ความสอดคล้องของการแปลผลการวัดค่าสายตาในเด็กเล็กก่อนวัยเรียนระหว่างแพทย์และครูผู้ดูแล: ต้นแบบการคัดกรองสายตาเด็กเล็กก่อนวัยเรียนในประเทศไทย

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Abstract: Agreement of Interpretation of Preschool Visual Acuity Tests among Doctor Screeners and a Teacher Screener: Preschool Vision Screening Model in Thailand

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Background: A recent report from Holmes suggested that the optimal screening age should be around five years old. The preschool vision screening is essential and should be included in the vision screening program in Thailand. The objective of this study was to assess the agreement of the interpretation of preschool visual acuity among doctor screeners and a teacher screener. Methods: The study was performed between August and October 2011. Preschool children aged between 36 and 72 months old from 3 Child Care Centres (CCC) were enrolled. All participants were tested for visual acuity (VA) by a combination of the following screeners: a third-year resident, a teacher from one of the CCCs who has been trained in VA measurement, and two ophthalmologists each with over 10 years' experience. The VA measurement was carried out in pairs as follows: an ophthalmologist with the resident, an ophthalmologist with the teacher and the resident with the teacher. Results: Two hundred and sixty-four eyes (132 patients) met the criteria. The mean age of the preschool children was 43.71±4.54 months (range, 51-36 months). The agreement rates among the three pairs that carried out VA screening were excellent (k=0.81), moderate (k=0.63) and good (k=0.75) respectively. Conclusion: A teacher trained in VA measurement reliably measured VA in preschool children when compared to ophthalmologists.

Keywords: Child, Vision Screening; Visual Acuity; Eye; Child Care; Ophthalmologists

บทคัดย่อ

ภูมิหลัง: รายงานล่าสุดพบว่าการคัดกรองภาวะสายตาในเด็กควรเริ่มในช่วงอายุประมาณ 5 ปี การตรวจคัดกรองในเด็กก่อนวัยเรียนจึงมีความจำเป็น และควรรวมอยู่ในโครงการการคัดกรองสายตาเด็กของประเทศไทย **วัตถุประสงค์:** เพื่อเปรียบเทียบการแปลผลการวัดค่าสายตาในเด็กก่อนวัยเรียนระหว่างผู้คัดกรองที่เป็นแพทย์และครู **วิธีการ:** ทำการศึกษาในช่วงสิงหาคมถึงตุลาคม 2554 คัดเลือกเด็กช่วงอายุ 36 ถึง 72 เดือน จากศูนย์พัฒนาเด็กเล็กองค์การบริหารส่วนตำบลจำนวน 3 แห่ง ทำการศึกษาค่าสายตาโดยกลุ่มผู้ตรวจคือแพทย์ประจำบ้านจักษุปีที่ 3 ครูผู้ดูแลเด็กเล็กที่ผ่านการอบรมการวัดสายตาแล้ว และจักษุแพทย์ที่มีประสบการณ์การทำงานมากกว่า 10 ปีจำนวน 2 คน ตรวจวัดสายตาเด็กเล็กโดยจับคู่ดังต่อไปนี้ จักษุแพทย์กับแพทย์ประจำบ้าน จักษุแพทย์กับครู และแพทย์ประจำบ้านกับครู **ผล:** ศึกษาในทั้งหมด 264 ตา (132 คน) ที่ผ่านเกณฑ์ อายุเฉลี่ยเด็กเท่ากับ 43.71±4.54 เดือน (ช่วง, 36-51 เดือน) ความสอดคล้องของการแปลผลการวัดค่าสายตาที่ตรงกันของทั้ง 3 กลุ่มอยู่ในระดับยอดเยี่ยม (k=0.81) ปานกลาง (k=0.63) และดี (k=0.75) ตามลำดับ **สรุป:** ครูที่ได้รับการฝึกวัดสายตาสามารถวัดสายตาในเด็กได้อย่างน่าเชื่อถือเมื่อเทียบกับจักษุแพทย์

คำสำคัญ: เด็ก, การวัดสายตา, สายตา, ดวงตา, การดูแลเด็ก, จักษุแพทย์

Introduction

Amblyopia is one of the important and preventable causes of visual loss in children and adults worldwide. The prevalence rate has been found to be between 1-5% in the general population worldwide.[1] The most common causes are refractive errors and anisometropia. Early detection of these causes can prevent amblyopia.

Vision screening in preschool has been developed in many countries to detect amblyopia at an early phase of life. However, the appropriate methods and cost-effective techniques are still controversial. The main instruments for screening are photoscreener and photorefracter methods, however access to these different methods depends on socioeconomic status. The screeners may be ophthalmologists, optometrists, teachers or laypersons.

This study aimed to determine the agreement rate of preschool visual acuity screening among ophthalmologists, a resident, and a teacher in the Child Care Centres in Thailand. This study was designed to assess the potential viability of a visual acuity screening programme for pre-school children. Early detection of visual acuity problems is advised to prevent amblyopia and diagnosis of other visual development problems.

Materials and Methods

We conducted the prospective study in Sam Phran District, Nakhon Prathom Province, Thailand. We recruited a teacher (AP) from one Child Care Centre (CCC) in Sam Phran District and a third-year resident (SK) from the Ophthalmology Department of Mettapracharak (Wat Rai Khing) Hospital as screeners. Two ophthalmologists (SS and NC) with more than 10 years-of experience in Ophthalmology were experienced screeners. The teacher was taught to understand each step of measuring visual acuity starting from explaining each symbol to her students in an easy way such as what these symbols look like. They might think that the symbols might be the heart instead of an apple. The teacher was then asked to measure the visual acuity test repeatedly until she could answer more than 90% correctly. We then matched these screeners into three pairs: an experienced ophthalmologist with the teacher, the resident with the teacher, and an experienced ophthalmologist with the resident. One of the experienced ophthalmologists trained the teacher and the resident to use and interpret the results of a Lea Symbols Visual Acuity Test (Good-Lite, Inc.,Elgin, IL, USA) at 3 metres or 10 feet. Three CCCs were selected in Sam Phran District by convenience sampling to participate in the study, namely Song Kanong, Bang Toei and Hom Kret Child Care Centres. The criteria for inclusion in the study were pre-school pupils between 36 and 72 months old from these CCCs who were capable of cooperating with examinations. We collected data between August and October 2011. Informed consents were obtained from the children's guardians. The Institutional Review Board (IRB) of Mettapracharak (Wat Rai Khing) Hospital approved the study proposal (number 4/2554). The research adhered to the tenets of the Declaration of Helsinki.

Participants were made familiar with each of the following Lea symbols; a circle, a square, a house and an apple or a heart. We instructed the children to sit on a chair alone, or with their teachers if they could not sit alone, at a distance of 3 metres from the symbols chart. Then we put a colourful eye frame on their faces. All children were tested for visual acuity of both eyes using Lea symbols at the distance of 3 metres or 10 feet. If they could accurately read more than or equal to 3 lines of symbols, then the ophthalmologist, third-year resident and trained CCC teacher recorded their visual acuity in

LogMar, and then asked the children to read symbols with each eye separately (Fig.1). All students were asked to read symbols using right eye first (close left eye) and then left eye (close right eye). If the student wore glasses, we would measure his/her visual acuity both with and without glasses.

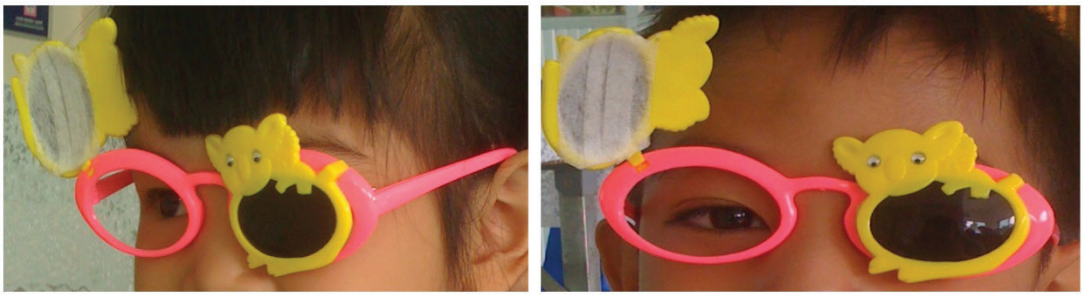

Figure 1 Students with colorful eye frames

The ophthalmologists, third-year resident and trained CCC teacher each independently recorded the participants' visual acuity on the record forms and all of the record forms were masked from each other. In addition to the VA measurement, the experienced ophthalmologists and the third-year resident also examined eyelids, conjunctiva, cornea, pupil, afferent pupillary defects with penlights and recorded the findings. If participants had abnormal eye findings, or their visual acuity was less than or equal to LogMAR 0.3 (20/40), they would be referred for further examination by pediatric ophthalmologists at the Mettapracharak Clinic.

Statistical Analysis

Descriptive statistics were presented using mean±SD for continuous data and percentage for nominal data. Inter-rater agreement of visual acuity among each group was assessed with Cohen's kappa statistic. All statistical data analyses were performed by SPSS for Windows version 26.0 (IBM, Armonk, NY, U.S.A.).

Results

A total of 155 children attending the three CCCs. Two hundred and sixty-four eyes from 132 children met the criteria. We excluded 18 participants who could not cooperate with the examinations and 5 participants who were less than 36 months old. The mean age of the participants was 43.71±4.54 months (range, 51-36 months). The number of females (%56.82) was slightly higher than males (%43.18).

During the study, 4 participants were found with hordeola, 1 participant with head tilt to left side and face turn, 1 participant with allergic conjunctivitis and dermatitis and 1 participant with attention deficit disorder, these patients were referred for further examination by paediatric ophthalmologists and the paediatrician. Only one student went to see the paediatrician. The child was diagnosed with attention-deficit/hyperactivity disorder (ADHD) with learning disability. Anyway, the patient was lost to follow up later. No participants had strabismus nor nystagmus. The average visual acuity in right eye was LogMAR 0.16 and LogMAR 0.15 in left eye. The agreement of visual acuity interpretation in right and left eye in 3 groups was 97.4% and 98.2% respectively. The inter-rater agreement among ophthalmologist-teacher group was moderate (k=0.63) ophthalmologist-resident group was excellent (k=0.81) and resident-teacher group was good (k=0.75).

Discussion

Amblyopia is one of the leading causes of unilateral blindness in children and adults. It is defined as the difference in best corrected visual acuity between two eyes greater than or equal to two lines of the visual acuity charts. The cause of amblyopia may be occlusion of clear images to the retina or abnormal binocular alignment. Worldwide, the incidence rate of amblyopia has been found to be about 1% to 5%, varying from study to study. Left untreated, patients with amblyopia may reduce capacity in real-life tasks,[2] and fine motor skills.[3]

Consequently, they might experience difficulties getting work that requires stereopsis and have almost twice the life time risk of bilateral visual impairment[4] and have poor quality of life in the end of life. The prevalence of visual acuity less than or equal LogMAR 0.3 was 10.2% (27 eyes out of 264 eyes). Anyway, this is not the true prevalence of amblyopia because we could not follow these students to re-examine their best-corrected visual acuity.

Currently, there is no consensus on the optimal screening age in amblyopia management. Visual acuity screening at certain ages can detect and lead to the treatment of amblyopia. A recent report from Holmes[5] suggested that the optimal screening age should be at around 5 years old. On the balance of available evidence, he suggested not to screen in the early life period. Many ophthalmologists have established preschool vision screening programs in their countries around the world based on Holmes' theory.[6-22]

There is also no consensus on the appropriate screening test for amblyopia management. Current available tests are visual acuity tests, autorefractor methods for refractive error tests, photoscreener methods for strabismus tests and stereoacuity test for other type of visual function. While the literature shows that the autorefractor methods had a higher sensitivity than other methods, such as HOTV letters or Lea symbols, photoscreener methods or stereoacuity tests, but they were not better than visual acuity screening.[23] Published evidence about the accuracy of autorefractor methods among children in population-based studies are limited.[24] Many studies reported the use of Lea symbols,[8,9,12,22] photoscreener methods,[10] autorefractometers,[17] home test kits,[13] stereoacuity tests,[8,11] or other visual acuity tests.[16,21] We chose Lea symbols as a screening test in this study because they are not expensive and are most suitable for the context at the time.The main strategy in our study was to recruit a layperson, especially one who is familiar with the children, to be one of our screeners. We taught her how to use and interpret Lea symbols. The agreement among experienced ophthalmologist-resident, ophthalmologist-teacher and teacher-resident were excellent (k=0.81), moderate (k=0.63) and good (k=0.75) respectively. Wang et al[22]found that there was no statistically significant difference in accuracy among local optometrist screening model, teacher screening model and volunteer screening model. This study found that the teacher screening model was more cost-effective than the other two models. Other studies have included screeners such as pediatricians,[12] ophthalmologists and residents in Ophthalmology,[9] trained personnels,[10] ophthalmic technicians,[11,17] optometrists,[11] orthoptists,[8,21] parents[13,16]and teachers.[14] In this study, the resident was used as a control to compare the agreement between experienced ophthalmologist and the teacher.

There were some limitations in our study. First, we used two ophthalmologists as experienced screeners instead of only one. However, the measurement and interpretation of visual acuity results should not be different especially between ophthalmologists with at least 10 years-experience. Second, one of the key factors in the finding of high rates of agreement is the teacher's training. In this case, the teacher used to work in a hospital, so that she may have been more familiar with this kind of work than an average pre-school teacher. Third, only one child was re-evaluated at the hospital so we could not calculate the true prevalence of amblyopia.

The strategy we might introduce in the future is to train a group of teachers who could teach others to understand and conduct screening by themselves. The teaching technique is important. The diagnostic study of visual acuity that is interpreted by preschool teachers is also needed. In Thailand, the vision screening program is currently only offered for pupils in the first year of primary school, aged around 6 to 7 years old. This might be too late to diagnose and treat amblyopia patients. Therefore, based on this study, we propose developing the preschool vision screening program with lessons learnt from this project to diagnose amblyopia earlier and to improve vision screening coverage because some of our children may not start their education in kindergarten schools. The referring system and guidelines to refer to other hospitals have also to establish. In conclusion, for the preschool vision screening model in Thailand, a well-trained teacher can screen her students' visual acuity almost as accurately as ophthalmologists.

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