to those measuring 0.50 D or less of either with-the-rule or against-the-rule astigmatism.

Table 1 presents the results and differences of the right-eye examinations of the nine subjects by Examiners 1 and 2. They are recorded in spherical equivalent dioptric values equal to the distance measures. There were no astigmatic differences greater than 0.50 D when distance measures were converted to dioptric values. Since the left-eye measures were comparable to those of the right eye, there was no reason to report them in this study.

It was apparent that there was a significant discrepancy between the findings of the two examiners. The differences ranged from no disagreement for subject #7 to as much as 3.69 D at 40 cms for subject #1. The mean dioptric differences between examiners for subjects 1 through 9, at all three retinoscopy distances were close to 1.00 D.

An examination of the raw data brought only one discernible pattern of examiner differences. It was noted that in all cases Examiner 2 measured a later against motion than Examiner 1. Nothing further could be made of this information.

It was hypothesized that the differences in results were due to a varied use of the retinoscope. An inquiry lead to the discovery that Examiner 2 was using his instrument essentially for clinical purposes. Examiner 1, on the other hand, was using his retinoscope to determine subtle retinoscopy changes while engaged in problem solving talks.

The two optometrists demonstrated their retinoscopic techniques to each other. It was apparent that Examiner 2 was making greater sweeps with the retinoscope than Examiner 1. In addition, the demonstration revealed that the two optometrists
watched different parts of the reflex during the test. Examiner 2 neutralized the changes in motion of the light-shadow border lines as they passed through the central pupillary area. Examiner 1 neutralized the center of the reflex and did not sweep the instrument enough to see the light-shadow edge of the beam.

**Second Experiment Test Procedure**

The validity of the hypothesis that technique differences accounted for the discrepancies in the results of Examiners 2 and 1 was tested. Three of the original subjects were re-examined: one whose results revealed a great difference between the two examiners; one whose results showed an average difference; one whose results showed little difference. The test was administered at the same three retinoscopic distances. The only exception to the schedule was that subject 3 was not tested at 50 cms. Retesting was done by Examiner 1 alone (because Examiner 2 was not available for the second day of testing).

Two different retinoscopy techniques were used to retest subjects 1, 2, and 3. These two techniques employed the differing procedures of Examiner 1 and Examiner 2. Two measurements were taken: 1) of the distance at the time that the center of the reflex changed from a with to an against motion, as the instrument was moved in very small, rapid sweeps and 2) of the distance at the time that the light-shadow edge of the beam changed from a with to an against motion with wider, slower sweeps of the instrument.

The measurements of the previous day were not consulted by Examiner 1.

The results of the second testing procedure are plotted (Fig. 2) and are compared to the initial findings of the two examiners. The data supported the hypothesis that differences in the examiner’s techniques were responsible to a large extent for the discrepancies in the initial test results.

Table 2 presents possible ways of comparing the mean differences in results of the findings. From the results it can be seen that: 1. The two procedures in retinoscopy technique give findings which differ closely from one another, each resembling one of the two examiner’s findings, 2. Examiner 1’s findings differ only slightly from the central reflex findings (which could be expected since this is testing test-
retest reliability on different days) and Examiner 1’s peripheral reflex (shadow-light) neutralization on the second day findings closely resemble Examiner 2’s findings on the first day.

**Discussion**

It would have been desirable for both examiners to have retested the children. It would also be desirable to have pupillary size measurements for the different subjects at each test distance. It was possible, however, for Examiner 1 to simulate the technique used by Examiner 2 initially. The data supported the hypothesis that differences in the examiners’ retinoscopy procedure and technique were responsible to a large extent for the discrepancies in the initial test results.

The study shows that the technique of retinoscopy in this test situation did account for relatively large differences in test results (as much as 3.82 D for subject 1 at 40 cm). It is understandable that optometrists lack confidence in the retinoscopy procedure and results. The implication of this study raised several questions. How can retinoscopy findings be reported in a more standard manner? How can retinoscopy findings yield two optical neutrals with a spread of 3.82 D, both findings being relatively reliable on a test-retest basis? What is the difference between subjects who show large difference between central reflex neutralization and shadow-light neutralization and subjects who show little difference?

It is clear that optometrists must understand and recognize different techniques and their results in retinoscopy. Further, reports of retinoscopy findings should be accompanied by clear descriptions of the procedural techniques employed. In this way, retinoscopy can be more meaningful and communicable, and confidence in the findings can be restored.

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**Selected Bibliography**