STUDYING THE VALIDITY OF THE PARSONS VISUAL ACUITY TEST

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INTRODUCTION

Subjective acuity tests are the single most effective tool available to vision screeners to determine the need for professional vision care. (Blum, Peters, Bettman, 1959.) The Parsons Visual Acuity Test (PVAT) was developed for young children, illiterates, and handicapped individuals who are unable to perform on standard visual acuity tests.

The PVAT is first conducted at near point while the person being screened maintains forehead contact with a headrest which is 13 inches from the stimulus card. Cards with three figures, (a hand, cake, and bird) decreasing in size from 20/250 to 20/20 are presented. Pointing to the hand is the correct response throughout testing. Four correct responses out of six or fewer trials on one threshold size, and three errors on the next smaller size,,is the criterion for determining the person's visual acuity. Far point testing is done in the same headrest, with the same cards at 13 inches, but with a +3.00 dioptor lens in front of the eyes to optically simulate the 20 ft. distance. Criterion for distance visual acuity is the same as it was for near. (Cress, Spellman, DeBriere, Sizemore, Northam, Johnson, 1981.)

The purpose of this study was to determine the validity of the PVAT as a screening instrument in identifying people with refractive errors and are in need of professional eye care. Specifically, the following questions were raised and evaluated:

1.) What is the relationship between the distance PVAT and distance Snellen acuity?

2.) What is the relationship between near PVAT and near Snellen acuity?

3.) What is the relationship between distance PVAT and distance Snellen acuity for hyperopes and myopes?

4.) What is the relationship between near PVAT and near Snellen acuity for hyperopes and myopes?

5.) What is the inter-examiner reliability in testing acuity with PVAT at distance and near and the Snellen test at distance and near?

6.) What is the inter-examiner reliability for determining refractive error with retinoscopy?

PROCEDURE

The 35 subjects were selected on the basis of the normal population distribution for refractive errors as reported by Sorsby [illegible] (Refractive Anomolies of the Eye, 1967.), using the sperical equivalent. They were all of normal intellegence ranging in age from 6 to 30. There were six categories;

1.) High myopes (≥-4.00), Sorsby 1.8%, Study 3.0%.

2.) High hyperopes (≥+6.00), Sorsby 1.7% Study 0.0%.

3.) Medium myope (> -1.00 to -4.00), Sorsby 4.7%, Study 10.3%.

4.) Medium Hyperopes (> +2.00 to +6.00), Sorsby 13.3%
Study 10.3%.

5.) Low Myopes (-.25 to -1.00), Sorsby 5.1%, Study 2.9%.

6.) Low Hyperopes (plano to +2.00) Sorsby 73.4%, Study 73.5%.

There were two examiners, a senior optometry student and an experienced clinical faculty member, who examined each subject independently. The variables that were measured by each examiner for each subject were:

1.) distance Snellen acuity (20ft.) O.D. & O.S.

2.) near Snellen acuity (16 inches) O.D. & O.S.

3.) near PVAT (13 inches) O.D. & O.S.

4.) distance PVAT (13 inches with +3.00 dioptor lens) O.D. & O.S.

5.) retinoscopy O.D. & O.S.

6.) subjective refraction O.D. & O.S.

RESULTS

A correlated "t" test was computed indicating a very high correlation between the PVAT distance (13 inches and +3.00 D. lens)

and the distance Snellen acuity (r= 0.929). There was, however, a difference between the means (t= 2.40, df=139, $p < .01$) with the PVAT acuities higher.

The correlation between the PVAT at near and Snellen acuity at near was very high using the correlated "t" test (r= 0.916). There was no significant difference between the mean acuities (t= 1.39, df= 139, $p > .05$).

The relationship between the distance PVAT and distance Snellen acuity for medium hyperopes (+2.00 to +6.00 D.), had a very high correlation (r= .87), but there was a significant difference between the mean scores (t= 7.74, df= 13, $p < .005$). The Snellen mean was approximately 20/40 while the PVAT was close to 20/25.

If passing a screening test is based on 20/40 or less, or refractive error less than +2.00 D. (Blum, Peters, and Bettman, 1959), then the distance Snellen results would only have accurately referred 43% of this +2.00 D. or greater hyperopic sample group and passed or "under-referred" 57%. The PVAT group would have accurately referred only 14% and passed or "under-referred " 86% of this sample.

The "t" test computation revealed a very high correlation (r= .968) for the distance PVAT and distance Snellen acuity for myopes of -1.00 D. and over. Once again there was a significant difference between the mean acuity (t= 5.53, df= 17, $p < .005$) with the PVAT yielding the better acuity. Based on referral for myopia, using -0.50 D. or greater for the cutoff (Blum, Peters, and Bettman, 1959), in the sample of -1.00 D. or worse refractive errors, the distance Snellen test accurately failed 100% of this group. The distance PVAT passed or "under-referred" 33% identified as persons requiring care.

The near PVAT and near Snellen acuity for medium and high myopes (greater than -1.00 D.) and all hyperopes showed high correlations (r= .91 for myopes and r= .86 for hyperopes). There was no significant difference between the mean acuities for myopes (t= 1.02, df= 17, $p>.05$), or hyperopes (t= 0.34, df= 13, $p>.05$). This is a strong support for the valid use of the PVAT as a nearpoint visual acuity test.

A two factor analysis (ANOVA) with repeated measures was computed to determine the inter-examiner reliability in testing acuity with PVAT at near and distance and the Snellen at near and at distance. The results of the ANOVA support the inter-tester reliability (F= 0.69, df= 1.68, $p>.05$).

The inter-examiner reliability for determining refractive error with retinoscopy proved to be very favorable (t= .06, df= 68, $p>.05$.). The spherical component from the retinoscopy from each examiner on each subject was used in the computation.

IMPRESSIONS AND CONCLUSIONS

1.) The PVAT is a reliable measure of near point acuity.

2.) The PVAT, when used at 13 inches with +3.00 D. lenses, does not appear to be a valid measure of distance visual acuity when compared with Snellen acuity at 20 ft. The "under-referral" of hyperopia by the use of Snellen acuity tests alone has been shown (Peters).
The distance PVAT yeilded an even higher "under-referral" rate, 86%, than the Snellen, 57%, in this study. Other studies (Fantle, Perlstein, 1961, Gardiner, 1964, Kolb 1962) have indicated that the retarded and brain damaged population, which the PVAT was developed for, has a

higher incidence of hyperopia than the normal population. This would potentially raise the "under-referral" rate of the PVAT for distance even higher.

3.) There is good inter-tester reliability in the use of the PVAT when compared with the Snellen test.

4.) There was a very good inter-tester relibility for determining the refractive error of each subject based on static retinoscopy. This lends strong support to the validity of the relationship of the visual acuity finding in the PVAT and the Snellen test with each subjects refractive error.

Based on these results, the PVAT is only a valid and reliable near point acuity test. The distance PVAT can be used provided appropriate cautions and restrictions are kept in mind. For example, if an examiner lowered the "pass-fail" criteria to 20/30 at distance, this would reduce the "under-referral" rate, However, the "over-referral" rate would concomitantly increase.

SUMMARY

The relationship between refractive error and visual acuity cannot be overlooked. There is, however, a strong and clear risk in missing or "under-referring" those exceptional and handicapped persons with refractive and accomodative problems interfering with vision , if screening programs only use visual acuity values as the criteria for referral. As can be seen from these findings, the risk is higher when the PVAT is used.

The combined use of visual acuity testing and objective

measures of refractive error (retinoscopy) is the most accurate and efficient method for screening this area of visual functioning.

The PVAT does have definite clinical value in testing vision. Its use should be encouraged as long as the examiners and screeners are clearly informed and understand its restrictions.

BIBLIOGRAPHY

Blum, H.L., Peters, H.B., Bettman, J.W., Vision Screen for Elementary Schools: The Orinda Study. Berkley, University of California Press, 1959.

Cress, P.J., Spellman, C.R., DeBriere, T.J., Sizemore, A.C., Natham, J.K., Johnson, J.L., Vision Screening for Persons with Severe Handicaps. The Journal of the Association for the Severely Handicapped, 1981, 6, 41-50.

Fantle, E.W., Perlstein, M.A., Ocular Refractive Characteristics of Cerebral Palsy. American Journal of Disabled Children, 1961, p.63.

Gardiner, P.A., Factors Associated with the Development of Myopia in the Growing Child. First International Conference of Myopia, New York, 1964.

Kolb, E.H., Examining the Mentally Retarded Child. American Journal of Optometry and Archives of the American Academy of Optometry, 1962, 39:669,

Peters, H.B., Vision Screening with a Sneller Chart. American Journal of Optometry and Archives of the American Acedemy of Optometry, 38:487.

Refractive Anomalies of the Eye, U.S. Department of Health, Education, and Welfare, 1967.