

A QUESTIONNAIRE BASED STUDY TO ASSESS THE CORELATION BETWEEN VISUAL SYMPTOM AND NSBVA AMONG TIBETAN COLLEGE STUDENTS OF BANGALORE



By Vanshika Malhotra

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Dissertation submitted

in partial fulfillment of the requirements for the degree of
Bachelor's of Optometry

Under the guidance of

Mrs.Vandhana kamath, M. Optom

Mr. Aditya Goyal, M.Optom, FCOVD

Mrs.Bhavya Mathpathi ,M. Optom, FASCO



SANKARA EYE HOSPITAL

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Declaration

I Hereby declare that the thesis entitled “**A QUESTIONNAIRE BASED STUDY TO ASSESS THE CORELATION BETWEEN VISUAL SYMPTOM AND NSBVA AMONG TIBETAN COLLEGE STUDENTS OF BANGALORE**”. It is a record of bonafide work carried out by me. I affirm that it’s entirely my effort and has not been copied. The project/dissertation has been conducted for the award of the degree of B.OPTOMETRY to Arka Jain University. The project work is carried out by me, under the guidance of Mrs.Vandhana kamath, Mrs. Bhavya Mathpathi and Mr. Aditya Goyal professor at Sankara Eye Hospital, Jamshedpur, Jharkhand as the external guide and Mr. Sarbojeet Goswami, Head of Department, School of Health and Allied Science, Arka Jain University, Jamshedpur, Jharkhand. The above-mentioned information is authentic to the best of my understanding.

I further declare that the work reported in this thesis has not been submitted and will not be submitted either in part or in full for the award of any other degree or diploma in this institute or any other institute or university

Place: Jamshedpur

Date:9 May, 2023

Bhavya M
25/10/22
SANKARA COLLEGE OF OPTOMETRY
SANKARA EYE HOSPITAL
Varthur Main Road,
Kundalahalli Gate, Bangalore - 560 077

Vanshika
Malhotra

Signature of the external Guide

Signature of the candidate

Certificate

This is to certify that the thesis entitled “**A QUESTIONNAIRE BASED STUDY TO ASSESS THE CORELATION BETWEEN VISUAL SYMPTOM AND NSBVA AMONG TIBETAN COLLEGE STUDENTS OF BANGALORE**” submitted by Ms **Vanshika Malhotra** for the award of the degree of B.Optomety, is a record of bonafide work carried out by the student under my supervision at Sankara Eye Hospital, Bangalore, Karnataka ,as per the academic code of the university.

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Blavya M
25/10/22
SANKARA COLLEGE OF OPTOMETRY
SANKARA EYE HOSPITAL
Varthur Main Road,
Kundalahalli Gate, Bangalore - 560 022

Place: Jamshedpur

Signature Guide

Date:9May,2023

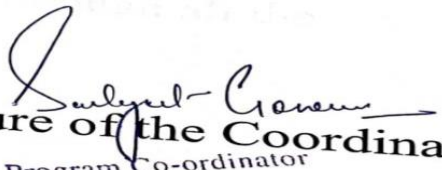
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Signature of the Coordinator
Program Co-ordinator
Department of Optometry
School of Health & Allied Science
ARKA JAIN University, Jharkhand

Place: Jamshedpur

Date:9May2023

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LIST OF ABBREVIATIONS USED

- BV : Binocular vision
- NSBVA: Non-strabismic binocular vision anomalies
- BAND : Binocular- vision and normative data
- NPC : Near Point of Convergence
- COVD : College Of optometrists in Vision Development
- QOL : Quality Of Life
- AI : Accommodation insufficiency
- AE : Accommodation excess
- AIF : Accommodative infacility
- ISA : Ill- sustained accommodation
- CI : Convergence insufficiency
- CE : Convergence excess
- DI : Divergence insufficiency
- DE : Divergence excess
- FVD : Fusional vergence dysfunction

Abstract

Title: “A questionnaire-based study to assess the correlation between visual symptoms and NSBVA among Tibetan college students of Bengaluru”

Aim: To determine the visual symptoms and status of non-strabismic binocular vision anomalies(NSBVA) among Tibetan college students of Bengaluru.

Methodology: Prior to the onset of the study, the study was approved by the Institutional research committee and ethics committee. Permission was taken from the Tibetan college of Bengaluru and written consent was taken from the participants who are willing to participate based on the inclusion and exclusion criteria of this study. The baseline evaluation was done like a brief history followed by COVD- QOL-14 questionnaire, vision, refraction torch light examination was done followed by color vision and stereopsis. Fundus is also checked with direct ophthalmoscope followed by three minimum test battery like NPC using penlight and red filter, phoria test and monocular accommodative facility were examined. The subjects were diagnosed based on the details given by Schieman and Wick. Post that data was compiled and analyzed.

Result: Of the 281 participants of age group 18 to 25 years examined,129(46%) students presented some form of non-strabismic binocular vision anomalies. Overall, symptoms reported by the students were more highly correlated with diagnosis. The most common non strabismic binocular vision anomaly was accommodative excess (15.30%) followed by convergence insufficiency (11.03%). Among 281students , 220 (78.29%) were asymptomatic and 61 (21.7%) were symptomatic. Among gender female students had higher symptoms than male students.

Conclusion: The COVD-QOL questionnaire is an effective, quick and easy tool which can be used for screening to identify the possible visual symptom. This study indicates that non-strabismic binocular vision anomalies are prevalent among Tibetan college students in Bengaluru and accommodative excess and convergence insufficiency was the most diagnosis seen among the age group of 18 to 25 years.

Keywords: Tibetan students; Accommodative excess; Convergence insufficiency, COVD-QOL 14questionnaire.

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1. Introduction

Binocular vision is achieved by coordination and integration of images of both the eyes, which may be defined as the state of simultaneous vision. Single binocular vision is when images fuse together and form a single percept, achieving it requires complete binocular fusion. Series of sensory and motor processes gives perception of single image and stereopsis depth.

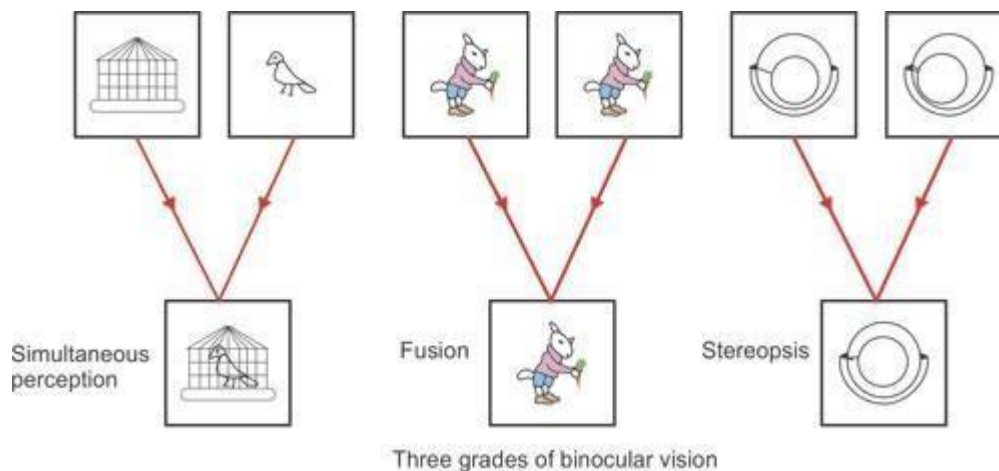


Figure 1 Grades of binocular single vision

Normal binocular vision requires accurate alignment of the eye and binocular mechanism for accommodation, vergence, sensory and motor function. [2]

Accommodation is a mechanism by which the eye changes the refractive power by altering the curvature of the lens in order to focus objects at variable distance. It is measured in (D) diopters, which is reciprocal to the object distance. [3]

Vergence is a disconjugate binocular movement of eyes together simultaneously in or out. It is of two types: convergence disconjugate inward movement of both eyes and divergence disconjugate outward movement of both the eyes simultaneously. [3]

Binocular vision dysfunction is a visual condition where the line of sight from one eye tends to be out of alignment with the line of sight from the other eye, which puts a heavy strain on the ocular muscles as they are constantly trying to single focused image by alignment of the muscle. [1]

There is various reason where the binocular vision gets affected and some of them are, amblyopia where one eye vision will be reduced, strabismus in which loss of eye movement coordination is seen and also some neurological problems lead to binocular vision anomalies. [4] Binocular vision anomalies are associated with asthenopia symptoms, headache, eye strain, diplopia and blurred vision. [5]

There is evidence which presents that binocular vision can be affected by the race "the near point of convergence and the heterophoria AC/A ratio can be influenced by race factor". [6]

Non- strabismic binocular vision anomalies (NSBVA) were considered as binocular vision anomalies which affect the integration of image of both the eyes. NSBVA is categorized into two groups, which are accommodation anomalies and vergence anomalies.

Accommodative anomalies include accommodative insufficiency (AI), accommodative excess (AE), accommodative spasm, accommodative infacility (AIF), and ill-sustained accommodation (ISA). while

vergence anomalies include convergence insufficiency (CI), convergence excess (CE), divergence insufficiency (DI), divergence excess (DE), basic esophoria, basic exophoria, vertical phoria and fusional vergence dysfunction (FVD)

The common symptoms of NSBVA are blurred vision, ocular discomfort, ocular or systemic fatigue, double vision, motion sickness, and inability to concentrate during task performance.



Figure 2 Facial difference among different race

The above picture represents the changes in inter pupillary distance, palpebral fissure height and also the canthal folds. changes in facial features can alter the binocularity of the eye, which can cause binocular vision anomalies.^[7]

In this study Tibetan students who live in India are chosen to find the binocular vision changes associated with their symptoms by using COVD-QOL 14 questionnaire. COVD-QOL questionnaire is a set of 14 questions which are related to the near work symptom. Based on the symptom score the person is judged whether he\she has some problem in their eye and the person is recommended to the eye hospital.

It was suggested that the COVD-QOL questionnaire could be a suitable choice as a vision screening instrument because it showed the ability to discriminate against those with vision problems. According to the standard procedure of the 14 set of COVD-QOL questionnaire, a total score of 9 and above should be classified as symptomatic and score below 9 should be classified as asymptomatic.

2. Literature Review

- Non –strabismic binocular dysfunction are the common visual disorder which can occur specially who performs continuous near work for extended period without break which results in poor academic performance and other near work-related work by adding stress. If these dysfunctions left untreated leads to NSBVA. **“Prevalence of non-strabismic binocular vision disorder in college students”**. In this study they have found that NSBVA are highly prevalent among college students where 76.5% diagnosed with accommodation and convergence disorder, 27% diagnosed with convergence insufficiency are the most common binocular vision disorders followed by convergence excess and accommodation excess. The least frequent NSBVA fusional vergence dysfunction, basic esophoria and basic exophoria compare to male, female^[4]
- A study done by Nurul Farhana et.al titled **“The use of COVID-QOL questionnaire in school vision screening”** was published in the year 2011. The study included 90 children who are aged between 6 to 12 years. The aim of this study was to evaluate the use of COVID-QOL questionnaire in vision screening among normal students and students with learning disability and also to determine the referral score for different populations. An interview session with parents or teachers was made to determine visual symptoms using a shorter version of COVID-QOL questionnaire. A comprehensive eye examination was performed after completion of the questionnaire. The evaluation was made based on the sensitivity and specificity for refractive error detection and other binocular vision anomalies. The result showed the mean score of normal and students with learning disability was 22.47+/- 10.75 and 12.24+/- 8.72. Referral score of normal students showed highest sensitivity and specificity^[8]
- A study done by Qian et.al titled **“Prevalence of refractive errors in Tibetan adolescents”** it was published in BMC Ophthalmology in the year 2018. The study included 3248 students “plateau group” avg 3500 M above the sea level and 11,102 students “plain group” Methodology includes assessment with Spot TM vision screener , 6 common ophthalmic disorders were assessed which include Anisometropia , Astigmatism , Gaze , Anisocoria and Myopia .Result of the study shows refractive error was 28.51% in plateau group .56.93% in the plains group. Prevalence of refractive errors among female was higher than males. Anisometropia, astigmatism, gaze and myopia were significantly lower in the plateau group. Prevalence of anisocoria is greater in the plains group. The study concluded that the Tibetan adolescents had a lower prevalence of refractive errors than did adolescents in the plains area, which may be related to less intensive schooling and greater exposure to sunlight.^[9]
- A study done by Jameel R Hussain den et.al titled as **“The minimum test battery to screen for binocular vision anomalies: report 3 of the BAND study”** was published in Clinical and Experimental Optometry in 2018. The study included 305 children (minimum test battery) prevalence of NSBVAs was obtained and compared with the original BAND study .Receiver operating characteristic analyses were per- formed to identify the minimum test battery to diagnose NSBVAs. The result of this study shows overall prevalence of NSBVAs was found to be 26% This proportion was statistically insignificant compared to the BAND cohort prevalence of 30.8%. The prevalence estimates obtained with the three tests battery in the receiver operating characteristic cohort was comparable to the original BAND cohort prevalence and thus represents a valid diagnostic battery to screen for NSBVAs. The study concluded as the minimum test battery of near point of convergence with penlight and red filter, difference between distance and near phoria, and monocular accommodative facility yield good sensitivity and specificity for diagnosis of NSBV as community

3 Need for the study

Recent studies have described the importance of binocular vision and negative impact on the daily living activities of binocular vision disorder. The quality of life and academic scores of college students with NSBVA shows poor performance associated with eye strain and other asthenopic symptoms.^[11] The effect of race has been reported to influence the accommodation and vergence complications.

To know the visual symptoms and status of binocular vision function among tibetan students which has not been reported previously.

4 Aim and objective

Aim:

To determine the correlation between visual symptoms and NSBVA among Tibetan college students of Bengaluru by using COVD-QOL 14 questionnaire.

Objective:

- 1) To study the symptomatic score of Tibetan college students in Bengaluru with Non strabismic binocular vision anomalies using COVD-QOL 14 questionnaire.
- 2) To know the number of symptomatic and asymptomatic students with Non Strabismic Binocular Vision Anomalies among age and gender.

Hypothesis:

Null Hypothesis: There is no statistical correlation of NSBVA and visual symptoms with the Tibetan population.

Alternate Hypothesis: There is statistical correlation of NSBVA and visual symptoms with the Tibetan population.

5 Methodology

5.1 Research design

- Study-design : Questionnaire based study
- Study setting : Tibetan colleges at Bengaluru
- Study participants : Tibetan college students (18-25 years)
- Study duration : September 2022– November 2022
- Sampling method : Convenient Sampling
- Sample size : 281
- Sample size calculation: $N = Z^2 \frac{pq}{d^2}$

Where $Z_{\alpha} = 1.96$ at 95% confidence level

Prevalence and $q = 1 - p$ = absolute precision

here $p = 76.5\%$ $q = 23.5\%$ $d = 5\%$ absolute precision

With 95% confidence level and 80% power with 5% absolute precision

5.2 Inclusion and Exclusion criteria

Inclusion criteria:

- BCVA ≤ 0.1 Log MAR at 4m distance.
- BCVA $\leq N6$ at 30-40 cm for near.
- Age group from 18 to 25 years old Tibetan college students.

Exclusion criteria:

- Ocular abnormalities / strabismus (constant or intermittent)
- Unilateral blindness
- History of intra ocular strabismus surgery, ocular or head trauma.
- Self-reported history of ocular or head trauma.

5.3 Materials required:

- Log MAR visual acuity for distance at 4 meter distance
- Visual acuity chart for near (reduced Snellen's chart)
- Retinoscopy and direct ophthalmoscope.
- Trial set (Bali Walla and Homi)
- Torch light.
- Stereopsis and red-green filter (TNO).
- Color vision (Ishihara)
- Modified thorington chart for near and distance phoria.
- W4DT torch.
- Accommodative flippers ($\pm 2.00D$).
- Red Filter and transilluminator.

5.4 Methodology:

This is a questionnaire-based study which was conducted in Dhalai Lhama Institute of higher education in Bengaluru, Mentsee-Khang college and Tibetan youth hostel in Bengaluru, India between the period of September 2022 to November 2022.

Before enrolling the students, permission was taken from the scientific and ethics committee and also from respective Tibetan colleges. The written consent was taken from each subject prior enrolling into the study. Subjects were included into the study based on the inclusion and exclusion criteria and also due to covid - 19 all the safety measurements were taken priorly.

Initially history was taken about their main ocular complaints, associated with systemic and medical history and then the visual acuity of the subjects was checked by using LogMAR visual acuity chart at the distance of 4 meter with best corrected visual acuity for distance and near visual acuity at the distance of 30 to 40 cm , after recording the distance and near visual acuity COVID-QOL 14 questionnaire was given to the subjects ,the score was recorded based on the severity of their symptoms (refraction).

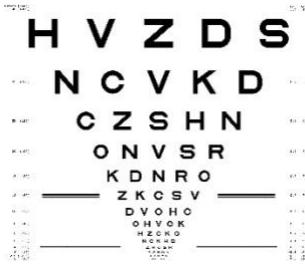
Torch light examination was done on the subjects followed by other test like ,fundus was examined by using the direct ophthalmoscope ,color vision with Ishihara (75cm), stereopsis was measured with TNO test ,sensory status of each subjects was measured with W4DT for near (40cm),intermediate (1 meter),distance (3meter);then the motor test is evaluated by doing extra ocular motility test, cover test ,modified thorington test for both distance and near ,near point of convergence without accommodative target was measured and monocular accommodative facility were performed.

According to the data collected the diagnosis was based on the minimum test battery and the symptom score were analyzed to correlate with diagnosis, to know the NSBVA among Tibetan college students in Bengaluru.

Once the subjects had been classified according to the binocular dysfunction, we analyzed their symptoms based on the COVID-QOL set of 14 questionnaires. This questionnaire contains 14 sets of symptom-based questions. By using COVID-QOL questionnaire reference score we can tell whether the person is symptomatic or asymptomatic. If the total symptom score is greater than 9 it denotes that the person is symptomatic and if the total score is less than 9 then it is said to be asymptomatic. Based on this reference score the number of symptomatic and asymptomatic students' data will be separated and correlated with NSBVA.

5.5 Clinical procedure:

5.5.1 Distance visual acuity:



- Distance visual acuity was measured by using Log MAR ETDRS chart, kept at a distance of 4 meter apart from the subject and asked to read monocularly.
- When the subject was not able to read the letter from 4-meter distance, the chart was moved close until the subject read the first line clearly.
- If subjects were not able to read 0.2 lines from the Log MAR, for them with the help of pinhole vision was checked that whether the vision is improving or not, then visual acuity was recorded. visual acuity for that subject was recorded in logarithmic units. It was done in both aided and unaided.

5.5.2 Near visual acuity:



- Near visual acuity was measured by using an N-notation chart, held at 40cm from the subject and asked them to read monocularly, near visual acuity was recorded.
- If they are not able to read from 40cm, then the chart is moved close till the distance where the subject can read N8 target clearly and values are recorded.
- If they use spectacle, then near vision was checked with the correction.

5.5.3 Objective refraction



- Subjects are made to sit comfortably and then the procedure was explained and asked to fixate the distance target. larger letter size

(6/60) in distance acuity chart.

- Test the right eye of the subject with the examiner right eye and vice versa. Shine the retinoscopy light into the subject's retina
- According to the movement of reflex, the plus or minus lenses over the eye using a trial frame and trial lenses till both the meridians are similarly neutralized.
- Then the dioptric value of the arm length is detected from the gross value. This gives the net retinoscopy value.

5.5.4 Subjective refraction

- Subjects were asked to sit comfortably.
- Procedure was explained to the subjects.
- Starting point for the subject was taken from net retinoscopy value.
- Control of accommodation was done by fogging technique.
- Same procedure was repeated for another eye.
- Binocular balancing was done by a vertical prism method where accommodation of both eyes will be balanced. Finally, a binocular end point was performed where the concept of maximum plus and minimum minus gives best visual acuity.

5.5.5 Torch light examination



- A general torch light examination was done for general eye evaluation.
- Subjects were asked to sit comfortably.
- Test was performed binoculars.
- By the torch an overall assessment of the anterior segment was done.
- One eye was examined first and the same procedure was performed on another eye.

5.5.6 Direct Ophthalmoscopy



- Raise the chair to such a position that you can comfortably look into the patient eye.
- Inform the patient that you are going to examine the health of their eyes.
- Use largest aperture for patients with larger pupil size, and smaller aperture for smaller pupil size.
- Ask the patient to remove their spectacle and examiner respectively.
- Find out the spherical equivalent of both and add it.
- Set the power wheel to that of the spherical equivalent.

- Dim the room illumination.
- Hold the direct ophthalmoscope in your right hand and use your right eye to examine the right eye of the patient and instruct the patient to look up and temporally.
- Move as close to the patient until you see the optic disc or blood vessels.
- If you do not see the disc straight away but can focus on the vessels, follow the vessels backward towards the disc the bifurcation of the blood vessels forms a v and this will point in the direction you should move to get the disc.
- Record the cup disc ratio, artery and vein ratio, presence of fovea reflex, color of the disc area.

5.6 Sensory evaluation

5.6.1 Stereopsis

Equipment needed: TNO stereo acuity chart, Red –Green glasses



Setup:

- The subject should wear red- green filter glasses over his or her appropriate prescription.
- The plates should be well illuminated, glare free. Did not allow the patient to do any head tilting or turning.

Procedure:

The test plate was presented in order, at 40 cm.

- The plates were well illuminated, glare free and upright to ensure proper axis of polarization. Did not allow the patient to do any head tilting or turning.
- Asked the subject to identify the hidden shapes.
- In case of positive response, go for the next page and ask them which one was popping out and what is the shape, but in case of negative response the read page is recorded the value in seconds of arc.

5.6.2 Worth Four Dot Test

Equipment needed: Worth 4 dot flashlight, red green glasses



Setup:

The patient was wearing red-green glasses and distance correction in place and held the worth four dot flashlight at 33- 40cm.

Procedure:

- Patient is asked to report “How many lights do you see?”
- If a patient reports less than or more than four lights, then cover the left and ask “how many lights do you see?”
- Then with both eyes open ask “how many lights do you see?”
- Repeat the test.

Important points:

- It is not necessary to ask about the color of the lights. Simply ask how many lights are seen with the right eye, left eye, and both eyes.
- It is important to perform the test at 33cm, 1 meter and 6 meter.

Interpretation:

4 dots = Flat fusion

5 dots = Diplopia

2 red dots = Left eye suppression

3 green dots =Right eye suppression

Sometimes 2 red and sometimes 3 green = alternate suppression.

5.7 Motor evaluation:

5.7.1 Extra ocular motility test:

- Patient was instructed to follow the light in different directions with his eyes and reported if he or she experiences double vision, pain or discomfort etc.
- Penlight was held in the primary position and then moved in a different direction of gaze.
- Note the corneal reflex, smoothness and accuracy of the movement.
- If everything appears normal, then record it as FFP –full free painless, otherwise note the deficits.
- If the patient complains of diplopia, note the direction in which it was observed by the patient.

5.7.2 Cover Test:

Equipment needed: Gulden fixation stick 20/30 target for distance.



Setup:

- If the patient wears glasses for close work, these should be used.
- For distance testing, isolate a 20/30 letter on the distance visual acuity chart.
- For near testing, hold a Gulden fixation stick 40cm from patients face and direct the patient's attention to the isolated 20/30 letter.

Procedure

- Instruct the patient to fixate the letter and keep it clear throughout testing.
- Cover the subject's right eye and watch the left eye as the right eye is covered. Cover the subject's left eye and watch the right eye as the left eye is covered.
- Allow the subject to regain their fixation.
- Repeat the procedure at 40 cm using a single 20/30 letter on the gulden fixation stick. If an intermittent strabismus is present use the intermittent fixation target and follow the direction as follows:
- The control scale is for both distance and near fixation.
- The fixation objects are accommodative and age appropriate, such as small stickers and videos for younger children and letters for older children and adults.
- Level 5 to 3 are assessed during a 30 seconds observation period. If exotropia is observed, testing stops and control score is recorded as 5,4,3 at that distance.
- If no exotropia is observed during 30 seconds observation period testing is continued.
- Level 2 to 0 are then assessed and graded as the worst of three successive 10 seconds and on removal the time required to refuse is noted.
- The worst of these three 10 seconds trials was recorded.

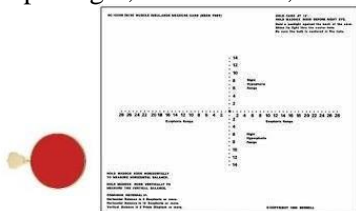
Important points:

- Control accommodation using
 1. 20/30 target
 2. Occasional movement of target
- The cover test is objective and can be used with young children.
- Watch for small horizontal movement and small movement of the upper lashes, if a vertical phoria is suspected. With practice, clinicians can less than 1 prism heterophoria on the cover test.

5.7.3 Modified thorington test

5.7.4 Horizontal and vertical phoria

Equipment needed: pen light, Maddox rod, Thorington card.



Setup:

- The subject should wear his or her distance glasses.
- The patient holds the Maddox rod before the right eye with the striations of the Maddox rod oriented horizontally.
- Hold the Thorington card at 40cm with a penlight behind the center hole of the card.

Procedure:

- Instruct the subject to look directly at the center of the card.
- The patient was instructed to see a red vertical line.
- Ask the patient to report the number through which the line is passing and whether it is to the right or left of the zero.
- For measurement of the vertical phoria, the Maddox rod is held so that the striations are oriented vertically.
- Asked the patient to report the number through which the line is passing and whether it is above or below the zero.

Important points:

- Control accommodation by reminding the patient to keep the letters on the card clear at all times.
- This test has been shown to have the best repeatability of the various subjective tests of motor alignment.
- This test can be valuable for patients who cannot be tested with a phoropter.

5.8 Vergence evaluation

5.8.1 Near point of convergence:

Setup:

- If the subject wears his/her correction for the near work, then glasses should be worn while performing this test.
- Hold the fixation target at 40cm from the subject's face at eye level.
- Ask the patient to look at the isolated 20/50 target on the fixation target.

PROCEDURE

- Slowly moved the fixation stick toward the patient at eye level and between the two eyes.
- Ask the subject to tell when he/ she sees two targets.
- Once diplopia occurs, move the fixation target in another inch or two and then begin to move it away from the subject.
- Asked the subject to try and focus to see the target as a single image again.
- Also watched the eyes carefully and observed whether the eyes stop working together as a team.
- Recorded the distance at which the patient reports double vision and when the patient reports recovery of single vision.
- Repeated the test using a penlight and red filter.

Important points:

- Repeat the test several times if the result is not definitive.
- Watch the subject's eye and try to determine the break and recovery objectively.

5.9 Accommodation test:

5.9.1 Accommodative facility

Equipment needed: word card and $\pm 1.5D / \pm 2.00D$ flip lenses.

**Setup:**

- If the subject wears his/her correction for near work, then the subject is asked to wear his/her spectacle.
- The accommodation target was held at 40cm from the subject's face at eye level and the flip lens was chosen according to their age and placed in front of the subject's eye.
- The test is initially performed binocularly.

Procedure:

- Asked the patient to try to get the letters clear and single as quickly as possible.
- Instructed the subject to report as soon as the letters are clear.
- When the letters are reported to be clear, quickly flip the flipper so the minus side is before the same eye, again instructing the subject to read the letters and report when the letters appear clear or if they disappear.
- Continued alternating sides of the flipper lenses for 1 minute, calculating the cycles per minute achieved.
- Repeated the procedure monocularly.
- Recorded the cycles per minute. Record if one side (plus or minus) of the flippers was more difficult, or if neither side was more difficult.

Important point:

- Stress the importance of trying to keep the target both clear and single.
- Once all these tests had been performed, the results were analyzed in order to determine the existence of accommodation, vergence and non-strabismic binocular vision dysfunction. In order to avoid bias, diagnosis of each dysfunction was completed by two authors different from the person who performed the visual examination.
- The diagnosis was done based on the below format,
- If exophoria is greater ($>+/- 2$) for distance than near then it is diagnosed as divergence excess, If near phoria is greater than distance then it is convergence insufficiency. In case of Esophoria if distance $>$ near =divergence insufficiency, If near $>$ distance =convergence excess.
- In case of near point of convergence based on the phoria test and the recorded value the diagnosis was done i.e. If the near point of convergence breakpoint is 10 with $+/- 4$ then it is considered as within the normal limit. If the values are below or above the range then they are diagnosed with vergence problems.
- For accommodation, if the subject has fewer cycles per minute with plus or minus lens difficulty the diagnosis was done like if a patient has less than 7 cpm difficulty with plus lens then diagnosed as accommodation excess. If the subject has 7cpm complaining difficulty with minus lens then diagnosed as accommodation insufficiency and if subject have difficulty to clear the target with of the lenses, then they come under accommodative infacility.

Once the subjects had been classified according to the binocular dysfunction, we analyzed their symptoms based on the COVD-QOL questionnaire.

5.10 Statistical Analysis

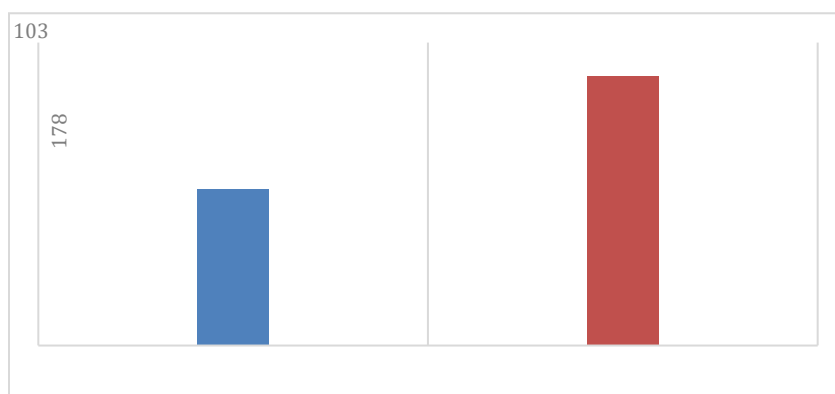
The data were compiled and entered in Microsoft excel. Then the descriptive statistical analysis was done by using the statistical tool Microsoft excel.

6 RESULT:

6.1 Descriptive:

In our study total 281 Tibetan college students were evaluated falling under the age group of 18 to 25 years. Among them 103 were males and 178 were females.

Figure 4: gender bar graph



The age distribution of the student was done, In that 18 year student were 6%, 19 (11%), 20(23%), 21(22%), 22(11%), 23(13%), 24(8%) and 25 (6%), Mean of 21.5 years with standard deviation of ± 2.44 represented in pie chart(figure.3)

Figure 5: Age distribution

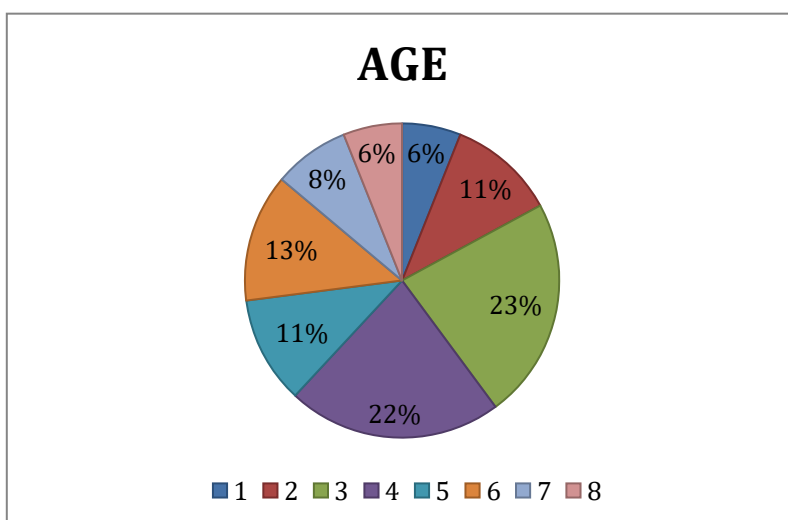
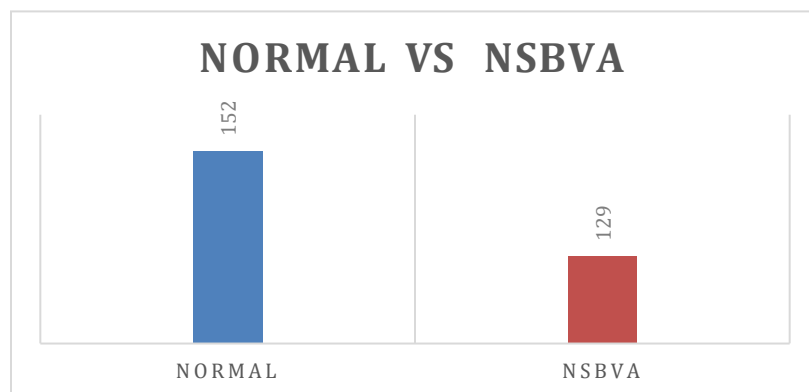


Figure 6 represents how many students were with and without symptoms of NSBVA. In those 152 (54%) students had normal binocular vision and 129(46%) students had NSBVA. As shown in the figure 6, the majority of our subjects were in the normal

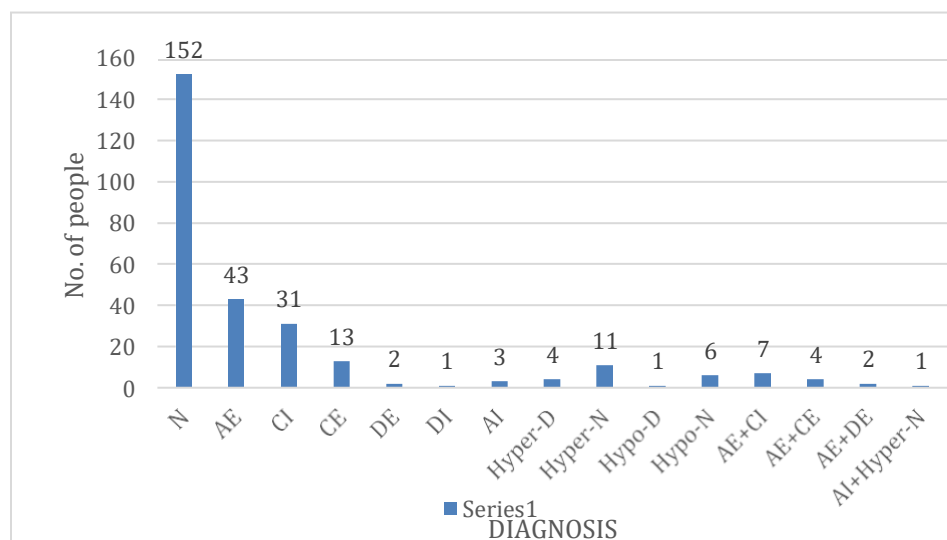
Figure 6: Non strabismic binocular vision anomalies and normal binocular vision.



In our study Non strabismic binocular vision anomalies are diagnosed based on the minimum battery test and the symptom score result. Accordingly the figure 7 bar graph shows the students with different diagnoses.

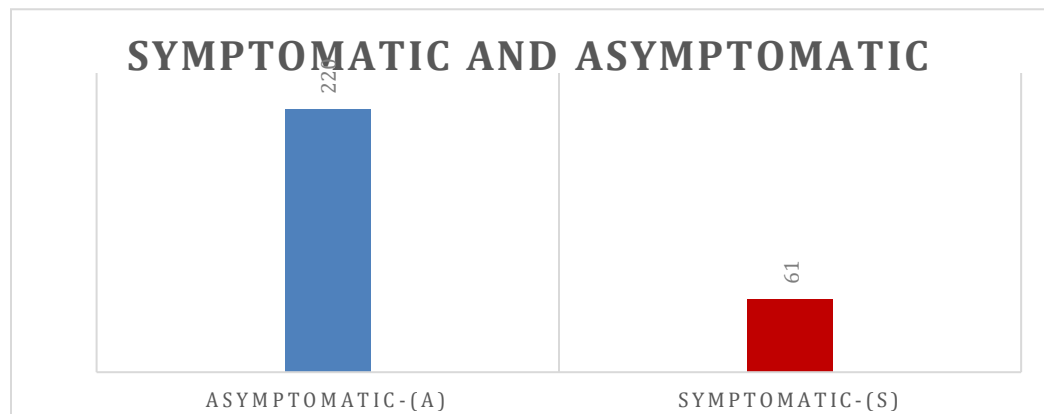
The normal and binocular vision dysfunction among Tibetan college students was as follows (figure 7), (N-54%) category. Among non-strabismic binocular vision anomalies, accommodation excess (AE-15.3%) was seen majorly, second most was convergence insufficiency(CI- 11.03%), convergence excess (CE-4.63%), divergence excess (DE-0.71%), accommodation insufficiency (AI-1.07%), divergence insufficiency (DI-0.36%), vertical phoria for distance (1.77%), vertical phoria for near(6.044%) and combination of accommodation excess with convergence insufficiency was (AE+CI -2.49%), accommodation excess with convergence excess (AE+CE- 1.42%), accommodation excess with divergence excess (AE+DE - 0.71%) and accommodation insufficiency with vertical phoria was (AI+Hyperphoria for near 0.36%).

Figure 7 Diagnosis of the students with non-strabismic binocular vision anomalies.



The COVID-QOL 14 questionnaire with total symptom score of 9 and above indicates that the student has symptoms, if the total symptom score lies below 9 then the student comes under asymptomatic. According to Figure 8 it shows the number of students with symptoms and without symptoms. In this total number of students with symptoms are 220(78.29%) and the number of students without symptoms are 61(21.7%).

Figure 8 Symptomatic and asymptomatic non strabismic binocular vision anomaly students.



The figure 9 represents how many students have NSBVA with symptoms and also without symptoms. From the figure we can understand that 152 students are normal but there are some students who have symptoms but don't have any NSBVA. In that 125(44.48%) are asymptomatic and 27(9.61%) are symptomatic but who doesn't have any abnormalities and students with NSBVA are 129 in that students with AE are 43 where 33(11.74%) students were asymptomatic and 10(3.56%) were symptomatic, 31 students had CI in that 22(7.83%) were asymptomatic and 9(3.20%), 13 students had CE were 11 (3.91%) students are asymptomatic and 2(0.71%) students are symptomatic these diagnosis was highly seen among students other diagnosis have been mentioned below .

Figure 9 Frequency distribution of samples according to the Asymptomatic and Symptomatic students with their diagnosis.

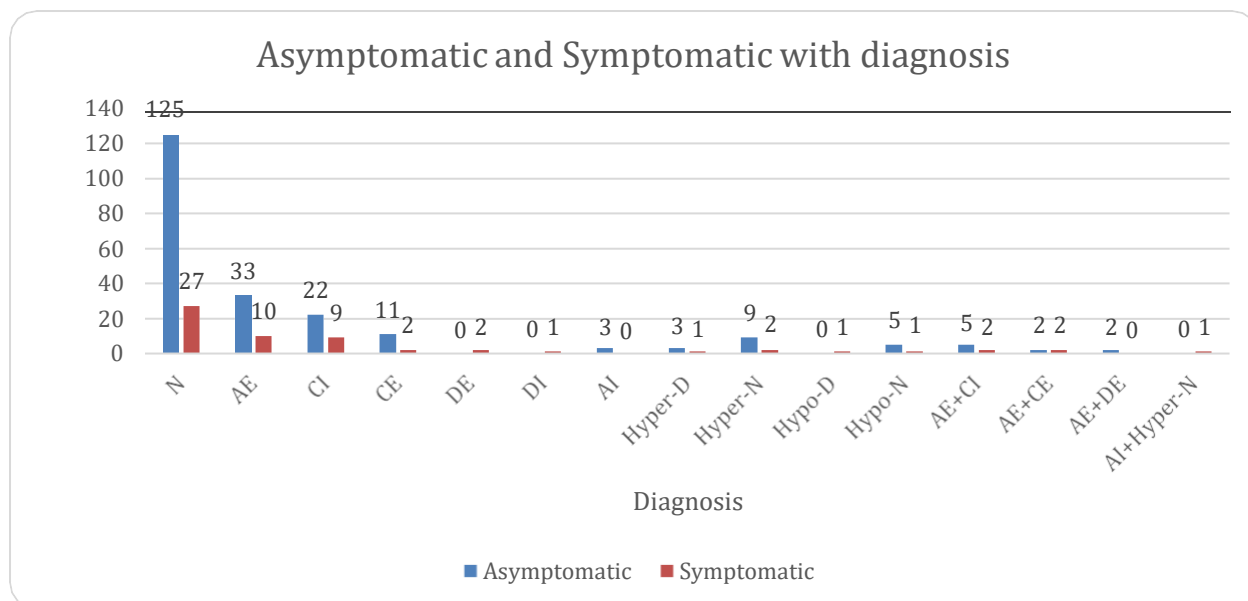


Table 5 represents those 55(19.57%) male students are normal and 48(17.08%) have NSBVA. And 97(34%) female students are normal and 81(28.83%) of them have NSBVA. When we compare between male and female, female students are highly affected with NSBVA.

Table 5 Frequency of normal and NSBVA among genders .

Gender	Frequency	% Total
Normal male	55	19.57%
NSBVA male	48	17.08%
Normal female	97	34.52%
NSBVA female	81	28.83%

Figure 10 represents those 97 female students are normal and 81 students are affected with NSBVA, in that accommodation excess, convergence insufficiency and convergence excess is seen more.

Figure 10 Diagnosis of female students with symptoms and without symptoms.

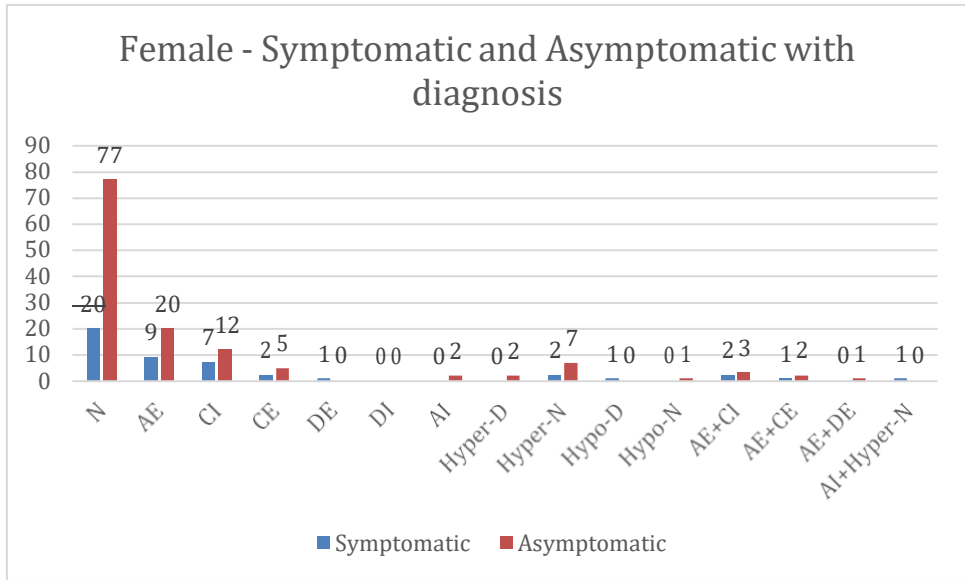


Figure 11 represents the normal and male students with NSBVA with and without symptoms. Where accommodation excess, convergence insufficiency and convergence excess is seen more than other diagnoses.

Figure 11 Diagnosis of male students with and without symptoms.

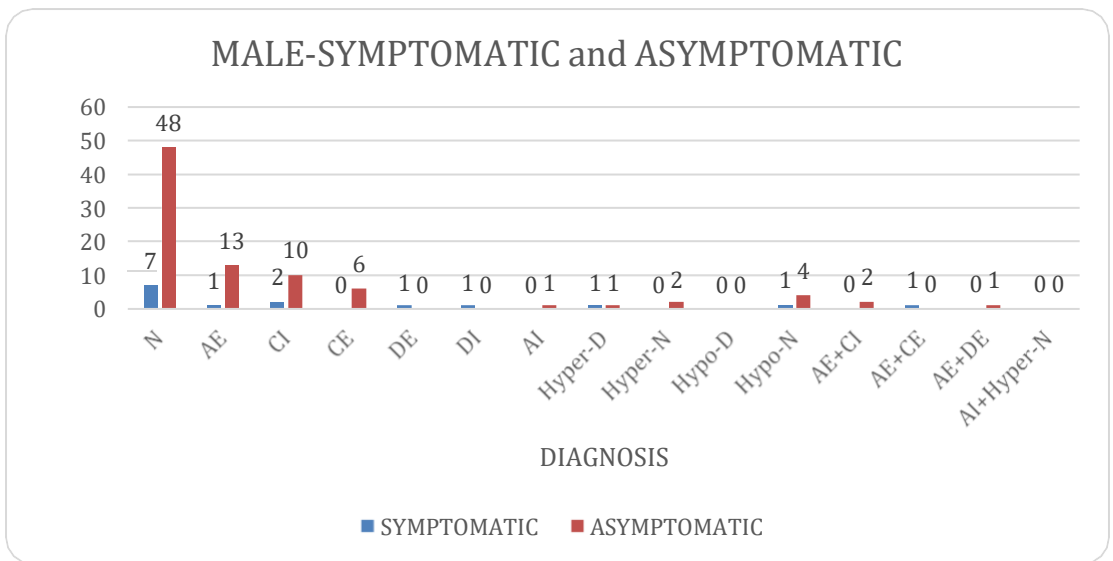
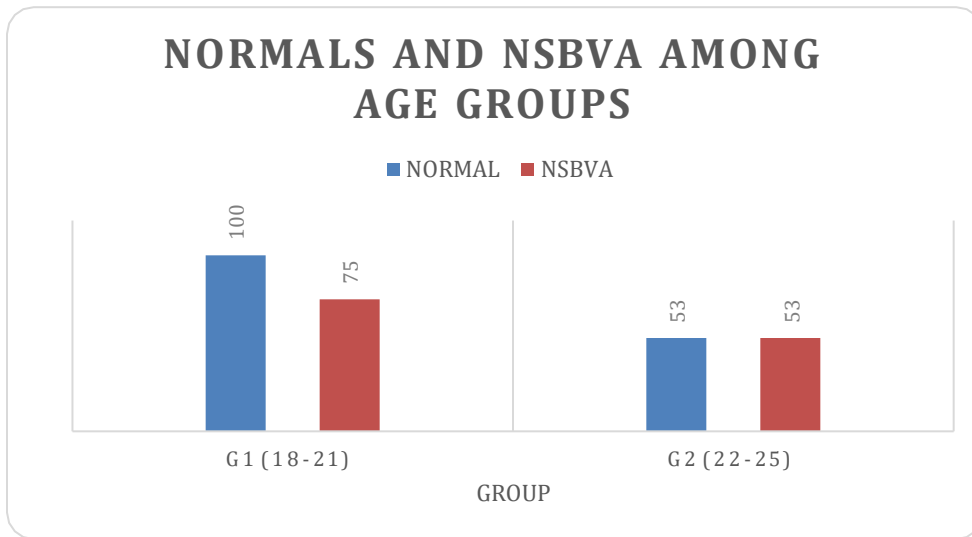


Figure 12 Normal and students with NSBVA among two different age groups. Group-1 includes the age group of 18-21 & Group-2 includes the age group of 22-25.



From the figure 13 we can see that group 1(G1) who are aged between 18 to 21 have 65% of normal students and in group 2(G2) who are aged between 22 to 25 years 35% students are normal. Figure 14 represents that in group 1 (G1) 59% of students have NSBVA which is higher than group 2(G2).

Figure 13 Normal students among two age groups.

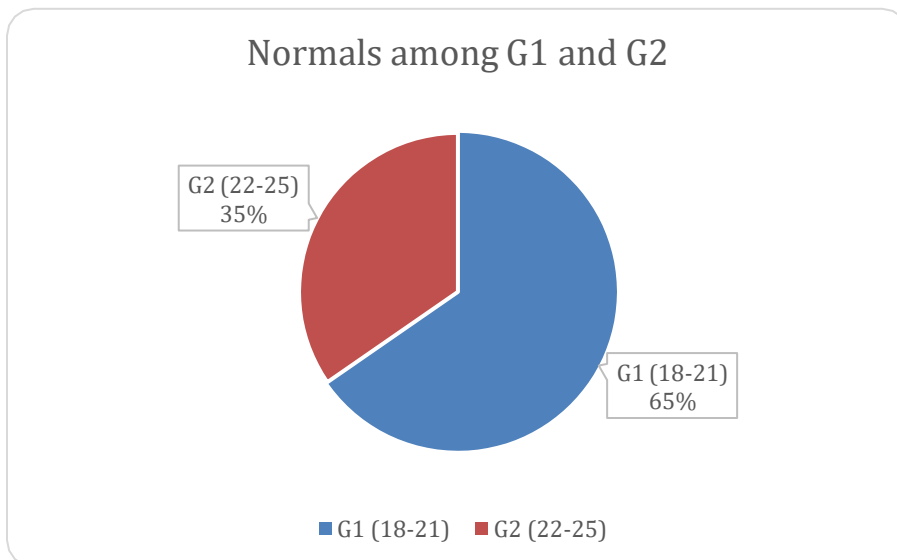
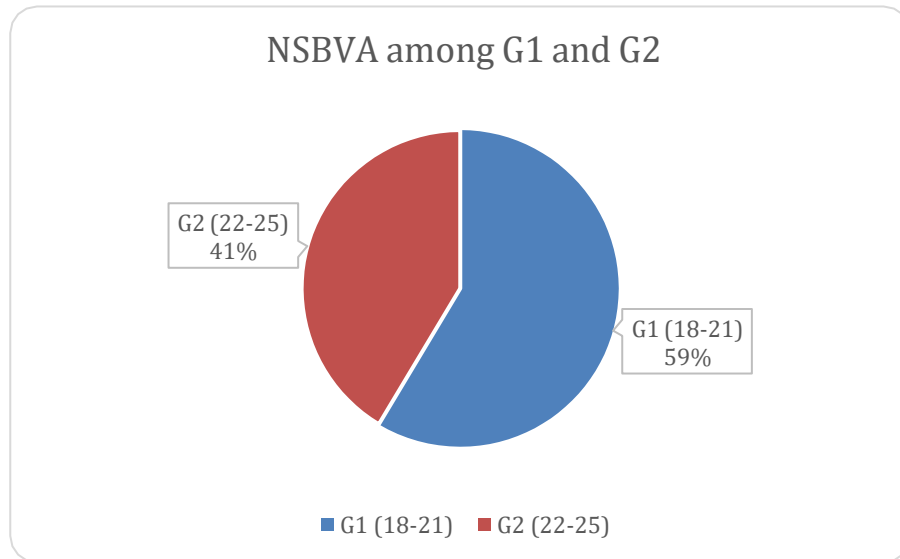


Figure 14 Students with NSBVA among two age groups.



7 DISCUSSION

In our current study we have examined 281 subjects in which 103 students were males and 178 were females and the age group of 18 to 25 years with mean age group of 21.5 ± 2.44 years. Here we found that the majority of students had non-strabismic binocular vision anomalies 46% which implies that the Tibetan college students had an impact on binocular vision.

In the present study of these binocular dysfunction, most of the students were asymptomatic 78.29% that could negatively impact their performance as students.

The result from the present study implies that a simplified version of the COVD-QOL questionnaire could be a suitable tool for screening not only for school going children but also for college students. However, most of the students were asymptomatic, in that case it is necessary to do a clinical eye examination before we confirm the diagnosis.

A status of NSBVA study was done at a private university of Malaysian students who uses VDU. The sample size of the study was 140 Malaysian college students irrespective of gender and race. In this study the overall percentage of NSBVA was 40% among those students who were using VDU. The mean age for this study and our study is 22.54 +/-1.48 years and 21.5+/-2.44 years respectively which is quite similar. But in our study, we have grouped into two age groups, group 1(G1) which includes students who are aged between 18 to 21 years and group 2 (G2) includes the students who are aged between 22 to 25 years. It shows that students who are aged between 18 to 22 have more symptoms than students who are aged between 22 to 25 years. And also, in our study we have compared among genders where the results showed that females are more symptomatic to NSBVA than male students but we cannot completely rely on the gender results; it may vary because the genders are not equally divided.

In a study done by Mondal A et.al among 600 Indian college students it was reported that the prevalence of NSBVD was 76.5%. convergence insufficiency was the most prevalent (27.5%) followed by convergence excess (24%) and accommodative insufficiency (22.5%) among all types of NSBVD. Prevalence of NSBVD is more in females than males which shows the similar results among gender. In our study 28.83% of female students had NSBVA and 17.08% of male students had NSBVA.

In the study of Esteban porcar et.al they have reported that accommodative excess was the most prevalent disorder in university students. In 10.8% of the cases, accommodative excess was present 7.7% had convergence insufficiency with accommodative excess. In our current study results also support this statement with the accommodative excess being most prevalent 15.30% followed by convergence insufficiency

8 CONCLUSION

From this study we can conclude that visual symptoms which were calculated by using COVD-QOL questionnaire were correlating with the diagnosis and most of the female students are more symptomatic than males and also the students who are aged between 18 to 21 years are mostly affected with non- strabismic binocular vision anomalies than the age group of 22 to 25 years old students. Which indirectly affects their academic performance.

The findings indicate a need to increase the awareness, diagnosis, and management of non- strabismic binocular vision anomalies among students suffering from this condition. Proper treatment will positively impact their future and increase their academic performance. These findings suggest that it is very important to conduct a thorough eye and vision examination to detect NSBVA so that every student will be aware of binocular vision dysfunction.

Conflict of the interest

There is no conflict of the interest in this study.

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10. Annexure

10.1 Proforma

Sankara Eye Hospital

**TITLE: Non-strabismic binocular vision anomalies
among Tibetan college students of Bengaluru**

Principle investigator: Mrs. Vandana kamath, M. Optom

Co-investigator: Mrs. Bhavya Manthpathi, M. Optom

**FASCO, Prof. Aditya Goyal,
M. Optom, FCOVD**

DEMOGRAPHIC DATA:

SL. NO.....

Date:

Name.....

Age:Years

Gender: Male/Female Mobile No.....

Occupation..... Mail I'd.....

HISTORY:

- Chief Complaint.....
.....
.....
- Ocular History: Surgery/Trauma/Spectacle
wearer.....
- Systemic History:
DM/HTN/IHD/BA/RA/Other.....
- Medication.....
.....
- Allergies.....
.....

VISUAL ACUITY & REFRACTION:

UA VA (log MAR)	OD: With PH: OS: W
A VA (log MAR)	OD: log MAR OS: log MAR
Near Vision (Near Log MAR)	OD: @ CM OS: (
PGP	OD: OS:

Objective	OD					OS		
Accommodation	OD					OS		

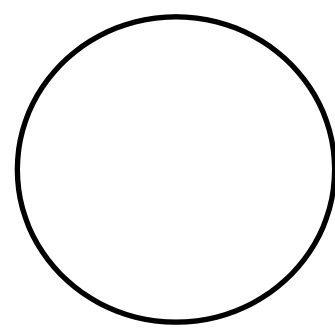
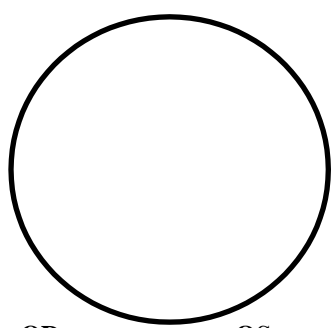
Torchlight Examination:

Ant segment	OD	OS
Lids		
Conjunctiva		
Cornea		
Pupil	PERRLA/ RAPD/Others	PERRLA/ RAPD/Others
Lens		

Fundus evaluation :

OD

OS



Color vision: OD:OS:

<u>Sensory Evaluation</u>		
TESTS	FINDINGS	NORMATIVE VALUES
STEREOPSIS		60 sec of arc
WFDT	D: I: N:	Fusion

10.2 Questionnaire

I.D. NUMBER: _____ DATE: _____ DATE OF BIRTH: _____			
Check the column which best represents the occurrence of each symptom			
SYMPTOMS	NEVER (SCORE=0)	OCCASIONAL (SCORE=1)	ALWAYS (SCORE=2)
Headaches with near work			
Words run together reading			
Burn, itch, watery eyes			
Skips/repeats lines reading			
Omits small words when reading			
Writes up/down hill			
Misaligns digits/columns of numbers			
Reading comprehension down <small>↑ ↓</small>			
Trouble keeping attention on reading			
Difficulty completing assignments on time			
Always says *I can't* before trying			
Does not use his/her time well			
Loses belongings/things			
Forgetful/poor memory			
Total score			
* Total score of ≥ 3 indicates a need for referral to the eye care professional			

10.3 Informed consent form

Title: Non-strabismic binocular vision anomalies among Tibetan college students of Bengaluru

Principal investigator:

Mrs. Vandhana kamath, M. Optom

Co-investigator:

Mrs. Bhavya Manthpathi, M. Optom, FASCO

Prof. Aditya Goyal, M. Optom, FCOVD

Introduction:

You are invited to participate in a study/research/experiment. This document gives you a description of the study in which you are being asked to participate. Your participation in this study is voluntary, and you can enquire about all details before giving your written consent to participate in the study.

Purpose:

The purpose of this study is to determine the status of non-strabismic binocular vision anomalies (NSBVA) among Tibetan college students of Bengaluru

Information:

Prior to the onset of the study, the study has been approved by the Institutional research committee and ethics committee. Subjects agreed to participate in the study are given consent and included on inclusion and exclusion criteria. Brief history taking will be done followed by some questionnaires. Pupil is examined and followed by a few tests such as NPC using penlight and filter, phoria test and accommodative facility. Data collected will be compiled and analyzed.

Risks:

There are no foreseeable risks involved in this study.

Cost

The participant is not charged in this study. It's completely free of cost.

Benefits:

To the best of our knowledge, there is no risk involved in our research work. We strongly believe that the data collected from this research will be useful as a base to similar research studies

Confidentiality:

The information in the study records will be kept at Sankara College of Optometry. Data will be stored securely and will be made available only to persons conducting the study and to the regulatory authorities. The data will not be made available to another individual unless you specifically give permission in writing. No reference will be made in oral or written reports which could link you to the study. Results of the project will be communicated to the participants if they are interested to know. The participants and the community have a right to know the outcome of the research.

Compensation for protocol Related Injury

There is no any risks or danger involved in the study

Contact:

If you have questions at any time about the study or the procedures, (or you experience adverse effects as a result of participating in this study,) you may contact the researcher, Name: **Ms. Vanshika Malhotra** from **Sankara College of Optometry, Bangalore**, contact no: +91-8279736865

Participation:

Your participation in this study is voluntary; you may decline to participate at any time without penalty and without loss of benefits to which you are otherwise entitled.

If you withdraw from the study prior to its completion, you will receive the usual standard of care for your disease, and your non participation will not have any adverse effects on your subsequent medical treatment or relationship with the treating physician

If you withdraw from the study before data collection is completed, your data will not be entered in the project report. Your legal rights will not be affected by signing this document.

Consent

I have been explained, and have read and understood the above information and voluntarily agreed to participate in this study. I have received a copy of this form.

Participant's name (print):

Participant's signature & date:

Address (capital letters):

Phone Nos.:

Legally Acceptable Representative (LAR) name:

Legal Representative Signature & date:

Witness's name (Print):

Witness's signature & date:

Name of PI or the person administering the consent (Print):

PI or person's Signature & date:

