



## The MTT: A More Comprehensive Vision Screening Test for British Columbia Schools

J. Reynolds\*

### Abstract

Literature regarding the vision care needs of school children indicates that visual anomalies occur in sufficient numbers to warrant recommendation of a comprehensive school vision screening program. This study investigated the referral effectiveness (accuracy) of the Keystone Telebinocular (KTT), the Modified Telebinocular (MTT) and the Snellen against a standard optometric exam. The performance of 60 children, aged 6 yrs, 0 months to 9 yrs, 11 months, on each screening measure was compared to that on the standard optometric exam and categorized as a positive, negative, over or underreferral. Chi-square and phi coefficient analyses indicated that the MTT had greater effectiveness than the Snellen in identifying students needing professional care (21/25, 7/25 respectively,  $\chi^2(1) = 7.000$ ,  $p < .01$ ). The MTT missed fewer students needing professional care than did the Snellen (4/25, 18/25 respectively,  $\chi^2(1) = 8.909$ ,  $p < .01$ ). The Snellen referred fewer students unnecessarily (1/35) than either the MTT (10/35,  $\chi^2(1) = 7.364$ ,  $p < .01$ ) or the KTT (8/35,  $\chi^2(1) = 5.444$ ,  $p < .05$ ). Upon evaluating all factors of vision screening, the MTT proved to be the most useful measure for identifying children requiring professional care.

### Résumé

D'après la documentation qui traite des besoins des enfants d'âge scolaire en matière de soins de la vue, les anomalies visuelles chez les écoliers sont suffisamment nombreuses pour justifier la recommandation d'un programme complet d'examen de la vue dans les écoles. Menée auprès de 60 enfants âgés de 6 ans et 0 mois à 9 ans et 11 mois, cette étude avait pour objectif de déterminer l'efficacité de renvoi (justesse) du test "Keystone Telebinocular" (KTT), du test "Modified Telebinocular" (MTT) et du test de Snellen par rapport à un examen optométrique ordinaire. Après avoir comparé les résultats de ces trois tests pour chacun des enfants avec les résultats de l'examen optométrique ordinaire, on les a classés dans les catégories de renvoi positif, de renvoi négatif, de sur-renvoi ou sous-renvoi. Les analyses des coefficients du chi carré et de phi ont indiqué que le MTT est plus efficace que le Snellen pour déterminer quels élèves ont besoin de soins professionnels (21/25, 7/25 respectivement,  $\chi^2(1)=7,000$ ,  $p = 0,01$ ). Un nombre moindre d'anomalies ont échappé au MTT par rapport au Snellen (4/25, 18/25 respectivement,  $\chi^2(1)=8,909$ ,  $p = 0,01$ ). Les renvois inutiles ont été moins fréquents dans le Snellen (1/35) que dans le MTT (10/35,  $\chi^2(1)=7,364$ ,  $p = 0,01$ ) ou le KTT (8/35,  $\chi^2(1)=5,444$ ,  $p = 0,05$ ). Après évaluation de tous les facteurs liés à l'examen de la vue, on a établi que le MTT est le test le plus utile pour déterminer quels enfants ont besoin de soins professionnels.

### Purpose

Although the actual incidence of children requiring professional vision care has not yet been established, the reported rates indicate that a variety of visual anomalies occurs in sufficient numbers among children to warrant recommendation of a

comprehensive vision screening programme within the school system (Coleman, 1970; Cross, 1975; Harley & Lawrence, 1977; Jervis, 1978; Ontario Ministry of Health, 1976; Province of British Columbia, Ministry of Health, 1977; Rosen, 1966; and Woo & Badger, 1978). The purpose of the present study was to investigate whether the Keystone Telebinocular Technique (KTT), the Modified Telebinocular Technique (MTT), or the Snellen would be the most

\*B.A. (Psych), M.A.(Ed)  
Maple Ridge, BC



effective, in identifying students in need of professional attention.

## Screening Measures

No screening measure, regardless of its comprehensiveness, is equivalent to, or replaces, a clinical examination. Screening results do not equal diagnosis. This limitation must be considered when evaluating either an individual's screening performance or a measure's overall effectiveness.

The three screening measures investigated were selected on the basis of their suitability for administration by non-vision specialists (e.g., school psychologists, Public Health Nurses) and for their short administration time (five to fifteen minutes per student).

### *Snellen*

The Snellen is a monocular instrument which primarily measures far point acuity and myopia, although severe hyperopia and astigmatism may be detected.

Although the Snellen is a widely-used test, it is not without limitations. Perhaps its greatest limitation is its restricted content. For example, near point acuity is not checked unless an alternate form is given. The literature did not report this to be a common procedure in most school vision screening programmes employing the Snellen, yet a significant amount of near point work is required of students.

### *Keystone Telebinocular and Modified Telebinocular*

The Keystone Telebinocular Technique (KTT) and the Modified Telebinocular Technique (MTT) are binocular, stereoscopic screening instruments which measure the following visual skills at both far and near points: monocular and binocular acuity, muscle imbalance, fusion, and amblyopia. Stereopsis and colour vision are also tested at far point. The MTT also screens for hyperopia, astigmatism, and anisometropia. A standardized sequence of cards is presented following a standardized administration procedure. The eyes are tested separately and/or together on specific subtests. Recording forms indicate whether the examinee's visual skills are satisfactory or should be re-screened or evaluated by a professional. Overall performance on both the KTT and the MTT is evaluated in determining whether a referral should be made. The subtests have not been designed to yield diagnostic data, therefore results should not be compared to findings from clinical tests of the same name.

The main advantages of the KTT and the MTT include standardized procedures for testing, recording, and interpreting a variety of visual skills at both far and near point (reading) distances.

There are limitations for both the KTT and the MTT. They are considerably more expensive than the Snellen. Controversial referral rates have been reported for the KTT (Harley & Lawrence, 1977; Williams, 1974; Harris & Sipay, 1975; and Mangrum, 1970). Blum et al. (1959) reported 14% of subjects tested in 1956 were erroneously referred. Technical data are lacking in the KTT manual. The MTT is a relatively new vision screening measure. Walton (1976) reported the MTT to be comparable to the Modified Clinic Technique (MCT) as a screening measure (89.2% referral agreement). There is little other published data available to recommend its use in a school vision screening programme.

### *Standard Optometric Exam*

A consensus was obtained from the participating optometrists regarding the visual skills assessed during a standard optometric exam. These include tests of objective refraction (retinoscopy), subjective refraction (myopia, hyperopia, astigmatism), tropias, phorias and fusion at near and far points, vergences and versions at far and near points, amplitude of accommodation, stereo acuity, colour vision, and internal and external ocular health.

## Subjects and Method

Sixty children, aged 6 yrs, 0 months to 9 yrs, 11 months, who had scheduled appointments with one of five optometrists in Coquitlam, Surrey, and White Rock, British Columbia participated in the study.

All subjects were given a standard optometric exam, the three screening measures, and a letter identification test. The latter was included to determine whether limited letter identification skills or vision difficulties were responsible for errors on MTT subtests and the Snellen. Subjects making more than two errors were excluded from the study. Subjects wearing glasses were screened without their glasses.

Each child was administered the KTT and the MTT by the researcher. Subtests common to both measures were given only once; the complete KTT and remaining MTT subtests were alternated with the complete MTT and KTT specific subtests. The Snellen was given by the optometrists during the standard optometric exam.

The referral criteria given in the directions and on the record forms were followed for the KTT and the MTT. For this study all optometrists used a passing criterion of 6/12 (20/40) for each eye, on the Snellen. Performance on the standard optometric exam was evaluated by the optometrist's professional judgement.

Subjects' performance on each screening measure was compared to their performance on the standard optometric exam and categorized as a



positive referral (professional attention required), a negative referral (professional attention not required), an overreferral (unnecessarily referred), or an underreferral (needing professional attention but not referred).

## Results and Conclusions

Chi-square and phi coefficient analyses were used to make the following comparisons:

- 1) the referral effectiveness of the MTT versus that of the KTT
- 2) the referral effectiveness of the MTT versus that of the Snellen
- 3) the referral effectiveness of the KTT versus that of the Snellen

Of the 60 children tested in the study, the optometrists diagnosed 25 as needing professional care and 35 as not needing professional care.

Results indicated that there were no significant differences in the referral effectiveness of the MTT and the KTT, for any type of referral. The MTT correctly identified more students needing professional care (21/25) than did the Snellen (7/25), ( $X^2 (1) = 7.000$ ,  $p < .01$ ). The MTT erroneously identified 4 subjects as not requiring professional care when they in fact did need optometric attention (underreferrals). The Snellen made 18 such errors ( $X^2 (1) = 8.909$ ,  $p < .01$ ). No significant difference was found between these measures in identifying students not needing professional attention. The Snellen made fewer unnecessary referrals (1/35) than either

the MTT (10/35,  $X^2 (1) = 7.364$ ,  $p < .01$ ) or the KTT (8/35,  $X^2 (1) = 5.444$ ,  $p < .01$ ). No other significant referral differences were found between the KTT and the Snellen.

Not only is it important to know whether there are significant differences in the referral effectiveness of screening measures, but also for which type(s) of referrals these differences apply. Overreferrals and underreferrals are both undesirable. The former make unnecessary and therefore inefficient use of professional services. Underreferrals are more serious since the required professional attention is not obtained. Therefore, in selecting a vision screening measure, emphasis should be placed on the measure which misses the fewest students needing professional care. The results obtained indicate a significant difference between only the MTT and the Snellen for underreferrals; the MTT had the greater accuracy. Although the Snellen was more effective than either the MTT or the KTT for overreferrals, its higher underreferral rate decreases its usefulness as a screening test. Also noteworthy is that the MTT was more accurate than the Snellen in identifying positive referrals.

The appropriateness of a test depends upon more than its statistical merits. While statistical analyses did not show significant differences between the MTT and the KTT, there are administrative factors which differentiate between them. The MTT subtests tend to have content and requirements which are familiar to students, while some of the KTT subtests are novel and therefore confusing to some children. The overall impression was that administration of the MTT went more smoothly for most children than did the KTT. It could be hypothesized that the less frustration experienced by the examinee during screening, the more reliable his or her responses.

Taking into consideration both statistical findings and administrative differences when selecting among the Snellen, the KTT, and the MTT for use in a school vision screening programme, the MTT appears to be the more useful measure for identifying students requiring professional care. The 77% referral agreement (46 correct referrals) between the MTT and the standard optometric exam in this study compares favourably with the 89.2% referral agreement between the MTT and the MCT reported by Walton (1976). The results from these two studies recommend the MTT as a reliable school vision screening instrument.

## References

- Blum, H. L., Peters, H. B., & Bettman, J. W. (1959). Vision screening for elementary schools — the Orinda study. University of California Press, (reprinted 1968).
- Coleman, H. M. (1970). An analysis of the visual status of an entire school population. *Journal of the American Optometric Association*, 41(4), 1-7.

Table I

Comparison of Types of Referrals for Sixty Subjects on Each Screening Measure using a Standard Optometric Exam as the Criterion Measure

Screening Measure	Referral Categories			
	Correctly referred positive referrals no. (%)	negative referrals no. (%)	Incorrectly referred over referrals no. (%)	under referrals no. (%)
MTT	21 (35)	25 (42)	10 (17)	4 (7)
KTT	14 (23)	27 (45)	8 (13)	11 (18)
Snellen	7 (12)	34 (57)	1 (2)	18 (30)

Table II

Chi-square Comparisons of the Number of Referrals per Category between Screening Measures

Screening Measure	Referral Categories			
	positive referrals	negative referrals	over referrals	under referrals
MTT vs KTT	1.400	.077	.222	3.267
MTT vs Snellen	7.000**	1.373	7.364**	8.909**
KTT vs Snellen	2.333	.803	5.444*	1.690

\*  $p < .05$

\*\*  $p < .01$