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Prevalence of Accommodative Anomaly in High School Children Age from 13 to 17 Year in Clinical Population

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Abstract

- ***Purpose:***

To find out the prevalence of accommodation anomaly and distribution of Accommodation anomalies among High School children age from 13 to 17 year in clinical population Bangalore and correlation with COVD- QOL questionnaire

- ***Methodology:***

A prospective cross-sectional Analytical study was conducted in high school children age between 13 to 17 years visited to Dr.Agarwal's eye hospital Bangalore. Children with vision less than 20/20 U/O, strabismus/ amblyopia, systemic and ocular pathology and dyslexia/learning disability were excluded. The routine optometric eye evaluation done followed by detail history taking after that Accommodation diagnosis measurement done followed by first filling of COVD-QOL questionnaire. The diagnosis of Accommodation anomalies based on scheiman and wick criteria and the clinical and statistical analysis was done by MS Excel and SPSS 16 software.

- ***Results:***

Total of 160 high school children (male 78 and female 82) evaluated there is more prevalence of Accommodation anomalies 56% (N=90) found in clinical population, among them 41 were male and 49 were female. In Accommodation anomalies Acc.infacility is more prevalent (46%) than Acc. Insufficiency (33%) and Acc. Excess (21%).

In COVD-QOL questionnaire Acc. Infacility got more score compare to other Acc. Anomalies but very less child score more than 20, maximum child score between 5 to 9.

- ***Conclusion:***

On the basis of this result we can suggest the optometrist or eye health care professional to do binocular vision check up on regular basis and parent of the children for regular comprehensive eye check-up not just a vision check up and go for vision therapy if required as we know vision therapy is best treatment for Accommodation and binocular vision anomalies

Keywords:- *QOL-19:- Quality of life 19 Questionnaires, N:- Number, U/O:- Oculus Uterque(Botheye), SPSS16:- Statistical product and service solution version 16, Acc:- Accommodation*

I. INTRODUCTION

''Binocular vision is the ability to maintain visual focus on an object with both eyes, creating a single visual image''.[(1)] Non-strabismic binocular abnormality are vision disorder which affects the binocularity,vision clarity and impairment of visual performance of subjects, particularly when near tasks such as reading, writing and computer-based work is performed.[(2)] Learning involves reading, which is the process of extracting meaning from written text and is a fundamental part of a child's education.[(3)] A significantproportion of a child's activities in the classroom[(4)] and at home involve the Accommodation and vergence mechanism.Accommodation-vergence anomalies (AVAs) result from imbalances between these functions, and the anomalies are aggravated by prolonged visually demanding near tasks, resulting in symptoms.[(5,6)]

These symptoms (Table 1) [(7)] are the most-common ophthalmic vision conditions

	Symptoms of Accommodation-Vergence Anomalies
1	Blurred vision for near tasks
2	Headaches/eyestrain/dull orbital pain/pulling sensation around the eyes
3	Loss of comprehension/avoidance of near work
4	Watering or conjunctival or eyelids irritation, sensitivity to light
5	Eye fatigue/dizziness/sleepiness
6	Blurred vision worse after reading/near work
7	Difficulty focusing from far to near, or near to far
8	Holds reading material close or farther way
9	Difficulty sustaining attention on near point tasks; distance blur after performing near work

Table 1

Except refractive error which is common in optometric clinics. Same sign and symptom has been reported by the ophthalmologist, neurologist and eye care practitioners but due to failure in detect and diagnose patient with these symptom trying to avoid near vision related work thus this cause discomfort, impair efficient near tasks and finally it will have negative impact on quality of life of the students at school, working professional at their work place.[8] Accommodative-vergence demand increase in Children's from school and high school age spontaneously as they need prolonged reading and writing so symptoms tend to increase[2] which is very important in clinical practice and some studies reported many negative impacts associated with some behavioral and learning problems. Borsting et al.[5] search for attention deficit hyperactivity disorder like behaviors in his study and found out that children with accommodation and non-strabismic binocular anomalies have a higher frequency of getting it. Similarly, Grönlund et al[9] and Damari et al.[10] demonstrated in his study that near vergence related binocular vision anomalies are often misdiagnosed as attention deficit hyperactivity disorder (ADHD), while some studies reported that children who have binocular anomalies experience anxiety, emotional and social problems.[11] Due to these Accommodative-vergence anomalies (AVAs) children may be misdiagnosed as being dyslexic,[12,13] and sometimes it had been observed that children with these AVAs lowered in academic achievements[12] so to overcome these kind of problem in children need to utilize the traditional way like vision screening in every school frequently. However, such screenings may be inadequate and are limited to detecting reduced visual acuity and refractive errors without testing for Accommodation and vergence anomalies.[2] For refractive errors glass prescription is recommended to compensation inadequate AVAs.[3]

But its important for overall epidemiological studies required in enabling identification of individuals who require intervention and also to guid clinician and researcher in understanding the prevalence, characteristics of AVAs and determining the possible etiology of such anomalies by identifying the associated risk factors may be become clearer.[14] The cure rates in symptomatic patients who manifest non-strabismic accommodation disorders generally ranged from 80% to 100%,[15] Thus the accommodative systems need to be consideration for ocularmoter treatment for reducing the symptom, the following is classification to categorize binocular disorders[16] but the most common accommodation anomalies includes of Accommodation insufficiency (AI), Accommodation excess (AE) and Accommodation infacility.[17] Definitions of each condition, symptoms and signs are summarized in (Table-2).[11] this is used in diagnosis the type Accommodation anomalies. There are many symptoms and signs that may be used for diagnose these disorders. However, there is a lack of proper criteria in the scientific literature to define each anomaly.[18-19] But there are many grounds to know that the prevalence of these anomaly is important to know. So the prevalence study required to find out the proper information about prevalence is essential for clinical purposes, increasing awareness of the anomalies, and creating the hypotheses for forthcoming studies.[14]Many studies have suggested that these dysfunctions are often found in optometric practice [20] but there isinequality with regard to the prevalence value offered by different authors.

Classifications of Accommodation anomalies
Accommodationinsufficiency
Definition- Condition in which the patient has difficulty stimulating accommodation
Symptoms- Very similar to those associated with presbyopia. Are associated with near tasks, May include: blurred near vision, discomfort and strain, fatigue and difficulty with attention and concentration when reading
Signs- Low Accommodation amplitude (AA). AA >2 D from mean for age using Hofstetter's formula
Low positive relative accommodation (PRA).
Fails monocular and binocular Accommodation facility (MAF, BAF) with - 2.00 D.
High MEM or fused cross-cylinder (FCC) findings

Accommodation excess **Definition**- Condition in which the patient has difficulty with relaxation of accommodation. **Symptoms**- Asthenopia and headaches associated with near tasks and intermittent blurred distance vision. **Sign**s-Variable visual acuity findings. Variable static and subjective. Low degree of against-the rule- cylinder Low MEM or FCC findings. Low negative relative Accommodation (NRA). Fails MAF and BAF facility with + 2.00 D.
Accommodationinfacility **Definition**- Condition in which the patient has difficulty in changing the Accommodation response level. **Symptoms**- Difficulty focusing from distance to near and near to distance, Asthenopia associated with near tasks, difficulty with attention and concentration when reading, intermittent blur associated with near tasks. **Signs**-Fails MAF and BAF with ± 2.00 D. And Low PRA and NRA.

Table 2

➢ *Anatomy and Physiology of Accommodation*

Accommodation is the process by which eye lens change the shape and size and change the optical power to focus the light on the retina to see the image clearly at different distance like far point and near point (Far point- the farest distance point from the eye at which the eye can see the clear image and Near Point- the closest distance point from the eye at which the eye can see the clear image). During accommodation distance vary for every individual from close to far point of accommodation and it can be controlled consciously also,[(21)] in children the lens can change focus from infinity to 25 cm close to eye[(23)] in 350 millisec.which is 15 diopter approximetly that can be measured as amplitude of accommodation. The amplitude of accommodation decrease by ageing at 5th decade of life the it will be near to zero so for reading at near point lens not able to focus that time they need extra power to overcome the accommodation and then they can read with the help of extra power this situation is called as presbyopia. During presbyopic condition if any one is emmetripic they dinit need prescription for distance but need correction for near, if any one is myopic they need correction for distance as they can see near without correction, if any one is hyperopic they need correction for both distance and near as they get reading issues in both the distance. Accommodation amplitude is depends on age that is graphically summarized by Duane's classical curves.[(22)]

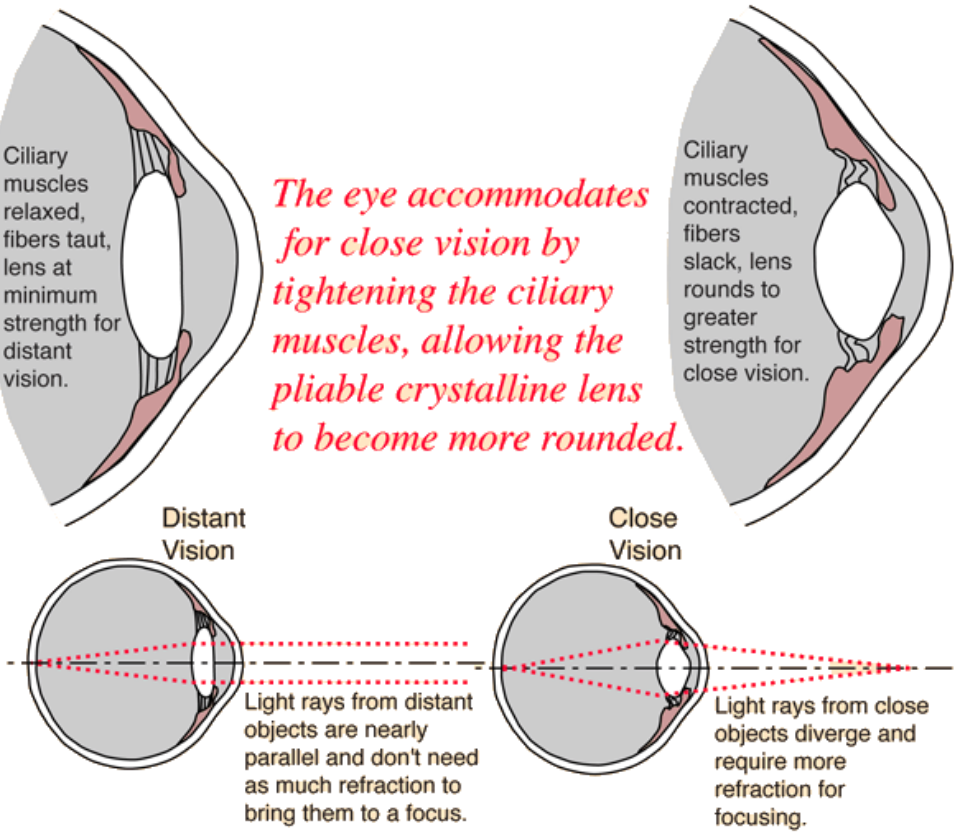

Fig 1

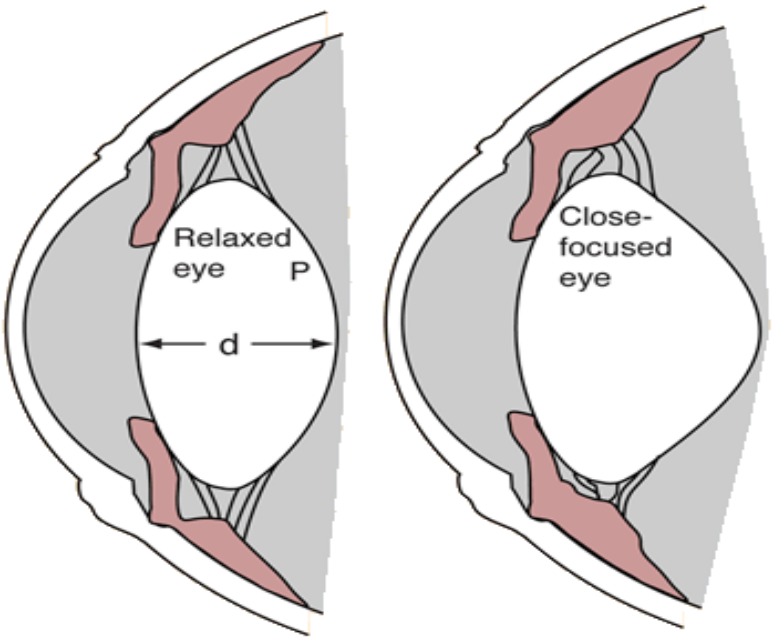

Fig 2

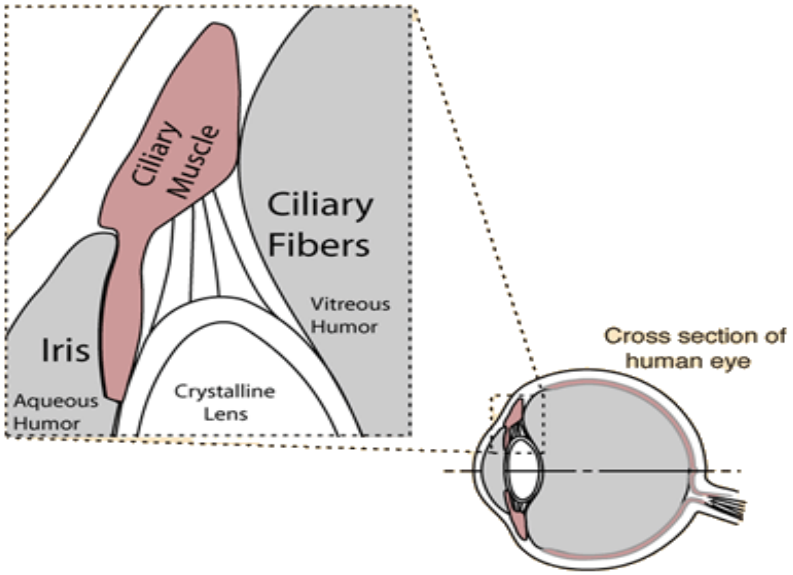

Fig 3

➢ *Induced effects of accommodation*

During accommodation at near eye generally converge and pupils constrict at the same time respectively, however the pupil constriction is not the part of the accommodation process, the combination of these three movements accommodation, convergence and pupils constrict is under the control of the Edinger-Westphal nucleus and is called as the near triad[24] The convergence is necessary to prevent diplopia that is well understood but pupil constriction is remains less clear but its mentioned many study that it may increase the depth of field by reducing the aperture of the eye[25]. We can able to measure it also that how much convergence should takes place because of accommodation (AC/A ratio, CA/C ratio). any kind of abnormalities with this can lead to many binocular vision problems.

➢ *Asthenopia:*

Eye conditions such as refractive error, weak eye muscles or intense use of eyes that result in eye pain, headaches, dizziness and vision problems.[26]

The Symptoms of aesthenopia include:

Ocular fatigue, Headache, Blurred vision, Dizziness, Nausea, Dim vision, Burning eyelids, Itchy eyelids, Eye pain, Aching around eyes, Red eyes and Double vision[26]

COVD-QOL 19:[27]

College of Optometrist in Vision Development-Quality of Life (COVD-QOL) questionnaire which consists 19 items as shown in APPENDIX III. Interview method was preferable as the questionnaire was in English which might be needed to be translated to the spoken language of

the children. The scoring method was according to the standard procedure: 0 for ‘‘never’’ 1 for ‘‘seldom’’, 2 for ‘‘occasional’’, 3 for ‘‘frequently’’ and 4 for ‘‘always’’. A Total score of 20 and above was classified as a ‘‘failure’’ As itindicated a possible for visual problem.

II. RESEARCH QUESTION

- *Three questions were considered to be important.*
- 1st how common is accommodation disorders in high School children age between 13 to 17 year visited in hospital
- 2nd is how are the various types of Accommodation disorders distributed
- And 3rd find out the Accommodation anomaly patient are Symptomatic or not on the basis of COVD questioner

III. REVIEW OF LITERATURE

The prevalence of binocular dysfunction (Accommodation anomaly) in school children is commonly reported but there are very few studies on their prevalence.

- **ESTEBAN PORCAR,et. All**.:- done clinical study on 65 university students aged 22(+/- 3 year)with heavy near visual demands. The criteria for selection were the absence of significantun corrected refractive error, healthy eyes, and no-strabismus or amblyopia. And they are found out 32.3% of the subjects showed general binocular dysfunctions. In 10.8% of the cases, accommodation excess was present.7.7% had convergence insufficiency with Accommodation excess. 6.2% showed Accommodation insufficiency and concluded that Accommodation and non-strabismic binocular vision problems are prevalentin this population. Accommodation excess is the most common condition. Because these dysfunctions may have a negative effect on performance, appropriate vision, evaluation for this population is important [28]

- **P Dwyer** : - This study was done to classify the binocular status of 144 school children (age 7 to 18 year) presenting for initial examination in an optometric clinic. and they find out 77 % of those presenting to clinic had a significant vergence or accommodation disorder, accommodative disorders affected 57 % and vergence disorders 58 % of the sample[29]

- **Diwakar Rao**:- In this study, total 182 asthenopic subjects between the age group of 8 to 49, were screened at hospital. Out of which 64 were females and 118 were male, out of 182 subject, 75 were Emetropes, 107 were having Ammetropes . Patients with binocular vision anomalies, strabismus, amblyopia and anisometropia (more than 2D), ocular pathology, ocular surgery, neurological deficits were excluded from the study, out of which 142 were diagnosed with Non strabismic binocular vision disorder. But researcher not able to classify how many have Accommodation infacility[30]

- **Francisco Lara**:- In this study 265 symptomatic subjects examined in optometric clinic and they find out the frequency, 59 patients (22.3%) had some form of Accommodation or binocular dysfunction and required not just the correction of the refractive error but a specific treatment for each of the problems diagnosed. The remaining subjects were classed as having refractive anomalies. The frequency of binocular dysfunctions was 12.9%, and 9.4% for Accommodation anomalies. Accommodation excess (6.4%) more prevalent than Accommodation insufficiency (3%).[31]

- **Moodley VR**:- In this study moodley done vision screening of 264 primary school children age between 6 to 13 year with mean of 9.38 year(SD = 1.85), on that 138 (52.3%) were males and 126 (47.7%) females, he find out that significant number of the children failed the monocular Accommodation amplitude tests (24%), binocular Accommodation amplitude test (26%), the Accommodation facility (30%) and the MEM test (27%). as per this result we can conclude that school age children need more comprehensive vision screening not only vision acuity checkup because this technique had more chances to miss-out many children who had other visual problem that can may effect their ability to perform accurately in school [32]

- **Sterner Bertil**:- In this study they are trying to find out the relation between subjective symptoms at near and Accommodation in terms of amplitude of accommodation and relative accommodation for young school children age between 6 to 12 and they find out the discrimination ability for accommodation both monocular and binocular was significant so accommodation measurement should be perform more regularly , may be as screening specially in children over 8 years of age. [33]

- **Wolfgang duseket,all** :- Describe and compare visual function measures of 328 school age children (6 to 14 year) attending a specialist eye care practice in austria and they find out the high proportions of visual function anomalies in children with reading difficulties and it confirm the importance of a full assessment of binocular visual status in order to detect and remedy these deficits in order to prevent the visual problem continuing to impact upon educational development. [34]

- **Hoffman** :-In this study they find out >85% children with learning disability had Accommodation and vergence dysfunctions. [35]

- **Hokoda**:- The prevalence of general binocular dysfunction with asthenopia was determined for non-presbyopes at an urban optometry clinic serving municipal workers and their dependents. Of the sample of 119 patients, 42.9% had jobs with heavy desk work demands (primarily secretarial and clerical) and 39.5%

were students. The prevalence of symptomatic general binocular dysfunction was 21.0%. Accommodation dysfunctions were the most commonly encountered condition at 16.8%. Symptomatic near esophoria was found in 5.9% of patients and convergence insufficiency in 4.2%. Both vergence dysfunctions overlapped with Accommodation dysfunctions. [36]

- **Mohammed abdul-kabir**:-this study sought to determine the prevalence of Accommodation dysfunctions among Junior HighSchool students in the Sunyani Municipality in the BrongAhafo region of Ghana. All the 204 students who were present in the randomly selected Junior High School on the day of the data collection participated in the study. Among the 204 participants, 65 (32%) were found to have Accommodation insufficiency whilst 54 (26%) had Accommodationinfacility. 80 (39%) out of the 204 participants had at least one of the two dysfunctions with 39 (19%) participants having both dysfunctions. Accommodation anomalies were common among the Junior High School students. [37]

- **Stefania M. Paniccia,et,all**.:- the prevalence of non-strabismic binocular and Accommodation disorders in the pediatric population of Puerto Rico. This study was performed using a random selection of 593 existing health records of patients between the ages of 5 and 20 years. Patients had participated in a complete optometric assessment between the years 2004 and 2012. The criteria for selection were the absence of strabismus, amblyopia, nystagmus, vertical deviation, corneal pathology, retinal pathology, lens pathology and Results of this study indicate that the most common non-strabismic and Accommodation anomalies in the studied population are Accommodation insufficiency (39.0%), convergence insufficiency (12.6%), convergence excess (9.1%), Accommodationinfacility (7.6%) and Accommodation excess(5.1%) . So they concluded that Accommodation and non-strabismic binocular vision problems are prevalent in the pediatric population. Due to the possibility of these non-strabismic and Accommodation anomalies resulting in a reduced quality of life for children and affecting school performance, sports performance, and play activities, an appropriate vision evaluation, diagnosis, and treatment is important. [38]

- **K.M.Daum**:- A retrospective review of the records of 114 subjects with Accommodation dysfunction has been completed. Most subjects (N = 96) were found to have Accommodation insufficiency. Lesser numbers of subjects were categorized in the class of infacility of accommodation (N = 14), spasm of accommodation (N = 3) and fatigue of accommodation (N = 1). A majority of the subjects presented with complaints of blur, headaches and/or asthenopia while attempting nearwork. Most subjects presented with reduced abilities in one or more of the following areas: Accommodation amplitude and facility, fusionalvergence, near point of convergence and stereo acuities. The clinical characteristics of the group as a whole and the major subgroups have been examined both before and after treatment of the condition with orthoptic exercises and/or plus lenses at the nearpoint. The result of the treatment indicates that although most subjects (96%) experienced some relief with treatment only about half (53%) had their problems totally solved.[41]

- **Samuel o. Wajuihianet,all.** :- Done the research of non-strabismicaccommodation anomaly in school children age between 6 – 19 years to find out the prevalence of Accommodation anomaly and they search using the term Accommodation insufficiency, Accommodation excess, Accommodation in-facility and they find out 15 article related to Accommodation anomaly and school children and after analysing they got wide range of prevalence Accommodation insufficiency (0.6 – 36 %) Accommodationinfacility (1.2 – 53%) Accommodation excess (0 – 3.7 %). Most of studies done on school setting (11) with 3 study on optometric practice and 2 in university clinic with sample that vary from 65 to 1910 patient. There is lack of proper diagnostic procedureand classification criteria.[8]

IV. AIM AND OBJECTIVES OF THE STUDY

- *General Objective*

Find out the prevalence of accommodation anomaly in high school children age from 13 to 17 year in clinical population

- *Specific Objective*

Find out Correlation between Accommodation anomaly and COVD-QOL questionnaire symptoms in high school children age from 13 to 17 year in clinical population

V. METHODOLOGY

- *Study design:-*

Aprospective cross-sectional Analytical study will be design to estimate the prevalence of Accommodation anomaly and different type of Accommodation anomaly in school children in hospital

- *Target population:-*

All Patient which are coming to the Dragarwal eye hospital

- *Study population:-*

The population selected for the study will be of age 13th to 17th year who are visited to Dragarwal eye hospital Bangalore

- *StudyApproach:-*

The study will be of quantitative approach.

- *Study setting:-*

Hospital based study

➢ *Study place :-*
Dr Agarwal eye hospital Bangalore.

➢ *Study duration:-*
1st August 2015 to 31stJanuary 2016

➢ *Sample size calculation:* [40]
n = Z^2p * (1- p) / d^2
here n is size of a sample,
Z is Z statistic for a level of confidence,
P is prevalenceexpected,
d is precision,

Z statistic (*Z*): For the level of confidence of 95%, which is conventional, *Z* value is 1.96. in this study we used 95% confidence intervals.

Expected proportion (*P*): This is the proportion (prevalence) that we can get from previous studies.
9.4 % from study done by Francisco lara on clinical population. So for the prevalence of 9.4% p is equal to 0.094.

Precision (*d*): It is very important for investigators to understand this value well. From the formula, it can be conceived that the sample size varies inversely with the square of the precision (d^2). *d* in the formula should be a proportion of one rather than percentage. herefore, by literature recommend *d* as a half of *P*. So d is equal to 0.094/2= 0.047

$n = 1.96^2 * 0.094(1- 0.094) / 0.047^2$
$= 3.842*0.094*0.906 / 0.00221$
$= 0.325 / 0.00221$
$= 147$

So minimum of 147 children were expected to have Accommodation anomalies out of all children age between 13 to 17 yr visited to Dr.agarwal's eye hospital.
The final no of children selected for the study was 160.

➢ *Sampling technique:-*
Convenient sampling method

➢ *Inclusion Criteria:*
All children under 13 to 17 year old who have visited Dr. agarwal eye hospital ,yalahanka , bangalore
Children presenting visual acuity of more than or equal to 20/20 U/O

➢ *Exclusion Criteria:*
Subjects presenting with strabismus/amblyopia
Presence of systemic or ocular pathology
Subjects with dyslexia/learning disability

➢ *Materials:-*
Accommodation measures testing equipment (Scale, VA charts for near and distance, +/- 2.00 D lens flipper, Accommodation rock chart, Timer)
COVD-QOL 19 questions questionnaire to evaluate symptom score

➢ *Ethical Approval:-*
Each patient was explained about the purpose and procedures and a written consent form was obtained from each patient prior to the enrolment in the study.

➢ *Method:-*
When patient is coming to the Dr. Agarwal eye hospital Bangalore age group of 13-17 years they are going under full eye check-up and eye evaluation and they will first fill the COVD-QOL questionnaire of symptom. The assessment of selected patients includes a detailed history, general & comprehensive ocular examination with the help of slit lamp (Anterior part of eyes) and Ophthalmoscope / 90 D (posterior part of eyes)

Visual acuityassessment done with the help of Log MAR visual acuity charts at distance and near.

Subjective refraction was done followed by Objective refraction with the help of retinoscope.

➢ *Near point of accommodation (NPA)*
Pull away method:-Student with best correction for distance and near is given a target of one line above best corrected visual acuity for near (N8 size target). The target card is pull away from subject's eye distance until he/she report a first clear than measured the distance in centimeter. Converting the distance in cm to diopter gives the amplitude of accommodation. The distance is measured from temporal canthus / spectacle frame of his / her eye. The test is done both monocular and binocular. This test was repeated 3 times. Subjective findings were recorded.

➢ *Phoria for Distance and Near*
Phoria for Distance- Over full refractive correction for distance put Maddox rod horizontally in front of right eye and then shows the torch from 10 FEET distance patient will appreciate one light and one vertical red line, now show the light through small hole present in Modified Thorington card and asked to the patient he/she able to see the red vertical line and which side from the small light hole and note the reading.

For measuring the Nearphoria hold the card at 40 cm
If the line coincide with the hole light that meansorthophoria
If the line is right side of the patient Esophoria
If the line is left side of the patient Exophoria

➢ *Negative relative accommodation (NRA) and Positive relative accommodation (PRA)*
Make the patient sit comfortably under a bright illumination with his/her prescription on the trial frame. Place the near chart 40 cm and ask the patient to hold. Now direct the patient's attention to one line better than his/her visual acuity that is N8 . Add plus lenses binocularly, +0.25D at a time, until the subject reports the first sustained blur or double (NRA). Note the total amount of plus added. Return the lenses back to the trial set and leave only the prescription on trial frame. By giving same line as target add minus lenses binocularly,-0.25D till the subject reports

the first sustained blur or double (PRA). Note the total amount of minus added

➢ *Accommodation facility (AF)*

Make the subject sits comfortably under a good illumination with his/her prescription or spectacles. Ask the subject to hold the near word rock chart at 40cm and direct his/her to call out the word after each flip of the lens. Place the +2.00 DS side of flipper in front of subject and ask to report when the print clears. As soon as it clears, flip it to -2.00DS side and ask to report again when it clears. note the number of full cycles that the subject completes. Occlude the left eye and check for right eye and vice versa. Monocular will be followed by binocular

MEM – Objective way of finding of Accommodation Status
High MEM shows lag of Accommodation
Low MEM shows lead of Accommodation
Over full subjective refractive correction perform the retinoscopy and find out the neutrality position from 40 cm
Normal value +0.75 (+/- 0.25)

➢ *AC/A ratio*

To determine the change in Accommodation convergence that occurs when the patients accommodates or relaxes accommodation by given amount. Current study had utilized gradient method for measurement of AC/A ratio. Over full refractive correction hold the Modified Thorington card at 40 cm distance from the eyes and show torch light through the small hole present in center of the card and note the number at which red vertical line coincide than put – 1.00 Diopter lens in front of the both eyes and Note the number at which vertical red line coincide.

The difference between the numbers before putting – 1.00 Diopter lens and after putting – 1.00 Diopter lens is the AC/A ratio.

➢ *Data Analysis*

Data will be captured and analyzed using Microsoft Excel and spss 16

Descriptive statistics were used to analyze the diagnostic data gathered from the existing patient health records. The data was placed into an Excel spreadsheet, and an analysis was performed with the SPSS (Statistical Product and Service Solutions) program

VI. RESULTS

A total of 160 patient were evaluated falling under the inclusion criteria that is age under 13 to 17 year and presenting visual acuity of more than or equal to 20/20 U/O with no sign of strabismus/amblyopia, ocular pathology and dyslexia/learning disability. There were 82 (51%) female and 78(49%) male among 160 patients and the mean age of the patient is 15 ± 2 years.

The prevalence of Accommodation anomalies among high school children in clinical population in Bangalore were 56% (N= 90). Among 90 Accommodation anomalies children most prevalent condition is Accommodationinfacility 46% (N= 41) followed with Accommodation insufficiency 33% (N= 30) and Accommodation excess 21% (N= 19).

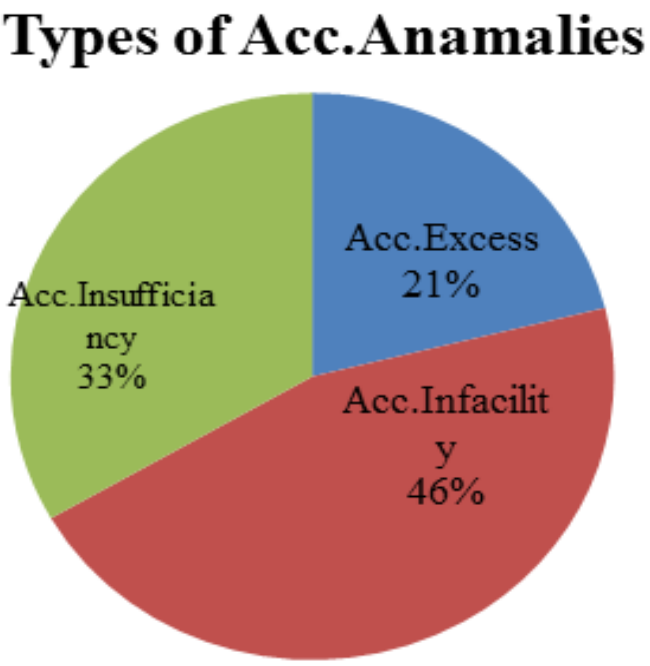

Fig 4

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While the comparing of Accommodation anomalies among 90 children between male and female, female 49 (54.5%) are more prevalent than the man 41 (45.5%).

Distribution of Accommodation anomalies according to male and female Shows that Acc.infacility is more and Acc.excess is less prevalent in male and female both.

Out of 49(100%) female 22(45%) having Acc.infacility, Acc.insufficiency 14(29%) and Acc.excess 13(26%) respectively out of 41(100%) male 19(46%) Acc.infacility, Acc.insufficiency 16(39%) and Acc.excess 6(15%).

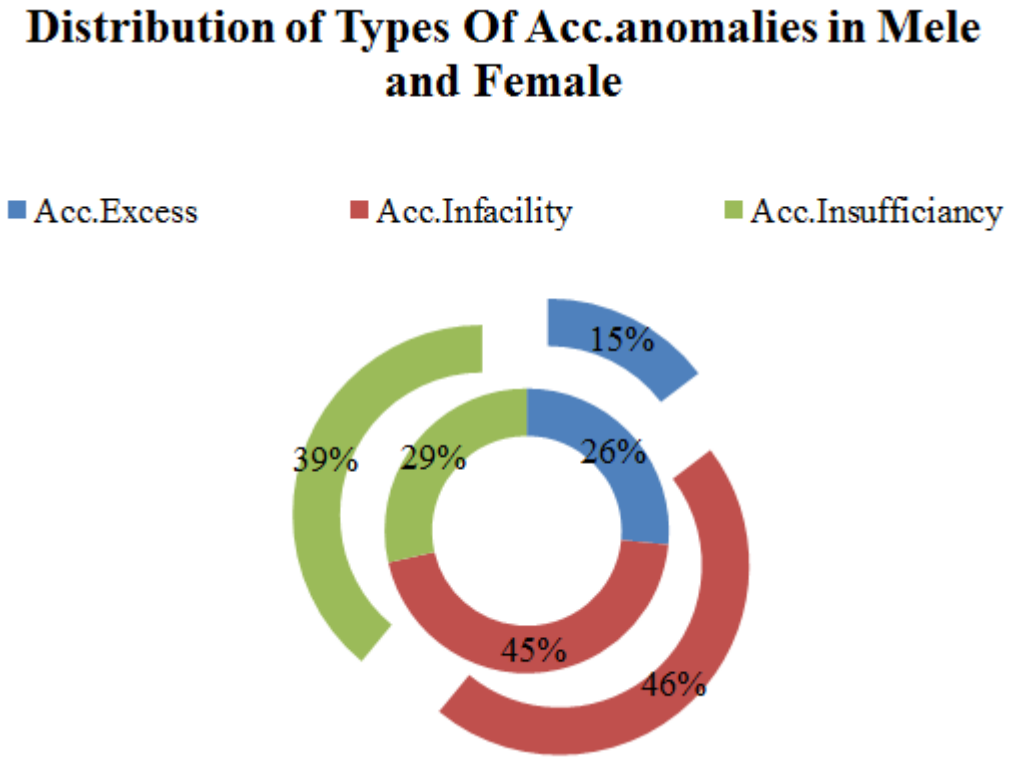

Fig 5

➢ *Acc. Anomalies in percentage outer rim is for male and inner rim is for female*

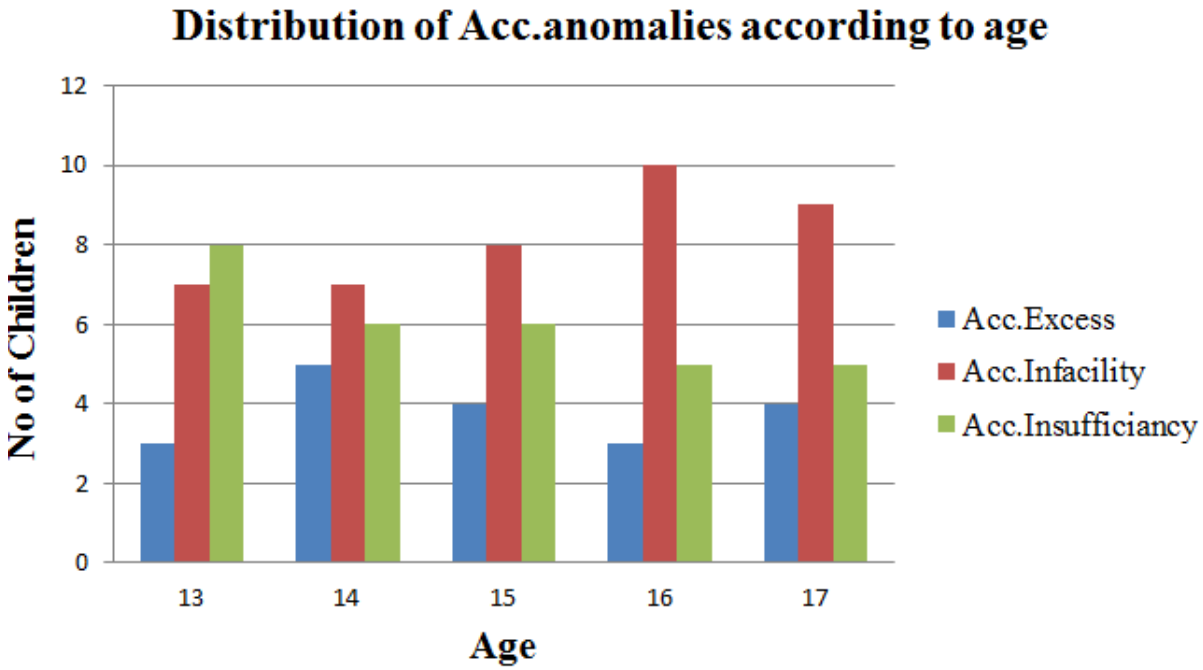

Fig 6

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➢ *Accommodation anomalies in respect to age of children*

According to the correlation between Age and Accommodation anomalies, Acc. Infacility is more prevalent than Acc. Insufficiency and Acc. Excess in all the age group children except 13 age group children which having Acc. Insufficiency more prevalent than Acc. Infacility and Acc. Excess. While the Acc. Excess is less prevalent in all the age group.

Correlations between Acc. Anomalies and COVD-QOL score shows that out of 160 high school children only 14 children got more than 20 score and 146 children got less than 20 score shows in table 3. COVD-QOL score shows not significant (p= 0.060) on that 3 children below 15 and 11 above 15 year.

		COVD-QOL score					Total
		0 - 4	5 – 9	10-14	15 -19	20 and above	
Age	Below 15	13	26	12	13	3	67
	Above 15	8	28	28	18	11	93
Total		21	54	40	31	14	160

Table 3

Above table shows that Above 15 year children got more score in all the COVD-QOL score group.

According to COVD-QOL 146 children are asymptomatic but Out of 160 only 3 children are not having any symptom other than that 157 children having atleast one symptom and if score are distributed in 5 groups, group 1(0 - 4), group 2(5 - 9), group 3(10 - 14), group 4(15 - 19), group 5(20 and above).

Than we found out that group 2 got the highest score (54) than group 3(40), group 4(31), group 1(21) and group 5(14) respectively

- Normal Children got the more score in 1st group
- Acc.infacility got the more score in 2nd group
- Acc.Insufficiancygot the more score in 3rd group
- Acc.Excessgot the more score in 2nd group
- Other got the more score in 3rd group

		COVD-QOL Score					Total
		0 - 4	5 - 9	10-14	15 -19	20 and above	
Diagnosis	Normal	17	12	4	4	2	39
	Acc.Infacility	2	16	13	5	5	41
	Acc.Insufficiancy	0	7	11	9	3	30
	Acc.Excess	2	10	2	4	1	19
	Other	0	9	10	9	3	31
Total		21	54	40	31	14	160

Table 4

VII. DISCUSSION

This is 1stcross-sectional Analytical study done using strict diagnostic Criteria According to scheiman& wick[7] table no- 2 and a comprehensiveevaluation of the prevalence of accommodation anomalies in a paediatric clinical population in Bangalore. As this is a clinical population study so the prevalence of accommodation anomalies is expected to be higher than the population as a whole. This study haslimitations most notable one is this study restricted to the clinical paediatricpatient's age between 13 to 17 yr in Dr.Agarwal's eye hospital. Binocular vision dysfunctions is a condition where the both eye line of sight is not properly align and accommodation anomalies is eyes focusing capability at any one point reduced and this both condition put heavy strain on the eye muscles as they are constantly trying to correct the alignment and trying to focus to achieve clear single binocular vision. This study not only aims to find out the prevalence of accommodation anomaly among high school children but also to determine the distribution of different Accommodation anomalies and correlate with COVD-QOL symptoms questionnaire.

➢ *Prevalence of Accommodation anomalies*

Porcar done the study on clinical population and he find out Accommodation excess is more prevalent in 32.3% of Accommodation and NSBVD, while Dwyar was find out disorders of accommodation and vergence disorders where it has affect 57 % and 58 % of the sample from age between 7 to 18 year in clinical population. In the study done by Francisco 22.3 % of patient had some form of Accommodation or binocular dysfunctions on that accommodation excess are prevalent.Because these dysfunctions may have a negative effect onperformance so appropriate vision evaluationfor this populationisimportant.Moodley, sterner and wolfgang suggest that comprehensive vision screening

(accommodation and binocular dysfunctions measurement) is more important to reduced the visual problem that could impact on performance in school on the basis of his study result.

Hokoda, Md Abdul, stefania, Pilar, Daun and the entire researcher done study on clinical population find out Accommodation Anomalies are more prevalent

In literature it is shows that there is a difference in prevalence rate of accommodative anomaly due to different in population size, diagnostic criteria, identical population so all the result are not reliable but the prevalence of Accommodation anomalies is high. The differentiation of patients on the basis of their age is important when we are considering prevalent values. Young children subjective response can vary in many test as compare to adult so it cannot be fully reliable that's why it must be taken into account at the time of diagnose young children but most of the binocular vision anomalies like accommodative amplitude, monocular and binocular accommodative facility, near point of accommodation and convergence, fusionalvergence, etc diagnose on the basis of subjective responses. In spite of that, these point must be taken into consideration to understand why we cannot compare prevalence of both different populations so according to this study diagnosis criteria is fixed and the population is clinical population of high school children that is identical so the result of this study is reliable and on the basis of this diagnosis criteria clinical population can diagnosed and treatable. Study in Paediatric clinical population shows that 5 patient coming to the hospital out of that approx 2 had accommodative anomalies. According to result of this study the prevalence of Acc.Anomalies in clinical population is 56%. In the literature the frequency of Accommodation anomalies varies from 9 to 57 %. Prevalence of types of Acc. Anomalies is Acc. infacility 46%, Acc. Insufficiency 33% and Acc. Excess 21% respectively in paediatricpatient's age between 13 to 17 yr in Dr.Agarwal's eye hospital. In respect to gender female(54.5%) are more prone to get acc.anomalies than the man(45.5%) and in both the gender Acc.infacility is higher than Acc.insufficiency and Acc.Excess. If we consider the age than age wise 16 yr children havingAcc.infacility much higher than other age group except 13 yr children, on them Acc.insufficiency is higher than acc.infacility and excess. As we knows that this age group children are more expose to near work like reading , writing etc so constantly they are focusing on near object so maybe they are not able to relax or stimulate their accommodation fast that's why this age group children are more prevalent to acc.infacility.COVD-QOL shows that very less children are got more than 20 score out of 160 children only 14 children got so according to COVD-QOL only 14 children are symptomatic but out of 160 children only 3 children got zero score other than that all the children 157 got atleast 1 symptom so COVD-QOL is fails to find out the symptomatic children.

And if we distribute the COVD-QOL score in 5 group as mentioned in result part PAGE NO- 45

That shows above 15 yr got more COVD-QOL score. Maximum children got the score between 5 to 9 (54 children) than 10 to 14 (40 children) than 15 to 19(31) and 20 above (14).

Out of 14 children got 20 and above COVD-QOL score on them 11 are above 15 yr and 3 are below 15 so COVD-QOL score more reliable in elderly children.

If we correlate Accommodation anomalies and COVD-QOL score than we find out Acc.infacility got more score on 20 and above and normal children got more score between 0 to 4 in COVD-QOL and overall COVD-QOL score also Acc.infacility got the high score than other acc.anomalies. Result of this study based on statistical data must be taken into consideration when applied to pediatric clinical population of Bangalore in its entirety. The high prevalence determined here gives credence to previously published literature indicating that besides refractive error, binocular and Accommodation anomalies will be the most frequent source of visual complaints in paediatric population

VIII. CONCLUSION

Accommodation anomalies are most important in the learning process of the paediatric population and this Acc. anomalies negatively impact on child study and performance in school. As we know according to Hoffman [(39)]>85% children with learning disability had Accommodation and vergence dysfunctions, result of the treatment indicates that although most subjects (96%) experienced some relief from symptoms with treatment but only about half (53%) had their problems fully solved.[(16)]In this study we found that the prevalence of Accommodation anomalies is 56 % in high school clinical population and more prevalent in female than the male.

Distribution of Accommodation anomalies that is Acc. infacility 46%, Acc. Insufficiency 33% and Acc. Excess 21% respectively in paediatric patients age between 13 to 17 yr in Dr.Agarwal's eye hospital.

On the basis of this result we can suggest the optometrist or eye health care professional to do binocular vision check up on regular basis and parent of the children for regular comprehensive eye check-up not just a vision check up and go for vision therapy if required as we know ''vision therapy is best treatment for Accommodation and binocular vision anomalies". [(43)]

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