Frequency of ocular conditions in native Brazilians from Avaí City, São Paulo State

Frequência das alterações oculares na população indígena da cidade de Avaí, no Estado de São Paulo, Brasil

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Abstract

Purpose: *To perform an epidemiological study of eye diseases in the population of four indigenous communities in the City of Avai in the state of São Paulo - Brazil: Ekeruá, Kopenoti, Nimuendaju and Tereguá.* ***Methods:*** *This is a prospective, cross-sectional, population-based study performed by the Medical Residency Program of the Center of Excellence in Ophthalmology (CEO-Bauru), including all the inhabitants of four indigenous tribes, between the months of March and April 2016. All participants were submitted to a complete eye examination that included refraction test and best-corrected visual acuity, external ocular motility and strabismus, measurement of intraocular pressure (IOP), color vision test, slit lamp examination and a complete evaluation of the fundus.* ***Results:*** *From a total of 584 natives from four villages, 377 (64.55%) attended the project. 283 appointments were performed at CEO - Bauru and 94 evaluations in the health center of Kopenoti village using a mobile ophthalmology unit. 48.54% of the participants were male and 51.46% female. The mean age was 32.03 ± 21.45 years. Our study found prevalence of pterygium of 14.05%, cataract of 6.63%, glaucoma of 1.85% and diabetic retinopathy of 1.59%. These numbers are higher than found in other epidemiological studies. Regarding refractive errors, 36.99% presented astigmatism, 4.24% simple myopia and 8.35% simple hyperopia.* ***Conclusion:*** *These information are extremely important because they show higher rates of eye diseases in a needy and remote population of urban health centers, and in need of medical care. It is noteworthy that all patients from this study who presented refractive errors, received glasses with the corrected refractive lenses.*

Keywords: *Eye disease/epidemiology; Indigenous population; Refractive errors; Brazil*

Resumo

Objetivo: Fazer um estudo epidemiológico das afecções oculares da população de quatro aldeias indígenas da cidade de Avaí, no estado de São Paulo - Brasil: Ekeruá, Kopenoti, Nimuendaju e Tereguá. **Métodos:** Estudo prospectivo, transversal realizado pelo serviço de residência médica da Clínica CEO-Bauru, em que foram incluídos todos os habitantes de quatro tribos indígenas, entre os meses de março a abril de 2016. Todos os participantes foram submetidos ao exame oftalmológico completo que incluía refração e medida da acuidade visual corrigida, avaliação da motilidade ocular extrínseca e estrabismo, aferição da pressão intraocular (PIO), teste de visão de cores, biomicroscopia e mapeamento de retina. **Resultados:** Do total de 584 índios das quatro aldeias, 377 (64,55%) compareceram participando do projeto. Foram realizadas 283 consultas na clínica CEO – Bauru e 94 consultas no posto de saúde da aldeia Kopenoti através do uso de uma unidade oftalmológica móvel. 48,54% dos participantes eram do sexo masculino e 51,46% do sexo feminino. A idade média foi de 32,03 ± 21,45 anos. Nosso trabalho encontrou prevalência de pterígio de 14.05%, catarata de 6.63%, glaucoma de 1,85% e retinopatia diabetic de 1,59%. Esses números são maiores do que os encontrados em outros estudos epidemiológicos. Em relação aos erros de refração, 36,99% apresentaram astigmatismo, 4,24% miopia simples e 8.35% hipermetropia simples. **Conclusão:** Essas informações são de extrema importância pois mostram maior índice de patologias oculares em uma população carente e afastada dos centros urbanos de saúde, e que necessitam de assistência médica. Vale ressaltar que todos os pacientes deste estudo que apresentaram erros de refração receberam os óculos com as lentes refrativas.

Descritores: Oftalmopatias/epidemiologia; População indígena; Erros de refração; Brasil

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Introduction

It is known that indigenous peoples around the world present worse health conditions and lower life expectancy compared with the population of urban centers.[1] Brazil is an important center of native population, and currently has about 817.000 citizens spread over 688 communities[2]. The first results of the 2010 Demographic Census reveal that 817.000 people have declared themselves as Indians, and the growth in the period of 2000/2010 was 84.000 indians, which represents 11.4% of the total.[2]

These individuals represent approximately 0.4% of the Brazilian population[2]. Despite the wide diversity among the different tribes, there are many similarities in relation to health status, disease prevalence and other determinants of health quality of the indigenous population.

Eye diseases are very prevalent throughout the world. Globally, in 2010 there were 32.4 million people blind and 191 million people had vision impairment.[3] There are few studies showing the exact prevalence of visual impairment and its causes in the Brazilian population.[4-7] It is known, however, that patients in risk groups, such as low-income families or people who live away from urban centers, such as native populations, have higher rates of visual disabilities.[8]

In Brazil, especially in native population away from large urban centers, there are few data regarding the most common causes of visual impairment, both in childhood and adulthood. But most publications involving the indigenous population were made including the Amazon region of Brazil.[9-14] This article is an epidemiological study of the prevalence of eye diseases in the population of Araribá Indigenous Land, which is divided in four indigenous villages: Ekeruá, Kopenoti, Nimuendaju and Tereguá. They are all situated at Avai City, in the State of São Paulo, Brazil.

Firstly, this study provides the identification of ocular diseases in a low-income population, contributing to the prevention of permanent damage to their vision. It also enables the analysis of the prevalence of eye diseases, contributing to the development of public health programs for the prevention of blindness, visual impairment and rehabilitation.

Methods

This is a prospective, cross-sectional, population-based study to detect the prevalence of eye diseases in residents of the four indigenous tribes of Arariba Indigenous Land, situated in Avaí City: Ekeruá, Kopenoti, Nimuendaju and Tereguá. Avaí City has 5.275 habitants and is located 368 km from São Paulo, the state capital and 921 km from Brasília[2]. It lies at 22º08'48" S and 49º19'59" W and has a total of 540.689 km^2. The main source of income of the tribes is agriculture. Primary health care is done at Avai city, but more complex cases are referred to Bauru city, including ophthalmologic exams. The four tribes are fully integrated with western culture, however they maintain their own cultural traditions.

The total population in the indigenous land of Araribá is 584 inhabitants. Regarding occupational activities, 96.4% of the natives work with agriculture in their own villages, mainly the cultivation of sweet potatoes and zucchini both for subsistence and commerce; 3.6% work in commercial establishments in the city of Avai. The four villages offer regular primary education and teach indigenous traditions for children. The Ekeruá village has a basic health permanent unit that performs clinical and gynecological care of low complexity.

All inhabitants of the four indian tribes were included. This study was conducted in one ophthalmologic center (CEO) and it was performed between the months of March and April 2016. The Ethical Committee of the University Nove de Julho prospectively approved the study protocol and the study followed the guidelines of the Declaration of Helsinki.

All study participants or family members responsible for individuals under 18 years old signed informed consent term, in addition to approval by indigenous leaders and responsible government agencies. All participants were free to decide to participate in the study.

All participants were submitted to a complete ophthalmological evaluation that included refraction test and best-corrected visual acuity (BCVA), external ocular motility and strabismus examination, measurement of intraocular pressure (IOP), color vision test, biomicroscopy and a complete evaluation of the fundus. Refraction test was performed with cycloplegia (obtained using two drops of cyclopentolate 1% in each eye) in patients under 40 years and without cycloplegia over 40 years.

The measurements of visual acuity were made through an optometric Snellen chart, which was positioned in a large and bright room at 6 meters from the examined patient. Each eye was tested separately, first the right eye followed by the left. The BCVA was equivalent to the last row of the Snellen chart in which the individual identified more than half of the presented optotypes.

Spherical equivalent (SE) defined the refractive errors as follow: myopia was defined as a spherical equivalent of <-0.5D, hyperopia >+0.5D and astigmatism as a cylinder of >0.5D.[15]

Slit lamp biomicroscopy (Topcon 7E model) was performed. Fundus examination was performed at the slit lamp using Volk 78D lens under mydriasis using tropicamide 1% in those who had not received instillation of cyclopentolate eye drops. Intraocular pressure was evaluated with a non-contact tonometer (Reichert 7 CR). If IOP was higher than 21 mmHg, the measurement was repeated using a Goldman tonometer.

Color vision test was performed using the Ishihara Test, because it widely accepted, readily available, not expensive and it has high sensitivity and specificity.[16] We used the abridged 14-plate edition and the fail criterion was three errors.

Evaluation of strabismus was performed using Hirschberg test, simple cover test and alternating cover test, and individuals could be classified as having orthotropia (when there was no deviation), esotropia (inward turning of the eyes), exotropia (outward turning of the eyes) or vertical deviation (hypotropia or hiperotropia).

The diagnosis of pterygium was made by slit lamp biomicroscopy and it was based on the presence of fibrovascular lesions radially oriented and passing over the limbus and invading the cornea.[17] Glaucoma or ocular hypertension were defined based on the presence of glaucomatous optic neuropathy (GON) and/or increase in intraocular pressure. GON was defined by the structural evaluation of the optic nerve head by a glaucoma specialist using the following criteria: focal or diffuse neuroretinal rim thinning, focal or diffuse retinal nerve fiber layer loss or an inter-eye vertical cup-to-disc ratio asymmetry > 0.2 not explained by differences in disc size.

Cataract was diagnosed if any visible opacity in the lens during the slit lamp examination was found, according to Lens Opacities Classification System II (LOCS II). Diabetic retinopathy (DR) diagnosis was based on the presence of any of the following

signs on fundoscopy: microhemorrhages and/or microaneurysms, hard exsudates or cotton wool spots and vascular abnormalities suggestive of DR. Age-Related Macular Degeneration (ARMD) was defined when any of the following findings was found in the posterior pole of the retina: hard or soft drusen, subretinal neovascular membrane in activity or geographic atrophy.

Results

Of the total of 584 natives of the four villages, 377 participated in the study, an adherence of 64.55%. The specific adherence rates for each village are illustrated in Figure 1. The reason for not participating in the project was impossibility of attendance, either by disease or by not want to participate. Two-hundred eighty-four evaluations were performed at the main ophthalmologic center in the city of Bauru (CEO) and 94 evaluations in the health center of the Kopenoti village using a mobile ophthalmology unit brought by our team.

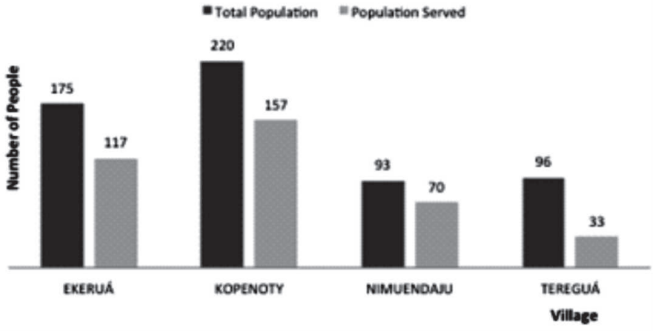

Figure 1: Village parcipation

Of the 377 natives who participated in the study, 48.54% were male and 51.46% female. The mean age was 32.03 ± 21.45 years. Table 1 discriminates participants according to age group, ranging from 1 month to 100 years old.

Table 1
Age group of patients

Age	Number of patients
0 – 10	66
11 – 20	78
21 – 30	56
31 – 40	51
41 – 50	50
51 – 60	34
61 – 70	22
71 – 80	11
81 – 90	6
>90	3

Table 2 shows the distribution of refractive errors found in the population. Patients with cataract, alterations in the retina, such as diabetic retinopathy and ARMD or newborns who did not allow the refractive examination were excluded of this table. Myopia was more prevalent in natives with 41-60 years old (43.75%), while hyperopia was more common in young natives, with age between 1-20 years old (41.93%). The highest myopic and hyperopic SE was -12,5 sf in a 23 years-old male and +4,25 sf in a 65 years-old male. The highest cylinder was -5,0 cyl in a 32 years-old female.

Table 2
Distribution of refractive errors

Diagnosis	Absolute number (eyes)* and percentages
Emmetropia	342 (45.35)
Myopia	32 (4.24)
Hyperopia	63 (8.35)
Simple Astigmatism (hyperopic or myopic)	112 (14.85)
Compound Myopic Astigmatism	63 (8.35)
Compound Hyperopic Astigmatism	73 (9.68)
Mixed astigmatism	31 (4.11)

* 716 eyes of 358 individuals.

Table 3 shows the prevalence of eye diseases found in the studied population. 67 males and 72 women presented eye diseases. We found two cases of blind individuals (no light perception), both because of ocular trauma a long time ago.

Table 3
Prevalence of eye diseases

Diagnosis	Absolute number (eyes) and percentages
Pterygium	106 (14.05)
Cataract	50 (6.63)
Pseudophakia	30 (3.97)
ARMD	12 (1.59)
Diabetic retinopathy	12 (1.59)
Glaucoma/Ocular hypertension	14 (1.85)
Epitheliopathy	9 (1.19)
Chorioretinal scars	4 (0.53)
Exotropia	9 (1.19)
Dyschromatopsia	1 (0.13)

Discussion

In India, a developing country like Brazil, refractive errors account for 16% of blindness, and poverty and poor access to health centers are the main barriers for rural people to correct their refractive errors.[18] Data on the prevalence of refractive errors in Brazil are scarce and may not show the reality across the country as it has continental dimensions, with large ethnic variation and large socio-economic differences among its regions.

Ferraz et al.[19] studied 7654 individuals from nine cities in the state of São Paulo, and found a prevalence of 59.7% of astigmatism, 33.8% of hyperopia and 25.3% of myopia. We found a prevalence of astigmatism (simple, compound hyperopic, compound myopic and mixed) of 36.99%, simple myopia (with exclusion of individuals with cylinder) of 4.24% and simple hyperopia (with exclusion of cases with cylinder) of 8.35%. Importantly, we did not consider presbyopia in this study, because it is a physiological hyperopia reflecting the conversion of latent hyperopia for manifest hyperopia, which occurs with the natural loss of accommodation. For this reason the hyperopia prevalence found in our group was much lower than the rates found by Ferraz et al.[19] In addition, the criteria for classifying the refractive errors were more discriminated in our study.

Pterygium is formed by a fibrovascular tissue of the bulbar conjunctiva that grows towards the limbus, and may extend over

the cornea and, depending on its extent, it can cause irregular astigmatism and even cosmetic problems.[16] Pterygium mainly affects individuals who inhabit equatorial countries with tropical weather and work exposed to the sun.[20] Our study showed a prevalence of 14.05% of pterygium in the studied indigenous population, a higher rate than found in the city of Botucatu in the state of São Paulo, which was 8.12%.[21] This difference can be easily explained by increased sun exposure of the indigenous population compared with urban centers population.

Cataract is the leading cause of reversible and treatable blindness in the world and is still responsible for more than 75% of global blindness.[22,23] In a study involving more than 4.000 individuals, Carlos et al.[24] found a prevalence of 4.94% of cataract in five cities located in the Midwestern region of São Paulo, Brazil. We found a prevalence of 6.63%. However 6.63% is the percentage among all indigenous population, without considering age group. Updating by age group, all cases of cataract were diagnosed in individuals over 40 years, that is, the prevalence of cataract in individuals over 40 years is 19.84% in the studied population. If we also consider cataract in individuals who have been surgically treated with phacoemulsification and implantation of intraocular lens in our service, the prevalence of cataract in individuals over 40 years in the studied population increases to 31.74%.

It is estimated that in 2020, 80 million people will be affected by glaucoma worldwide, of which 11 million will be bilaterally blind.[25] In the Brazilian population there are few studies reporting the actual prevalence of glaucoma. A study conducted in the southern region of the country found a prevalence of glaucoma of 3.4% in individuals over 40 years (95% CI: 2.5% to 4.3%).[26] In the indigenous population of Avai, the prevalence of glaucoma was 1.85% considering all age groups. In patients over 40 years, the prevalence was 5.55%.

It is known that the number of individuals with type 2 diabetes is increasing every year in Brazil and in the rest of the world, with increasing prevalence of DR.[27] We found a prevalence of 1.45% of DR in native population, which is higher than the rates found in national literature[28], which was 1.02%. Data provided by the Health Agency of Araribá tribes report that there are 65 patients with diabetes in these four indigenous communities, resulting in a prevalence of 9.23% of diabetic retinopathy in patients with diabetes.

Another retinal pathology studied in our article was Age-Related Macular Degeneration (ARMD), which is a degenerative disease that can lead to blindness. The degenerative process affects the area of the macula, which is responsible for central vision, causing distorted vision and significant visual loss, affecting the quality of life of patients.[29] ARMD is the third leading cause of visual impairment in the world, with a prevalence of 8.70% in people over 50 years, according to WHO.[30] We found a prevalence of 1.59% of people with ARMD in the entire indigenous population. However, all cases diagnosed with ARMD were in people over 50 years old, and taking into account only individuals over 50 years, the prevalence of ARMD rises to 7.89%, very close to the number found by WHO.[30]

Strabismus consists in the deviation of the binocular alignment, when visual axes do not intersect at the point of fixation. The images of the two eyes are misaligned, causing double vision or, more commonly in children, the image of the deviated eye is suppressed in the cortical level.[31] The classification varies according to the direction of the deviation in relation to the object of fixation: esotropia describes inward or convergent deviation towards the midline; exotropia describes outward or divergent misalignment; vertical deviations are also classified into two varieties: hypertropia when the axes are offset higher than the fellow eye, while hypotropia refers to an eye whose gaze is directed lower.[31] The prevalence of exotropia in this study was 1.19%, and there were no diagnosed cases of esotropia or vertical deviations. A study in the Asian population showed the prevalence of exotropia to be higher than esotropia.[32] There are no studies in the literature reporting the actual prevalence of strabismus in the Brazilian indigenous population, and this is the first to describe ocular deviation in this specific population.

One limitation of the study was that we did not evaluate their work activities or daily habits, and we missed the opportunity to better justify the ocular pathologies found in the natives, although indigenous natural vocation is agricultural. However some strengths should also be highlighted: a motivated team work, a community based rather than a clinic-based sample and the use of a mobile ophthalmology unit that allowed better access to the study population, allowing eye care in their own native village. In addition, all individuals diagnosed with conditions requiring medical and/or surgical management will be treated by the ophthalmic center responsible for the study.

Conclusion

The investigation of the prevalence of ocular pathologies allows better planning of preventive eye care programs, especially in minority and low-income populations such as indigenous tribes. Early identification of eye conditions, especially in children, like refractive errors and strabismus, may allow more precocious treatments and contribute to preventing permanent damage to vision.

Our study found higher prevalence of pterygium, cataract, glaucoma and diabetic retinopathy compared with other population studies. These information are extremely important because they show higher rates of eye diseases in a needy and remote population of urban health centers, and in need of medical care. It is noteworthy that all patients from this study who presented refractive errors, received glasses with the corrected refractive lenses.

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