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Original Article

The prevalence of ocular diseases in primary and junior high school students on Orchid Island

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ABSTRACT

Objective: To assess the prevalence of refractive error and ocular diseases in primary and junior high school students on Orchid Island.

Materials and Methods: This is a cross-sectional study of all students in the primary and junior high schools on Orchid Island conducted within 1 week in 2008. Each student received a visual acuity examination without correction with the Landolt-C chart. An experienced ophthalmologist performed associated assessments through retinoscopy, slit lamp, and fundoscopy.

Results: Of the 403 student residents, 260 were primary school students (139 boys and 121 girls) and 143 were junior high school students (74 boys and 69 girls). Visual acuity in two eyes was < 0.1, in 14 eyes was between 0.1 and 0.3, in 34 eyes was between 0.4 and 0.7, in 225 eyes was between 0.8 and 1.0, and in 531 eyes was between 1.2 and 2.0. Myopia was found in 21 students (21/403, 5.21%; 9 primary school students and 12 junior high school students). Four students (4/403, 0.99%) had amblyopia, of whom two had anisometropia (unilateral high hyperopia), one had high astigmatism in both eyes, and the other had unilateral esotropia. Lens dislocation was found in one student (0.25%) with Marfan syndrome. Retinal vasculitis and optic atrophy were found in one student (0.25%) with systemic lupus erythematosus.

Conclusion: Because it is a small, isolated island, Orchid Island still has a unique traditional culture and life style. Therefore the prevalence of myopia in primary school and junior high school students on Orchid Island is low, and 94% of all the students had uncorrected visual acuity above 0.8.

1. Introduction

Orchid Island is a small, isolated island that is remote from Taiwan. Most residents are pure blood members of the Tao tribe, an ocean aboriginal group. Because of its culture and geographic considerations, this area is not urbanized and the Tao people have specific health conditions different from people on mainland Taiwan. However, there are only a few reports describing ocular diseases in indigenous adults or elderly people in Taiwan [1–3]. In this study we analyzed the ocular condition and refractive status in all students on Orchid Island aged 7–15 years in 2008.

The high prevalence and incidence of myopia among students is an epidemic health concern in Asia, especially in the Far East, including Taiwan. Current observations showed that environmental factors are possibly of more importance than genetic predisposition. Much near work and fewer outdoor activities do play a role in the increased prevalence and incidence of myopia in schoolchildren. There is a significantly higher prevalence of myopia among schoolchildren in urban than in rural regions [4]. One study published in 1983 [5] revealed that mountain aboriginals in Taiwan

Conflicts of interest: none.

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had good vision, and the myopia rate was low. However, investigation of the refractive status of mountain indigenous people 2 decades later showed that more children had become myopic, which probably resulted from urbanization and changes in lifestyle [6]. Nowadays, myopia is increasing in all areas and in all populations; it would be valuable from an epigenetic point of view to know whether there is a tendency toward school myopia in this group of people.

2. Methods and materials

This is a cross-sectional study of all students in the primary and junior high schools on Orchid Island conducted within 1 week in 2008. There were four primary schools in four tribes and only one junior high school on the island. All students attending school were enrolled, except for those who were absent from school on the day of examination. We retrospectively reviewed their charts and analyzed the results. The study was approved by the Human Research Ethics Committee of Tzu Chi General Hospital, Hualien, Taiwan (IRB100-86). The children underwent measurement of visual acuity with the Landolt-C chart (at a distance of 5 m), measurement of manifest refractive status with retinoscopy, assessment of ocular motility, slit-lamp biomicroscopic examination of the anterior segments of the eyes, and direct ophthalmoscopic examination of the fundi. One experienced ophthalmologist carried out all slit lamp examinations, retinoscopy, and fundoscopy. The mean spherical equivalent refractive error was used for calculation. Myopia was defined as spherical equivalent ≤ -0.5 diopters (D). Hyperopia was defined as a spherical equivalent $\geq +0.5$ D. Anisometropia was defined as hyperopia or astigmatism anisometropia ≥ 2 D or myopia anisometropia ≤ -3 D in one eye. Amblyopia was defined as best-corrected visual acuity ≤ 0.8 without ocular diseases.

Cochran–Mantel–Haenszel tests were used to determine whether there were differences in the distributions of visual acuity between boys and girls while controlling for the children's age, and to test the association between visual acuity and age while controlling for sex.

3. Results

A total of 403 students were included in this study. There were 260 primary school students and 143 junior high school students. Age and sex distribution are shown in Table 1.

Visual acuity in two eyes was < 0.1, in 14 eyes was between 0.1 and 0.3, in 34 eyes was between 0.4 and 0.7, in 225 eyes was between 0.8 and 1.0, and in 531 eyes was between 1.2 and 2.0.

Four students were found to have amblyopia of whom two had anisometropia (unilateral high hyperopia), one had high astigmatism in both eyes, and the other had unilateral esotropia (Table 2).

Table 2
Characteristics of students with amblyopia.

Case	Age (y)/sex	Involved eyes (*n*)	Causes of amblyopia
1	9/Girl	1	Hyperopia/esotropia
2	12/Boy	1	Hyperopia/anisometropia
3	12/Boy	1	Hyperopia/anisometropia
4	13/Boy	2	Hyperopic astigmatism

The prevalence of amblyopia among students aged 7–15 years was around 0.99% (4/403).

Two of the 403 students were found to have other ocular diseases. Lens dislocation was noted in a 12-year-old boy with Marfan syndrome. Another 12-year-old boy was diagnosed with systemic lupus erythematosus-related retinal vasculitis and optic atrophy.

Those with uncorrected visual acuity between 0.8 and 1.0 had mild hyperopic astigmatism, mild hyperopia, or mild myopia (with spherical equivalence < -0.5D).

The prevalence of myopia was 3.5% among primary schoolchildren (age 7–12 years) and 8.4% among junior high school students (age 13–15 years). The prevalence of myopia for each year of age from 7 years to 15 years in this study were 2%, 0%, 0%, 9.5%, 4.9%, 4.4%, 0%, 11.3%, and 13% (Table 3). Overall, more girls had myopia than boys (prevalence rate among girls was 7.89% and among boys was 2.81%), but the difference was not significant ($p = 0.60$).

Table 4 presents the distributions of visual acuity by sex and age group. The Cochran–Mantel–Haenszel test (Chi-square = 4.93, with degrees of freedom = 1, $p = 0.026$) indicated that there were significant differences in the distributions of visual acuity between boys and girls while controlling for children's age. The visual acuity of boys tended to be better than that of girls. Another Cochran–Mantel–Haenszel test (Chi-square = 23.0, with degrees of freedom = 8, $p = 0.003$) indicated that the visual acuity increased significantly with children's age while controlling for sex.

4. Discussion

Approximately 2.28% (534,007) of the population of Taiwan are indigenous people. Recent research suggest that their ancestors may have been living on the islands for approximately 8000 years before the majority Han Chinese immigration began in the 17th century. Indigenous people in Taiwan are Austronesian, with linguistic and cultural ties to other Austronesian ethnic groups, such as those in The Philippines, Malaysia, Indonesia, Madagascar, Polynesia, and Oceania [7]. The bulk of contemporary Taiwanese indigenous people live in the mountains and cities.

Taiwanese indigenous people have been known to have a much better ocular condition than Han Chinese people. Informal studies done during the Japanese colonial period even found that the Tao people may have visual acuity > 3.0. Chen et al [5] screened

Table 1
Age and sex distribution of the students enrolled in this study.

Age (y)	No.	Boys *n* (%)	Girls *n* (%)
7	49	22 (5.45)	27 (6.69)
8	32	13 (3.22)	19 (4.71)
9	51	34 (8.43)	17 (4.21)
10	42	24 (5.95)	18 (4.46)
11	41	25 (6.20)	16 (3.97)
12	45	21 (5.21)	24 (5.95)
13	44	24 (5.95)	20 (4.96)
14	53	21 (5.21)	32 (7.94)
15	46	29 (7.19)	17 (4.21)
Total	**403**	**213 (52.85)**	**190 (47.14)**

Table 3
Prevalence of myopia among primary and secondary schoolchildren.

Age (y)	No.	Boys *n* (%)	Girls *n* (%)
7	1	0 (0.0)	1 (0.5)
8	0	0 (0.0)	0 (0.0)
9	0	0 (0.0)	0 (0.0)
10	4	0 (0.0)	4 (4.2)
11	2	2 (1.0)	0 (0.0)
12	2	0 (0.0)	2 (1.0)
13	0	0 (0.0)	0 (0.0)
14	6	1 (0.4)	5 (2.6)
15	6	3 (1.4)	3 (1.6)
Total	**403**	**6 (2.81)**	**15 (7.89)**