

Feature & Early Management of Childhood Intermittent Exotropia Patients Present in Tertiary Eye Care Center of Uttar Pradesh

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Abstract:

The Intermittent exotropia/IXT is a type of childhood strabismus in which the outward movement of one eye occurs intermittently, with inconsistent control of the binocular and decreased sensory capability. Early diagnosis and proper treatment is essential to preserve ocular positioning, binocular vision and stereopsis. The current paper was done to estimate the clinical presentations and initial treatment of childhood intermittent exotropia in patients in a tertiary eye-care centre in Uttar Pradesh. A quantitative, cross-sectional, retrospective study was undertaken in children aged 5-15 years old diagnosed with exotropia. Clinical records were used to collect information and included demographic factors, refractive status, alignment of oculars, the prism bar cover test (PBCT) distance angle and initial management plan. There were 115 patients used and the mean age was 7.57 ± 2.55 . The study population was 51.3% women and 48.7% men. The strategy that had the highest prevalence of documentation was spectacle-only management (62.6%), which was then closely followed by occlusion/patching (24.3%), and surgery (10.4%). Statistically, the management strategy did not have a significant relationship with gender. Equally, age, PBCT distance angle and stereopsis, as well as, PBCT distance angle were also not statistically different in management groups ($p < 0.05$). The results endorse early clinical review and personalized treatment of childhood IXT, and the conservative treatment is a significant part of the initial treatment.

Keywords: Intermittent Exotropia; Childhood Strabismus; Stereopsis; Patching; Early Management.

I. INTRODUCTION

Intermittent exotropia (IXT) is a widespread type of childhood strabismus where one eye periodically displaces outwards, especially when the child is fatigued, disinterested, sick or looking at objects at a distance [1]. Though the deviation might initially be very well managed using binocular mechanisms, it can worsen as the child grows and this can be impacting on the visual functionality i.e. binocular vision and psychosocial functionality of the child. Intermittent exotropia is a significant paediatric eye disorder in India, with little evidence available, especially on its prevalence, clinical features and the outcome of long-term management [2]. IXT has a variable clinical manifestation. Skew eyes, asthenopia, headache, intermittent diplopia or blurred vision may occur in children. Certain children also show the effect of the day's variation, and the fluctuation is more prominent towards the end of the day or in bright sunlight. Proper evaluation should thus encompass a detailed ophthalmic and orthoptic assessment which includes visual acuity, refractive examination, ocular tracking, binocular vision, ocular movement and fundus.

The treatment of IXT would vary according to age, frequency and extent of deviation, binocular control, symptoms and progression. The non-surgical methods are spectacles, over-minus lenses, alternate occlusion, prisms and orthoptic exercises [3]. There is some evidence that these interventions may enhance better control and possibly postpone surgical treatment but their effects and long-term outcomes vary between patients. Surgical intervention can give satisfactory short term alignment although recurrence is a significant issue. It is against this backdrop that this study aims at studying the characteristics and early treatment of childhood intermittent exotropia in patients visiting a tertiary eye-care centre in Uttar Pradesh. The research tries to investigate the clinical profile of the affected children and record the management strategies, thus espousing better knowledge and early clinical management of IXT in the Indian setting.

II. RELATED WORKS

Intermittent exotropia (IXT) is a usual childhood optical alignment disease wherein an outward movement periodically happens with binocular management also sporadically. The condition can be treated conservatively or surgically based on the extent of deviation, control, sensory status, refractive error and clinical progression. Past studies have thus been aimed at knowing the natural history of IXT and determining suitable early interventions. Part-time patching and observation In a randomized clinical trial, Pediatric Eye Disease Investigator Group (PEDIG) compared both part-time patching and observation among children with intermittent exotropia. The research established that part-time occlusion might offer an advantage in sustaining or enhancing the control of the deviation than observation. At least these findings favour patching as a possible early, non-surgical interventional approach, especially in children with binocular functional saving being a priority [15]. Cooper and Medow suggested a practical grouping of intermittent exotropia, which took into account various clinical manifestations, such as basic and divergence-excess forms. Their effort shifted focus on the significance of assessing the distance and near miss in determining the right management strategy. Such a functional strategy is not outdated since in IXT the treatment decision can not be made only in relation to the presence of an outward deviation but the nature and regulation of the deviation should be taken into account as well [16].

Conservative treatment has also been explored such as vision therapy. Pang, Allison and Frantz were able to present a prospective controlled study to explore the impact of vision therapy on intermittent exotropia. Their study showed that organized visual training can work towards bettering binocular control and visual performance. This gives justification to the thought of orthoptic as an element of personalized early interventions especially when the patient has adequate binocular capacity [17]. Another factor that is critical in deciding treatment is the natural history of IXT. Holmes, Hatt and Leske studied the natural history of intermittent exotropia and the factors that relate to when surgery is necessary. Their results underlined that all children do not progress in the same way, and clinical observation plays a significant role in making the decision on whether the conservative treatment should be continued or surgery is needed [18]. Surgical therapy has been tested on a great scale. Ing and colleagues conducted a study to examine bilateral lateral rectus recession in childhood intermittent exotropia and found out the results of surgical repair. Surgery may enhance the optical alignment, but a post-surgical outcome and recurrence are also critical factors to consider when deciding when and whether to carry out surgery [19]. In a similar way, Chia, Roy and Seenyen talked about comitant horizontal strabismus in the view of the Asian people, evidence that is pertinent to the clinical presentation and management of horizontal deviations in the Asian groups [20].

Control variability is encompassed especially in IXT. Hatt et al. showed that intermittent exotropia control can be increasing or decreasing, which means that a single clinical observation may not be a complete reflection of the functional condition of the child. This facilitates repeated testing and personalized treatment planning as opposed to measurement of a single measurement [21]. Issaho, Alves and de Carvalho reviewed additional surgical evidence and found that surgical work in intermittent exotropia evaluated the success of surgery by considering both preoperative features and postoperative alignment [22]. Similarly, Kushner also indicated that distance-near disparities are vital in choosing patients to undertake surgery, thus the necessity of clinical assessment prior to operative treatment [23]. Rosenbaum also has described adjustable sutures as a method that could yield benefits in specific strabismus surgery and which face practical constraints, as well [24]. Lastly, Pratt-Johnson and Tillson made comparisons between early and late surgical intervention, which is still debatable with regard to timing as to when surgery should be performed to treat intermittent exotropia [25]. In general, the literature reviewed suggests that successful IXT care involves early diagnosis and proper evaluation of binocular performance and personalized treatment. Selected children might respond to conservative interventions of spectacle correction, patching and vision therapy, whereas surgery is also of value to patients with poor control or significant clinical progression. The findings form the foundation of studying the clinical presentations and initial management trends of childhood IXT in this study.

III. METHODS AND MATERIALS

3.1 Study Design and Approach

This study was a non-probability purposive cross-sectional study adopted as a retrospective, quantitative study. The methodology was chosen to investigate the clinical presentation of childhood intermittent exotropia (IXT) as well as record early management strategies of the condition that are offered to the affected children [4]. The retrospective method helped the researcher to check previous clinical records and reference appropriate ophthalmic and

orthoptic results without any extra interventions to the subjects. This research was carried out according to the principles of the Declaration of Helsinki [5]. The ethics review board and ethics committee gave ethical approval to the study. Children and their parents or guardians who were present with them during the examination gave informed consent.

3.2 Study Centre

The experiment was done at the Department of Ophthalmology, Shri Ram Murti Smarak Institute of Paramedical Sciences, Bareilly, Uttar Pradesh. It offers services related to the assessment and management of ophthalmology and has an orthoptic clinic where children with ocular alignment disorder can be referred to [6]. The main source of information in this retrospective study was the patient records of the orthoptic clinic.

3.3 Study Population

The sample size was 37 children who visited the Ophthalmology Outpatient Department complaining of intermittent exotropia. The study protocol that is available has a range of age 5 to 15 years of patients having exotropia. Cases that were eligible were identified and classified based on their presenting signs, symptoms and clinical investigations [7]. The following pertinent demographic and clinical data were then obtained using patient records available to them.

Table 1: Study Population and Eligibility Criteria

Parameter	Description
Study centre	Department of Ophthalmology, Shri Ram Murti Smarak Institute of Paramedical Sciences, Bareilly
Study population	Children presenting with intermittent exotropia
Age range	5–15 years
Sampling method	Non-probability purposive sampling
Study design	Retrospective, quantitative, cross-sectional
Inclusion criterion	Patients aged 5–15 years with exotropia
Exclusion criterion 1	History of trauma or previous ocular surgery
Exclusion criterion 2	Ocular infective pathology
Exclusion criterion 3	Nystagmus and poor fixation

3.4 Sample Size

The formula to calculate the sample size was:

$$n = Z^2 P(1-P)/E^2$$

As shown by n being the initial sample size, P was the estimator prevalence, E was the error and Z was the value at the chosen level of confidence. The paper employed a prevalence estimate of 20 percent (0.20), margin of error of 5 percent (0.05) and a 95 percent confidence interval of 1.96 which is a Z value [8]. It was assumed that there would be a total population of 500 and that the required sample size would be about 115.

Table 2: Sample Size Calculation Parameters

Parameter	Value
Estimated prevalence (P)	20% (0.20)
Margin of error (E)	5% (0.05)
Confidence level	95%
Z value	1.96
Total population (N)	500
Calculated sample size	Approximately 115

3.5 Data Collection Procedure

The data were gathered by conducting an elaborate search of available clinical history of patients who had visited the orthoptic clinic. All of the eligible records were analyzed in a systematic manner in order to find information pertinent to the study objectives. Variables that were extracted were patient history, demographic, refractive status, ocular alignment, binocular vision, extraocular muscle motility and fundus examination results. The information about the management approaches to prescribe to each patient was also stored, such as methods such as spectacle correction to surgery [9]. The elucidation of thorough clinical history was regarded as a significant element of the examination. Data on age, sex, residence, presenting complaints, age of exotropia onset and duration were taken. Special focus was placed on the reports about outward deviation, particularly in the framework of fatigue, sickness/decreased attention. Where documented, other symptoms like asthenopia, headache, intermittent diplopia and blurred vision were also taken note of. The diurnal variation was also checked in the records, such as greater visibility of the deviation later of the day or with sunny sunshine [10].

3.6 Ophthalmic and Orthoptic Assessment

While conducting the clinical examination, visual acuity was evaluated using a Snellen chart. Visual acuity was considered in assessing impaired vision and potential amblyopia. Refractive information was examined that could determine applicable refractive errors and an ocular alignment test was taken into consideration that can determine the deviations of the exotropia [11]. Additional clinical records also yielded binocular vision status, extraocular muscular motility and fundus appears. The management information recorded in the records were scanned to determine the early treatment plans used on children with IXT. Treatment may involve spectacle correction, non-operative and surgical procedures depending on the clinical manifestation. Both the clinical presentation and the management pathway that was documented in each patient were therefore taken into account in the study [12].

3.7 Ethical Considerations

The secrecy of patient data was ensured during the research. Involvement was optional and the documentation of the study stated that the participants were at will to withdraw without impact on the healthcare that was given to them. Since the research was retrospective, data were collected using available clinical records, and ethical protocols and informed consent obtained according to the study protocol.

IV. RESULTS AND ANALYSIS

4.1 Demographic Characteristics of the Study Population

The current research examined 115 cases of children who had a diagnosis of intermittent exotropia (IXT) 5 to 15 years of age. The average age of the participants was 7.57 years of age $\pm$ 2.55 years, with it being evident that younger children are concentrated around that age range. The median age of presentation was 5 years meaning that IXT was often found at the tender school years.

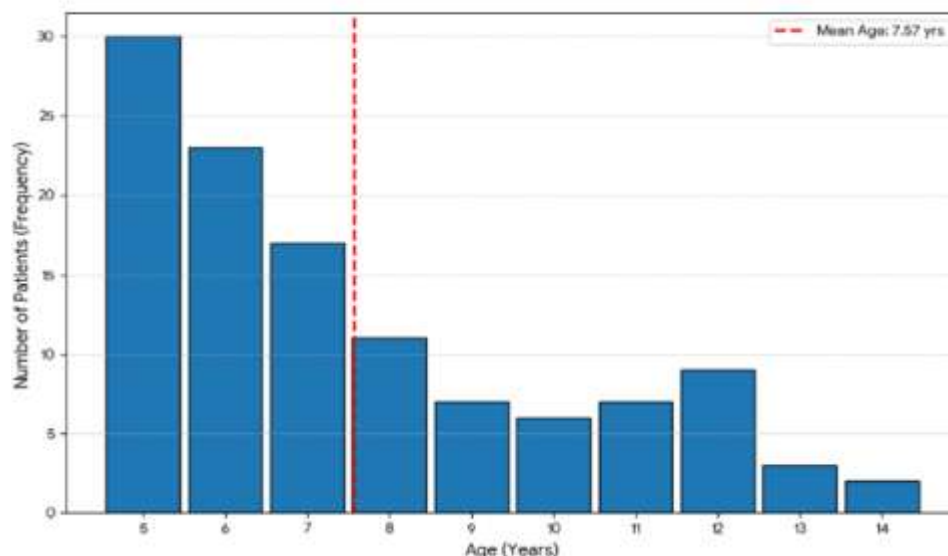


Figure 1: “Age distribution of IXT patients”

The prevalence of cases in young children is clinically significant as the duration is an active phase of binocular visual development. The early diagnosis offers a chance to test ocular alignment, sensor fusion and stereo-punk and the deterioration becomes more defined with time [13]. The results thus indicate that childhood IXT was mostly experienced in the younger section of the research sample.

Table 1: Demographic Characteristics of IXT Patients

Characteristic	Result
Total number of patients	115
Age range	5–15 years
Mean age $\pm$ SD	7.57 $\pm$ 2.55 years

Most common age	5 years
Female participants	51.3%
Male participants	48.7%

The gender ratio was nearly equal but there was a slight female dominance. The percentage of females was 51.3 and male was 48.7. This is a somewhat equal distribution that indicates that IXT influenced similar degrees in the study population of both sexes. Notably, gender was further evaluated to identify the presence of gender differences to assess that it affected the selection of the management in the first place [14].

4.2 Clinical Measurements

The main clinical measurements were age, and spherical equivalent (SE) of each eye, prism bar cover test (PBCT) the distance of each eye and stereopsis. These variables gave data regarding the demographic features, refractive condition, motor alignment and binocular sensory conditions.

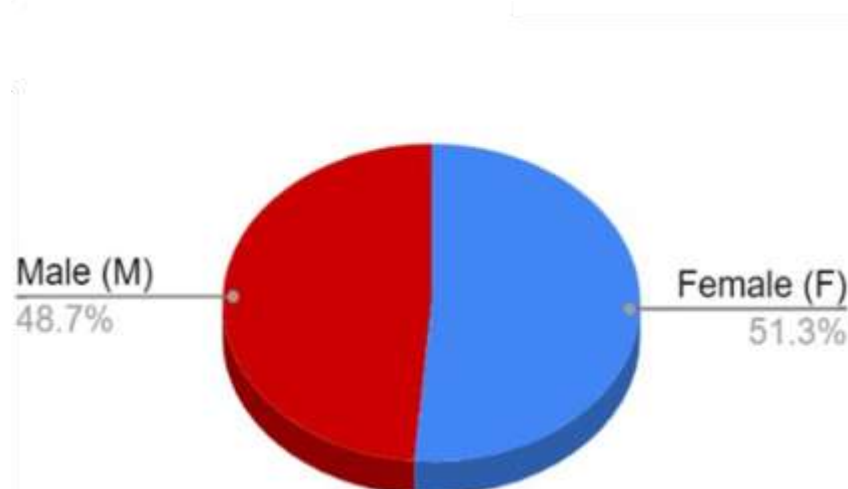


Figure 2: “Gender distribution of participants”

The mean spherical equivalent was -0.78 ± 1.41 D in the right eye (OD) and -0.16 ± 7.17 D in the left eye (OS). The findings thus showed a slight general tendency towards myopia but the large deviation recorded in the left eye showed that there was a great deal of variation among the cohort. Mean of the PBCT distance angle was 1.45 (T16) SD 6.01 prism dioptres (PD), with a range of 10x in 0 to 30 prism dioptres (PD). The PBCT information, however, was only available on 69 patients. 107 patients were provided with stereopsis. The average stereopsis was 35.89 ± 58.31 seconds of arc with a range of 0- 200 seconds of arc [27]. Such a large standard deviation means that there is significant diversification in the binocular sensory functioning of individual patients.

Table 2: Clinical Measurements of Study Participants

Clinical factor	Eye/Unit	Mean $\pm$ SD	Range	Available cases (n)
Age	Years	7.57 ± 2.55	5–15	115

Spherical equivalent	OD	-0.78 ± 1.41 D	-13.00 to $+14.00$ D	115
Spherical equivalent	OS	-0.16 ± 7.17 D	-12.25 to $+73.88$ D	113
PBCT distance angle	PD	1.45 ± 6.01	0–30	69
Stereopsis	Seconds of arc	35.89 ± 58.31	0–200	107

The results of the PBCT must not be carefully interpreted since the mean angle was rather low as compared with the value that was actually taken. This could lead to believe that a good share of the patients were identified when their deviation was comparatively stable. However, compared to the total population in the study, the size of the PBCT sample was smaller, thus conclusions drawn on the variable should be taken with a grain of salt [28].

4.3 Distribution of Initial Management Strategies

The analysis showed that the most commonly used approach of initial treatment was spectacle-only management. Out of the 115 patients a total of 72 (62.6%) patients were treated using spectacles. This was furthered by occlusion/patching on 28 patients (24.3) and surgery on 12 patients (10.4). Three patients (2.63%) were categorised as missing or uncategorised management information.

Table 3: Distribution of Initial Management Groups

Management group	Number of patients (n)	Percentage (%)
Spectacles only	72	62.6
Occlusion/Patching	28	24.3
Surgery	12	10.4
Unknown (missing/uncategorised)	3	2.6
Total	115	100.0

The dominance of spectacle correction means that the major starting practice in this group was a conservative optical management. Refractive correction was also thought to provide a significant basis of management since the uncorrected refractive error can disrupt accommodation, convergence and fusional control. A comparatively large percentage of spectacle-only cases thus indicates that there is a focus on correcting modifiable refractive factors and then advancing to more aggressive measures [29]. The second-largest treatment group was flagellation/patching. Occlusion was at part time especially in situations where risk of suppression or amblyopia were

deemed to be pertinent. The proportion of surgical management was relatively small, 10.4% of patients. This distribution shows that non-surgical techniques were initially applied to most children.

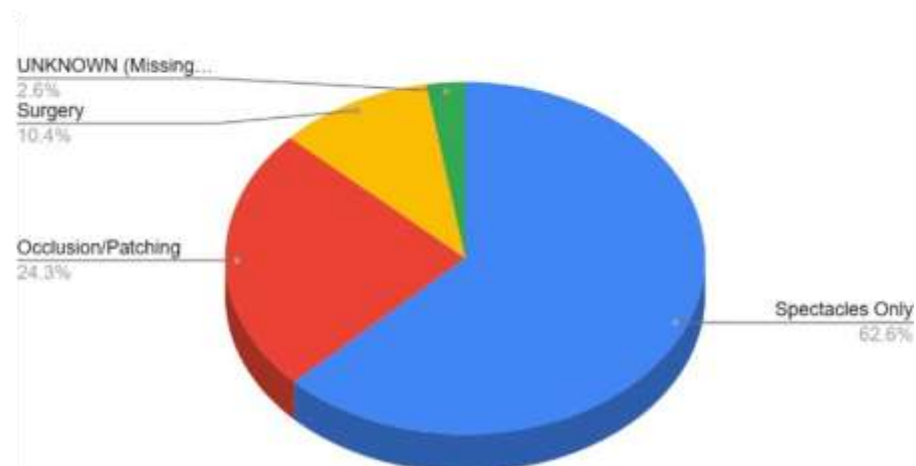


Figure 3: "Management plan for IXT patients"

4.4 Association Between Gender and Management Choice

To establish whether gender was in relation to the initial management strategy, a Chi-square test was done. All 115 complete cases were analyzed. The Chi-square value calculated was $\chi^2 = 3.797$ having 6 degrees of freedom, and the p-value was 0.704.

Table 4: Association Between Gender and Initial Management

Statistical test	Value
Test used	Chi-square
Sample size	115
χ^2 value	3.797
Degrees of freedom	6
p-value	0.704
Statistical interpretation	Not significant

Since the p-value exceeded 0.05, there was no statistically significant difference between gender and the management group. In this way, even though some female domination was found in the general sample, nothing in the data suggests that the choice in the initial treatment was determined by gender. Clinical considerations rather than sex of the child tended to be used as a basis in making management decisions.

4.5 Association of Continuous Clinical Factors with Management

ANOVA was applied to investigate the differences between continuous clinical variables observed in the first and second groups of management measured as significant differences. Age, spherical equivalent on both eyes, PBCT distance angle and stereopsis were all tested.

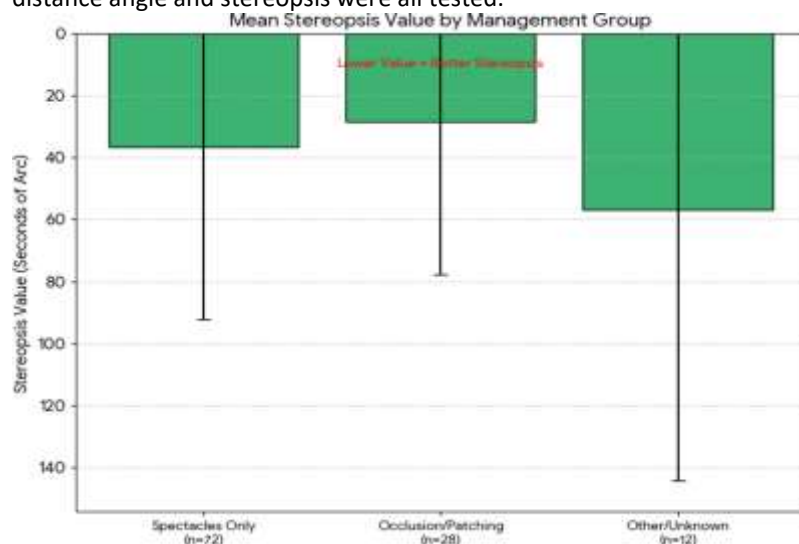


Figure 4: “Mean stereopsis value by management group”

The findings showed that the other analyzed variables, all of them continuous, did not exhibit a statistically significant relationship with management choice. Age produced an F-statistic of 0.588 and $p = 0.624$. The spherical equivalent of the right eye yielded $F = 1.797$ and $p = 0.152$ and the spherical equivalent of the left eye was $F = 0.768$ and $p = 0.514$. The PBCT distance angle produced $F = 0.659$ and $p = 0.580$, and stereopsis produced $F = 1.024$ and $p = 0.385$.

Table 5: ANOVA Results for Continuous Clinical Factors

Clinical factor	F-statistic	p-value	N used	Interpretation
Age	0.588	0.624	115	Not significant
Spherical equivalent (OD)	1.797	0.152	115	Not significant
Spherical equivalent (OS)	0.768	0.514	113	Not significant
PBCT distance angle	0.659	0.580	69	Not significant
Stereopsis	1.024	0.385	107	Not significant

These results suggest that age, refractive status, PBCT distance angle and stereopsis were not able to account for the use of the starting strategy of management in this sample separately. A non-statistically significant result does not imply that the given clinical variables did not play their role in the specific care of individual patients, but only indicates that no significant difference between treatment groups was identified by the employment of the statistical comparisons that the study provided [30].

4.6 Comparison of Clinical Factors Across Management Groups

The ANOVA analysis did not show any statistically significant difference yet, there were numerically significant differences among the management groups. The spectacles-only sample included 72 patients, with the mean values of the spherical equivalents of the OD and OS consisted of -0.59 and -0.57 respectively with a standard deviation of 0.63 and 0.71, respectively. The occlusion/patching group included 28 patients, with mean values of -1.15 ± 2.51 D in OD and $+1.63 \pm 14.93$ D in OS. Statistical comparison between the other/ unknown group had 12 patients and the mean spherical equivalents were -1.24 ± 1.23 D in OD and -1.57 ± 1.61 D in OS. The results of the stereopsis were outstanding. The lowest mean stereopsis value was found in the occlusion/patching group, 28.33 ± 49.31 seconds of arc as compared to the spectacles-only group, 36.47 ± 55.90 seconds of arc. The highest mean was observed in the other/unknown group with a seconds of arc of 56.67 which was the highest and a standard error of 87.73. There was numerically most favourable sensory performance in the occlusion/patching group since it had low seconds-of-arc values, suggesting superior stereopsis.

In general, the findings reflected that childhood IXT of this tertiary-care cohort was largely diagnosed in younger children, with an almost equal gender balance. The first approach to treatment, especially spectacle correction, was conservative management. The second most frequent strategy was occlusion/patching with the best numbers in favour of stereopsis mean. Nevertheless, statistical analyses revealed no significant correlation between management selection and measured demographic or even clinical variables. The results thus endorse the idea of an individualised management of early IXT and the fact that the retrospective design, as well as the absence of PBCT and stereopsis observations results in the lack of strength in the subgroup comparisons.

V. CONCLUSION

Intermittent exotropia (IXT) is a noteworthy type of childhood strabismus where early diagnosis and proper treatment are crucial in preserving binocular single vision, stereopsis and satisfactory ocular positioning. The current study assessed the demographic and clinical character and initial management practice of 115 children between the ages of 5 and 15 years in one of the tertiary eye-care centres of Uttar Pradesh. The results indicated that IXT was mostly watched when primary school teachers were only at the initial stages of teaching with the average age of 7.57 ± 2.55 years and also represented by a larger number of younger students. The gender distribution was quite equal with a small predominance in females (51.3%). The results of refractive assessment showed a difference in the spherical equivalent and results of stereopsis and prism bar cover test showed that there was a difference in the binocular sensory and motor functions among individual patients.

When it comes to management, spectacle correction was the most common method employed (62.6%), then it is occupancy/patching therapy (24.3%) and ultimately surgical management (10.4%). This distribution shows that the early management in the study population was predominantly conservative in nature. The group when not patched showed the highest mean stereopsis numerically which could imply a potentially useful sensory effect, but this finding should not be seen as evidence of treatment superiority due to the lack of significant differences in the statistical comparisons. ANOVA analysis and Chi-square test results revealed that there was no statistically significant relationship between strategy of management and age, refractive status, distance angle of PBCT angle, stereopsis or gender ($p > 0.05$). Thus, the choice of treatment seems to entail numerous clinical factors instead of being predetermined by one demographic or clinical parameter that could be measured. Quichen as well, the relatively small quantity of surgical cases and lack of clinical measurements, also restricts the strength of subgroup comparisons. In general, the research advocates the significance of early identification, thorough use of binoculars and personalized conservative treatment of childhood IXT. Enhancing school vision screening, periodic evaluation of eye position and stereopsis, and education of parents can help to make an early diagnosis and treat it. Subsequent longitudinal and multicentric research is suggested to assess the long-term treatment and provide a more solid case in support of early management intervention in children with IXT in India.

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