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Original Article

Characteristics of Non-Strabismus Binocular Vision Anomalies Patient Attending Tertiary Eye Hospital of Eastern Nepal

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Abstract

Background

Non-Strabismic Binocular Vision Anomalies are visual disorders that affect the subject's binocular vision and visual performance, especially when performing tasks requiring near vision. Undiagnosed binocular vision and oculomotor dysfunction may present with discomfort which can have a negative impact on academic performance. The objective of this study was to assess characteristics of NSBVAs patient attending at tertiary eye hospital of Nepal.

Materials and Methods

This was hospital based cross-sectional study done at Biratnagar Eye Hospital, Biratnagar, Nepal from July –December 2022. All consenting patients having asthenopic symptoms like headache, difficulty in doing near work from age group 10-40 years referred to VT clinic for further evaluation were included in the study while patient with binocular vision anomalies secondary to strabismus, amblyopia, anisometropia (> 2.00 Diopters), any other ocular pathology, any ocular surgery, and neurological disorders were excluded from the study.

Results

A total 852 eyes of 426 patients were enrolled during the study period who met the inclusion criteria. Majority of them were female 287(67.1%) and students 268(62.9%) were more referred for orthoptic evaluation. NSBVAs was found in 306 (71.8%) among them majority had convergence related problem 172 (56.2%) and mostly found in less than 30 years of age 257(84%). Different vision therapy exercises were advised to needy patients.

Conclusion

Non-strabismus binocular vision anomalies were common problem in all asthenopic patients less than 30 years of age who had more near work and it was treated with proper vision therapy exercises.

Keywords: *Asthenopia, Convergence insufficiency, Headache, Nepal, Strabismus*

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Introduction

Non-Strabismic Binocular Vision Anomalies (NSBVAs) are visual disorders that affect the person's binocular vision and visual performance, especially when performing near visual tasks such as reading, use of computer and cell phones [1]. With an increase in the use of computer and cell phones, the near and intermediate visual tasks have increased dramatically, and so a large percentage of individuals are found to have binocular vision problems and ocular discomfort [2]. Accommodative and binocular vision disorders are the second most common visual disorders in the clinical pediatric population after refractive error [3]. It mostly affects school-age children and especially high school learners who have an increased demand for the use of accommodative and vergence system [4]. The problems are also common in the pre-presbyopia [5]. The symptoms are headache, blurry vision, eyestrain, and double vision [6]. The most frequently encountered disorders of the binocular vision system include convergence insufficiency/excess and divergence insufficiency/excess, oculomotor dysfunction which shows inaccurate and inefficient pursuits and saccades [7]. The prevalence of accommodative and binocular vision anomalies are 8.5 times greater than the prevalence of other ocular diseases in children between 6 to 18 years [8]. It is estimated that 7-10% of the general population has some type of problem with accommodation and binocular vision function [9]. Therefore, the aim of this study is to assess characteristics of NSBVAs patients attending vision therapy clinic at a tertiary eye hospital of eastern Nepal.

Materials and Methods

This was a hospital based cross-sectional study conducted in the vision therapy (VT) clinic of Biratnagar Eye Hospital (BEH), Biratnagar, Nepal from July 2022 to December 2022 after taking ethical approval from institutional review committee of BEH with reference number 65A dated 28/9/2022. Written consent was obtained from all the patients willing to participate after sharing the objective of this study. All consenting patient from age group 10-40 years who had asthenopic symptoms like headache, difficulty doing in near work and referred to VT clinic for further evaluation during the study duration were included in the study while patient with binocular vision anomalies secondary to strabismus, amblyopia, anisometropia (> 2.00 Diopters), any other ocular pathology, any ocular surgery, and neurological disorders was excluded from the study.

The demographic information was collected from all the patients followed by measurement of visual acuity at distance using Snellen chart. Objective refraction was assessed using retinoscope (Heine, Germany) and subjective refraction was also measured based on objective retinoscopy findings. Amplitude of accommodation and near point of convergence were measured by using Royal Air Force (RAF) Ruler (Bernell, USA). Cover test was conducted at 33 cm for near and 6-meter for distance with the patients fixating on one line above the best visual acuity of the poor eye. The patients underwent ocular motility tests to assess the integrity of the eye muscles. The status of heterophoria was measured while the positive and negative fusional vergence were measured using a prism bar at 33 cm and 6 meters for near and distance respectively. The data was entered in microsoft excel spreadsheet and analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 20 (SPSS, Inc., Chicago, IL). Summary statistics were used for reporting demographic and clinical characteristics. All categorical variables were reported using frequencies and percentages and continuous variables were expressed in terms of mean (SD). The relationship between measures was determined using the chi-square analysis. Significance levels were set at $p < 0.05$.

Results

During the study period, total 432 patients were examined among them analysis was done for 852 eyes of 426 patients who met the inclusion criteria. The mean age (±SD) of the patient was 21.89 (±6.04) and majority were female 286 (67.1%). Most of the patients were below 30 years of age 366(85.9%) and students 268(62.9%) were the mostly found during examination (Table 1).

Table 1: Demographic characteristics of patients

Mean Age (±SD)	21.89 (±6.045)	
Characteristics	Frequency(N=426)	Percentage (100)
Age category (in Yrs.)		
10 to 19	174	40.84
20 to 29	192	45.07
30 and above	60	14.08
Gender		
Male	140	32.9
Female	286	67.1
Occupation		
Student	286	62.9
Housewife	73	17.1
Teacher	15	3.5
Tailor	14	3.3
Computer user	7	1.6
Others (Job holder,Business etc)	49	11.5

Among total patients, NSBVAs was found in 306 (71.8%) among them majority were convergence related problem 172 (56.2%). Vision therapy exercises were advised to all patients in which Brock string and cat card was suggested as vision therapy aid in majorities of patients. (Table 2)

Table 2: Status of Non-Strabismus Binocular Vision Anomalies (NSBVAs) of the study patients

NSBVAs status	Number	Percentage
Present	306	71.8
Absent	120	28.2
Types of NSBVAs		
Convergence insufficiency (CI)	80	18.8
Accommodative insufficiency (AI)	33	7.7
Fusional insufficiency	92	21.6
Accommodative infacility	19	4.5
Convergence insufficiency with accommodative insufficiency	38	8.9
Intermittent exotropia (IXT)	21	4.9
Refractive error	10	2.3
Others	13	3.1
Vision therapy advised		
Yes	306	71.8
No	120	28.2
Types of vision therapy exercises		
Cat card	135	44
Brock string	138	45
spot card	119	39
Albee card	9	3
spectacle	73	24
Accommodative flipper	7	2
Hart Chart	90	29
Pencil push up	30	10

Uncorrected and best corrected refractive status. (Chart 1)

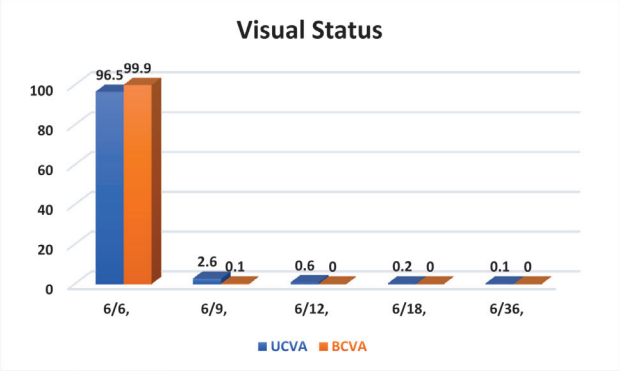

Figure 1: Uncorrected and Best corrected visual acuity of the patients

Out of 852 eyes of 426 patients 751(88%) eyes were emmetropic followed by astigmatism and hyperopia and least were myopia. In term of presence of binocular vision, 425 (99.8%) patients had binocular single vision and history of headache and other asthenopic symptoms was found in 375 (88%) patients. (Table 3)

Table 3: Types of refractive status, Binocular vision status and history of headache of the patients

Characteristics	Number	Percentage
Refractive status (852 eyes)		
Emmetropia	751	88
Hyperopia	34	4
Myopia	25	3
Astigmatism	42	5
BSV status		
Present	425	99.8
Absent	1	0.2
History of headache and other asthenopic symptoms		
Present	375	88
Absent	51	12

It was mostly found in less than 30 years of age group 257(84%) and CI was most prevalent 172 (56.2%) among all age groups. The presence of headache with types of NSBVAs was 265 (86.6%) and majorly affected female population 211 (68.95%). NSBVAs was statistical significant with age group and presence of headache while it was not-significant with gender ($p<0.05$). (Table 4)

Table 4: Association of Age, Headache and Gender with Types of NSBVAs.

	Types of NSBVAs						
Age category (yrs.)	CI	AI	CI and AI	IXT	Others	Total	P value
10 to 19	64	17	20	18	6	125	0.001
20 to 29	82	22	13	3	12	132	
30 and above	26	13	5	0	5	49	
Presence of Headache							
Yes	155	46	35	8	21	265	<0.05
No	17	6	3	13	2	41	
Gender							
Male	55	15	11	7	7	95	0.98
Female	117	37	27	14	16	211	
Total	172	52	38	21	23	306	

Discussion

We assessed Non-strabismic Binocular Vision Anomalies (NSBVAs) among the patients attending Biratnagar Eye Hospital which underscores high female participation which was similar to study done by Magdalene [4] usually females involve in indoor activities and near task activities which may be the reason to be highly prevalent but it was different from the study done by Rao [10] in which majority of the patients were male. Our study also found that a significant proportion (84%) of NSBVAs cases were among individuals less than 30 years of age. This age group is particularly vulnerable due to the high visual demands associated with academic and early professional activities and it was similar in many study [11].

The majority of the study patients were students (62.9%), highlighting the potential impact of NSBVAs on academic performance. Asthenopic symptoms such as headaches and difficulties with near work can hinder a student's ability to concentrate and perform well in academic tasks [11]. This relationship between NSBVAs and reduced academic performance has been documented in previous studies, which emphasize the need for routine vision screenings in educational settings [12]. Our study found convergence insufficiency was the most common NSBVAs. This finding aligns with existing literature suggesting that convergence insufficiency is one of the most common types of binocular vision dysfunctions, particularly among young individuals [13]. However, a study done on Engineering students found accommodative dysfunction was most common binocular vision dysfunctions followed by convergence insufficiency [7].

Our study found significant associations between age and history of headaches with types of NSBVAs but insignificant with gender. Younger patients, particularly those under 30, were more likely to present with convergence-related problems. Females constituted a majority of the study population (67.1%), which is consistent with other studies suggesting a higher prevalence of certain types of NSBVAs, like convergence insufficiency, accommodation related dysfunction among females [8, 13, 14]. Additionally, a history of headaches was frequently reported among patients with convergence insufficiency and accommodative dysfunctions, reflecting the discomfort associated with these conditions [15]. Vision therapy exercises were prescribed to patients diagnosed with NSBVAs, with many studies supporting their efficacy [1, 16]. Vision therapy, particularly for convergence insufficiency, has been shown to improve symptoms and enhance overall visual performance. Vision therapy exercises such as pencil push-ups, Brock string exercises, and computer-based vergence training have been found to be effective in improving binocular vision anomalies [1].

Regular follow-ups and adherence to prescribed therapy regimens are crucial for achieving the desired therapeutic outcomes. Being a hospital-based study, there might be a potential selection bias as it may not fully represent the general population. In the future longitudinal studies could provide more comprehensive insights into the efficacy of various treatment modalities over time.

Eye care practitioners should include comprehensive binocular vision assessments as part of routine eye examinations, especially for individuals reporting asthenopic symptoms. Further research is needed to explore the long-term benefits of vision therapy and to develop standardized protocols for the management of various types of NSBVAs. Collaboration between ophthalmologists, optometrists, and vision therapists can enhance the quality of care provided to patients with binocular vision anomalies.

Conclusion

NSBVAs were a common problem in patients with asthenopic symptoms, especially in younger and school-age patients. To lessen the negative impact of these anomalies on visual function and general quality of life, early diagnosis and customized vision therapy are essential. Addressing this public health issue can be greatly

aided by routine vision screenings, particularly in school settings, and raising awareness of NS-BVAs.

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