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Assessment of binocular functions in intermittent exotropia before and after surgical correction

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Abstract
Background: Intermittent exotropia (IXT) is a common form of childhood exotropia. It is an exodeviation which is controlled by fusional mechanisms. Exotropia is usually preceded by exophoria, and the deviation is mostly noticed when children are tired, ill, inattentive or after long period of near work. The aim of this work was to detect if a patient with IXT had improved in binocular functions after surgical correction.
Methods: This current study was carried out on 100 patients aged above 5 years old, both sexes, diagnosed with IXT. Assessment of binocular functions made through worth 4- dots test, Baglioni striated glasses test, four diopters base out prism test, titmus stereo test, TNO test and Frisby test.
Results: Significant relation between motor alignement in near and in far and the fusion 6 months post-operative (p=0.001). Stereoacuity in log sec of arc, pre- and post-operative angle of deviation and worth four-dots test in far and in near showed significant difference in one week, one month, six months after operation. Preoperative stereoacuity measured by Titmus, TNO and Frisby had significant effect (P = 0.001, 0.007, 0.006 respectively). Better preoperative stereoacuity is associated with better postoperative motor outcome and alignment stability.
Conclusions: Exotropia often disturbs the binocular functions. Bagolini test is less dissociative than worth four-dot test. Surgical correction of IXT causes improvement in sensory fusion. Successful motor alignment improves stereoacuity.

Keywords: Binocular functions, intermittent exotropia, surgical correction, stereoacuity, worth four-dot test, bagolini test

Introduction
Binocular vision is the coordinated use of both eyes to produce a single mental impression. It has many advantages, e.g., a wider field of view, stereopsis & binocular summation [1].
Intermittent exotropia (IXT) is a common form of childhood exotropia. It is an exodeviation which is controlled by fusional mechanisms. Exotropia is usually preceded by exophoria, and the deviation is mostly noticed when children are tired, ill, inattentive or after long period of near work. Adult patients may manifest exodeviation after taking sedatives or alcohol [2]. Children with intermittent exodeviations are less frequently symptomatic because, unless the deviation is of recent onset, a well-developed suppression mechanism eliminates diplopia. Photophobia and monocular closure in presence of bright light is common complaint with IXT. The control of IXT can be assessed in a variety of ways; parental report and office assessment [3]. One of them is the Newcastle Control Score (NCS).
Exotropia often disturbs the binocular functions. During the phoric phase of IXT, the patient may have a bifoveal fixation with excellent stereopsis between 40 and 60 seconds of arc. During the tropic phase, most patients have large regional suppression of the temporal retina. A small number may show the monofixation syndrome [4]. Even significant amblyopia may occur in some patients [5].
Treatment of choice for IXT is still debated. It includes over minus lenses, improving range of sensory fusion by orthoptic training, prism therapy and surgical correction. Surgery with orthoptic/occlusion therapy preoperatively had the highest rates of success [6]. Surgical correction substantially help to rebuild the binocular vision of both distance and near [7].
The aim of this work was to detect if patient with IXT was got improvement in binocular functions after surgical correction.

Patients and Methods
This current study was carried out on 100 patients aged above 5 years old, both sexes,

diagnosed with IXT. The study was done from April 2018 till December 2021 after approval from the Ethical Committee Tanta University Hospitals, Tanta, Egypt. An informed written consent was obtained from the patient or relatives of the patients.

Exclusion criteria were children below 5 years of age, previously operated cases, horizontally incomitant strabismus and any previous or current intraocular disease or surgery.

All patients were subjected to: history taking, inspection of patients, assessment of visual acuity (VA) [It was measured by standard Snellen chart. state of refraction [Cycloplegic refraction was carried out in every patient, using cyclopentolate 1% instilled for three times, 10 minutes apart, last time 30 minutes before the examination], complete ophthalmic examination [It was performed to exclude any pathology or any other abnormality related or not related to strabismus as opacity in the media or any retinal disease associated with reduction of VA] and measurement of the angle of deviation [It was measured for all patients preoperatively and postoperatively by the prism and cover test and the corneal reflection tests (Hirschberg test and Krimsky test). The angle was measured for near and for far in the primary position. In patients with difference in the angle of deviation between near and far, the angle of deviation for near was measured after 30 minutes of monocular occlusion and using +3 D lenses to differentiate true divergence excess from pseudo-divergence excess. The angle of deviation was also measured in side gazes to detect lateral gaze incomitance and measured in up and down gazes to detect any alphabetical pattern].

Assessment of binocular functions

Worth 4- dots test

It was performed for both distance and near to detect fusion and suppression.

Bagolini striated glasses test

It was used to differentiate between BSV, ARC or suppression. The two lenses were placed at 45° and 135° in front of each eye and the patient fixate a small light source. This test was used at 6 m and 33 cm.

Four diopters base out prism test

It was performed to detect monofixation at distance.

Titmus stereo test

It was performed at 40 cm. The patient was asked to touch or pick up one of the wings of the fly. Sometimes there was doubt whether the patient saw stereoscopically. We occluded one eye and asked the patient whether there was a difference in appearance of the housefly or not. Also, the plate was turned 90° which should block out the stereoscopic effect as only horizontal disparity produces stereopsis. If the book is inverted, the targets was appeared to be behind the plane of the page.

TNO test

It was done to measure stereoacuity. The patient wore red, green spectacles.

Frisby test

It was done to measure stereoacuity. It is done at different distances (30 cm, 40 cm, 50 cm, 60 cm, 70 cm, and 80 cm). The head of the patient and the plates were steady trying to avoid monocular clues.

Surgical technique

Surgery performed for all patients were bilateral lateral rectus recession (BLR) as all patients were of basic and pseudo divergence excess. The operation was done under general anesthesia. Sterilization was done. We exposed the lateral rectus muscle, and it was sutured with 6/0 polyglactin sutures (Vicryl). Then the muscle was disinserted, the site of new insertion was measured according to the amount of recession planned then the muscle was sutured to the sclera directly.

Follow up

All cases were examined before they left the hospital. All measurements were done. Follow up examination was performed weekly for one month then monthly till the condition of binocular vision became stable. All cases followed up for 6 months. Follow up examination included measurement of the angle to detect over or under correction also included assessment of VA and binocular functions (by worth four-dot, Bagolini, Titmus, TNO, Frisby).

Statistical analysis

Statistical analysis was done by SPSS v27 (IBM©, Chicago, IL, USA). The Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric data were presented as mean and standard deviation (SD) and were analyzed by ANOVA (F) test with post hoc test (Tukey). Quantitative non-parametric data were presented as median and interquartile range (IQR) and were analyzed by Kruskal-Walli's test with Mann Whitney-test to compare each group. Qualitative variables were presented as frequency and percentage (%) and were analyzed utilizing the Chi-square test. A two tailed P value < 0.05 was considered statistically significant.

Results

The mean age was 13.15 ± 9.00 years. 56 of cases were male and 44 were female. The mean of uncorrected V. A. OD was 0.63 ± 0.28 and for OS was 0.64 ± 0.30. The mean of post cycloplegic refraction OD diopter sphere was 0.14± 1.87 and diopter cylinder was -0.61± 0.70 while post cycloplegic refraction OS diopter sphere was 0.18± 1.76 and diopter cylinder was -0.63± 0.78. All the patients had IXT for near with angle was 39.3 ±7.21 prism diopters, and for far was 40.95 ±7.84 prism diopters. The mean of NCS done for all patients was 5.54 ± 0.78. Table 1

Table 1: Demographic data, clinical characteristic of patients with IXT of the studied patients

		N=100
Age (Years)		13.15±9.00
Sex	Male	56 (56.0%)
	Female	44 (44.0%)
V.A. OD		0.63±0.28
V.A. OS		0.64±0.30
Post cyclo OD sphere		0.14±1.87
Post cyclo OD cylinder		-0.61±0.70
Post cyclo OS sphere		0.18±1.76
Post cyclo OS cylinder		-0.63±0.78
Angle in far		40.95±7.84 PD
Angle in near		39.30±7.21 PD
NCS		5.54±0.78

Data are presented as mean ± SD or frequency (%). V.A: visual acuity, OD: Oculus Dexter, OS: oculus sinister, NCS: Newcastle Control Score, PD: Prism diopter.

The Worth four-dot test showed fusion in 53 (53.0%) of patients, unilateral suppression in 37 (37.0%) and

alternating suppression in 10 (10.0%) of patients. Bagolini test for near showed fusion in 60 (60.0%) of patients, unilateral suppression in 33 (33.0%), and alternating suppression in 7 (7.0%) of patients. While for far it showed fusion in 57 (57.0%) of patients, unilateral suppression in 33 (33.0%), and alternating suppression in 10 (10.0%) of patients. Preoperative stereoacuity was measured by Titmus, TNO, and Frisby. In Titmus test it was 2.22 ± 0.20 (from 80 to 800 sec of arc with mean 167 sec of arc). In TNO test was 2.29 ± 0.24 (from 120 to 1980 sec of arc with mean 195 sec of arc). In frisby test it was 2.11 ± 0.23 (from 40 to 600 sec of arc with mean 129 sec of arc). The preoperative four PD test showed central fusion in all patients. The BLR was done for all patients was 7.89 ± 0.86 mm. Angle in far and near was 19 (90.0%) patients after one week. Angle in far was 19 (90.0%) patients after one month while near in 21 (100.0%) patients after one month. Angle in far was 14 (45.0%) patients after 6 months while near in 11 (39.0%) patients after 6 months. Table 2

Table 2: Preoperative worth 4 dot, Bagolini test for near and for far and preoperative stereoacuity:

		N=100	
Worth 4 dot			
Fusion		53 (53.0%)	
Uni Suppression		37 (37.0%)	
Alt Suppression		10 (10.0%)	
Diplopia		0 (0.0%)	
Bagolini test			
		Bagolini near	Bagolini far
Fusion		60 (60.0%)	57 (57.0%)
Uni Suppression		33 (33.0%)	33 (33.0%)
Alt Suppression		7 (7.0%)	10 (10.0%)
Diplopia		0 (0.0%)	0 (0.0%)
Preoperative stereoacuity	Titmus	2.22±0.20	
	TNO	2.29±0.24	
	Frisby	2.11±0.23	
Surgery done		7.89±0.86	

Data are presented as mean ± SD or frequency (%).

Pre- and post-operative angle of deviation and worth four-dots test in far and in near showed significant difference in one week, one month, six months after operation. Table 3

Table 3: Pre- and post-operative angle of deviation in far and in near and the worth four-dots test in near and in far

	Pre	1 w.	1 m.	6 m.	P
Angle in far					
IXT	100 (100.0%)	21 (21.0%)	21 (21.0%)	31 (31.0%)	0.001*
ET	0 (0.0%)	31 (31.0%)	13 (13.0%)	8 (8.0%)	
Ortho	0 (0.0%)	48 (48.0%)	66 (66.0%)	61 (61.0%)	
Angle in near					
IXT	100 (100.0%)	21 (21.0%)	21 (21.0%)	28 (28.0%)	0.001*
ET	0 (0.0%)	33 (33.0%)	13 (13.0%)	8 (8.0%)	
Ortho	0 (0.0%)	46 (46.0%)	66 (66.0%)	64 (64.0%)	
The worth four-dots test in near pre and postoperatively					
Fusion	53 (53.0%)	69 (69.0%)	75 (75.0%)	78 (78.0%)	0.003*
Uni Suppression	37 (37.0%)	24 (24.0%)	18 (18.0%)	18 (18.0%)	
Alt Suppression	10 (10.0%)	5 (5.0%)	7 (7.0%)	4 (4.0%)	
Diplopia	0 (0.0%)	2 (2.0%)	0 (0.0%)	0 (0.0%)	
The worth four-dots test in far pre and postoperatively					
Fusion	53 (53.0%)	69 (69.0%)	75 (75.0%)	78 (78.0%)	0.003*
Uni Suppression	37 (37.0%)	24 (24.0%)	18 (18.0%)	18 (18.0%)	
Alt Suppression	10 (10.0%)	5 (5.0%)	7 (7.0%)	4 (4.0%)	
Diplopia	0 (0.0%)	2 (2.0%)	0 (0.0%)	0 (0.0%)	

Data are presented as frequency (%). *Significant p value <0.05, IXT: Intermittent exotropia.

Bagolini test in near and in far showed a significant difference in one week, one month, six months after operation. Stereoacuity in log sec of arc showed a significant difference in one week, one month, six months after operation. Table 4

Table 4: Bagolini test in near and far and stereoacuity in log sec of arc pre and postoperatively

	Pre	1 w.	1 m.	6 m.	
Bagolini test in near					
Fusion	60 (60.0%)	69 (69.0%)	75 (75.0%)	78 (78.0%)	0.001*
Uni Suppression	33 (33.0%)	24 (24.0%)	18 (18.0%)	18 (18.0%)	
Alt Suppression	7 (7.0%)	5 (5.0%)	7 (7.0%)	4 (4.0%)	
Diplopia	0 (0.0%)	2 (2.0%)	0 (0.0%)	0 (0.0%)	
Bagolini test in far					
Fusion	57 (57.0%)	69 (69.0%)	75 (75.0%)	78 (78.0%)	0.001*
Uni Suppression	33 (33.0%)	24 (24.0%)	18 (18.0%)	18 (18.0%)	

Alt Suppression	10 (10.0%)	5 (5.0%)	7 (7.0%)	4 (4.0%)	
Diplopia	0 (0.0%)	2 (2.0%)	0 (0.0%)	0 (0.0%)	
Stereoacuity in log sec of arc					
Titmus	2.22±0.20	2.04±0.22	1.90±0.21	1.88±0.21	0.001*
	P1=0.001*, P2=0.001*, P3=0.001*, P4=0.001*, P5= 0.001*, P6=0.688				
TNO	2.29±0.24	2.09±0.23	1.93±0.24	1.92±0.24	0.001*
	P1=0.001*, P2=0.001*, P3=0.001*, P4=0.001*, P5= 0.001*, P6=0.721				
Frisby	2.11±0.23	2.00±0.20	1.87±0.21	1.86±0.21	0.001*
	P1=0.001*, P2=0.001*, P3=0.001*, P4=0.001*, P5= 0.001*, P6=0.527				

Data are presented as mean ± SD or frequency (%). *Significant p value <0.05, P1: Significant bet. Pre and 1 w, P2: Significant bet. Pre and 1 m, P3: significant bet pre and 6 m, P4: significant bet.1 w. and 1 m, P5: significant bet 1 w. and 6 m, P6: significant bet.1 m. and 6 m.

There was a significant relation between motor alignment in near and in far and the fusion 6 months post-operative (p=0.001). There was non-significant relation between the degree of the preoperative control of IXT as evaluated by the NCS and the final motor outcome in far and near (P = 0.349, and 0.549 respectively). Table 5

Table 5: Relation between motor alignment in near and in far and the fusion 6 months post-operative and between preoperative NCS and the final motor outcome in far and near

	IXT	ET	Ortho	P
Angle in near				
Fusion	12 (42.9%)	4 (50.0%)	62 (96.9%)	0.001*
Uni Suppression	14 (50.0%)	2 (25.0%)	2 (3.1%)	
Alt Suppression	2 (7.1%)	2 (25.0%)	0 (0.0%)	
Angle in far				
Fusion	15 (48.4%)	4 (50.0%)	59 (96.7%)	**0.001***
Uni Suppression	14 (45.2%)	2 (25.0%)	2 (3.3%)	
Alt Suppression	2 (6.5%)	2 (25.0%)	0 (0.0%)	
Preoperative NCS and the final motor outcome in far and near				
Far	5.71±0.69	5.50±0.53	5.46±0.85	0.349
Near	5.68±0.72	5.50±0.53	5.48±0.84	0.549

Data are presented as mean ± SD or frequency (%). *Significant p value <0.05**,** IXT: intermittent exotropia, NCS: The Newcastle Control Score.

The preoperative stereo-acuity as measured by Titmus, TNO and Frisby did not affect the postoperative motor outcome in near (P = 0.058, 0.100, 0.152 respectively). While for postoperative motor outcome in far, preoperative stereoacuity measured by Titmus, TNO and Frisby had significant effect (P = 0.001, 0.007, 0.006 respectively). Better preoperative stereoacuity is associated with better postoperative motor outcome and alignment stability. Table 6

Table 6: The effect of preoperative stereoacuity on postoperative alignment in near and far

		IXT	ET	Ortho	P
In near	Titmus	2.29±0.24	2.19±0.13	2.19±0.18	0.058
	TNO	2.37±0.33	2.23±0.16	2.26±0.19	0.100
	Frisby	2.18±0.24	2.10±0.13	2.08±0.22	0.152
In far	Titmus	2.32±0.25	2.19±0.13	2.17±0.16	0.001*
	TNO	2.40±0.32	2.23±0.16	2.24±0.17	0.007*
	Frisby	2.21±0.25	2.10±0.13	2.06±0.22	0.006*

Data are presented as mean ± SD. *Significant p value <0.05, IXT: intermittent exotropia.

Case 1

Female patient aged 8 years old. V.A. for right eye was 0.9 and left eye 1.00. Post cycloplegic refraction was +1.25 D sphere and -0.50 D cylinder for the right eye, while the left eye was+1.75 D sphere and -0.25 D cylinder. The NCS was 4. Angle of deviation for near was 30 PD and in far was 35 PD. Worth 4 dot & Bagolini in near and far show fusion. stereoacuity was measured by Titmus, TNO, and Frisby. It was 100, 120, and 75 respectively. Operation done was bilateral LR recession 7 mm. Figure 1

The patient became orthotropic all the period of follow up. Post-operative stereoacuity by Titmus was 80, 60, and 60 sec of arc for one week, one month, and 6 months respectively.

By TNO it was 120, 60, and 60 sec of arc for one week, one month, and 6 months respectively. While by Frisby, it was 75, 55, 55 sec of arc for one week, one month, and 6 months respectively.

Case 2

Female patient aged 13 years old. V.A. for right eye was 0.2 and left eye 0.3. Post cycloplegic refraction was -3.00 D sphere and -1.00 D cylinder for the right eye, while the left eye was-2.00 D sphere and -0.50 D cylinder. The NCS was 6. Angle of deviation for near was 55 PD and in far was 60 PD. Worth 4 dot & Bagolini in near and far show alternating suppression. Stereoacuity was measured by Titmus, TNO, and Frisby. It was 200, 240, and 215 respectively. Operation done was bilateral LR recession 9 mm. Fig 2

The patient became orthotropic all the period of follow up. Post-operative stereoacuity by Titmus was 100, 60, and 60 sec of arc for one week, one month, and 6 months respectively.

By TNO it was 120, 60, and 60 sec of arc for one week, one month, and 6 months respectively. While by Frisby, it was 110, 55, 55 sec of arc for one week, one month, and 6 months respectively. Worth 4 dot and Bagolini show fusion postoperatively.

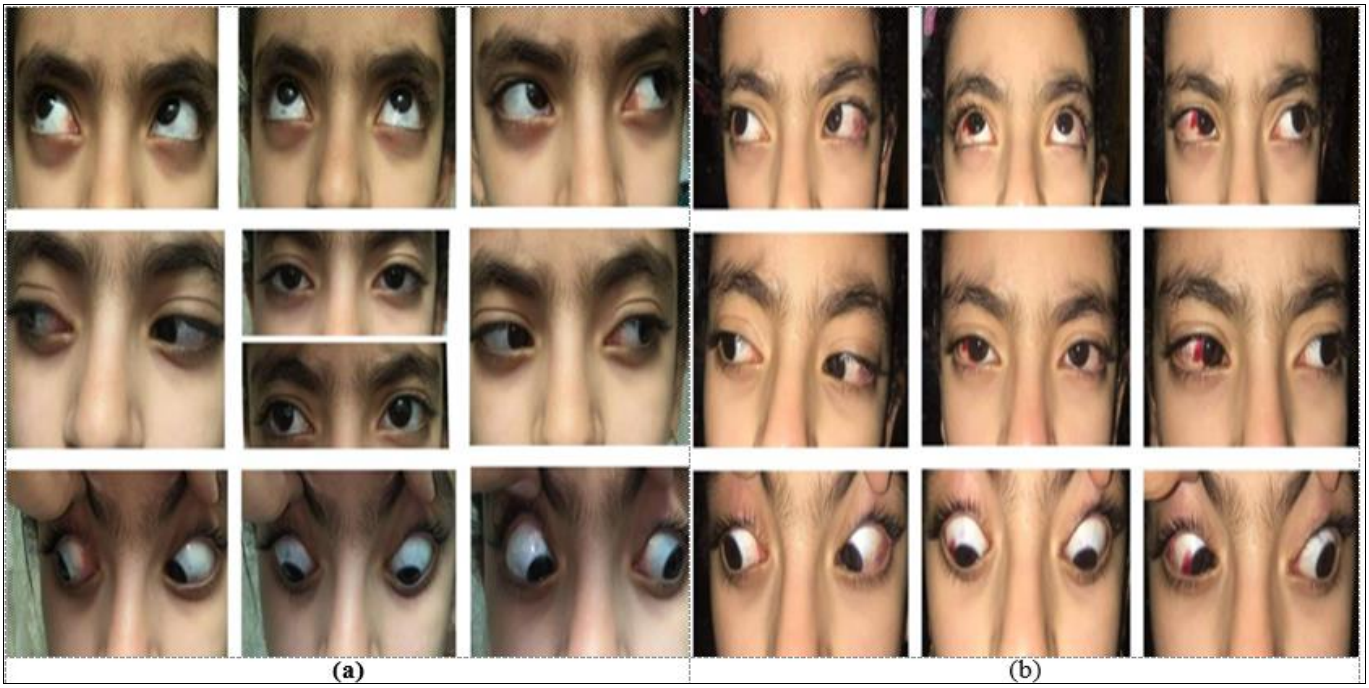

Fig 1: Case 1 (a) preoperative and (b) postoperative

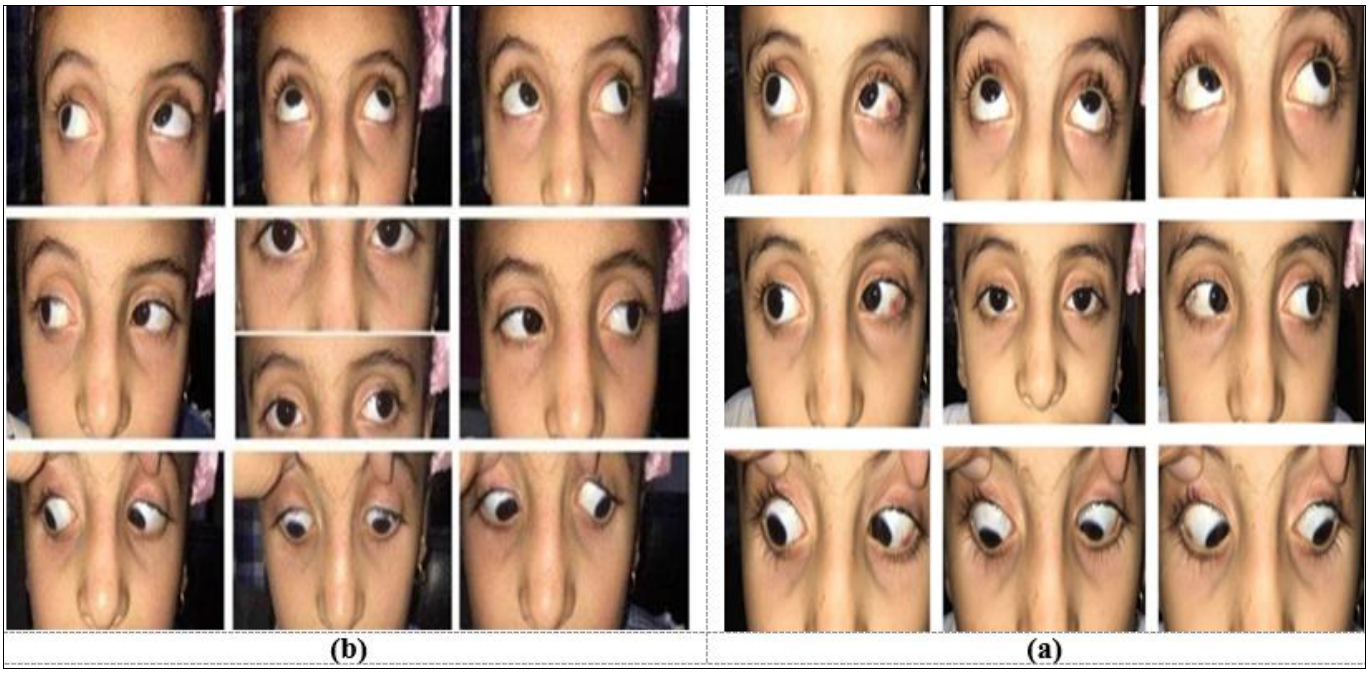

Fig 2: Case 2 (a) preoperative and (b) postoperative

Discussion

The mean of their uncorrected VA OD was 0.63±0.28. While the mean of their uncorrected VA OS was 0.64±0.30. We tested binocular fusion preoperative with worth four dot test and bagolini test in near and far. We found that 53% of the patient had fusion when we test them worth four dot while 60%had fusion when tested with Bagolini in near and 56% when tested with Bagolini in far. This may be explained that Bagolini is less dissociative than worth four-dot test. Arthur BW *et al*. [8] found that The Polarized Four-Dot (P4D) test was less dissociative than worth four dot test. In another study he compared between Bagolini and P4D, he found that P4D was more accurate than Bagolini test [9].

Stereoacuity was measured by Titmus, TNO, and Frisby test. It showed small difference; the mean of stereoacuity by Titmus was 167 sec of arc, by TNO it was 195 sec of arc, while by Frisby it was 129 sec of arc. This may be due to presence of monocular clues in Frisby also it doesn't need glasses, so it is less dissociative. Chopin A *et al*. [10] found that Observers can use monocular cues to deceive some of the most common stereo tests.

In our study we tried to exclude it as possible as we can. In Titmus we rotated the test and in Frisby we tried to fixate the head of the patient and the plate. BLR was done for all patients ranging from 6 mm to 9 mm (mean 7.89 ± 0.86 mm) as all patients were of basic and pseudo divergence excess.

Motor evaluation was done, and the result compered one week, one month and six months postoperative. One week after surgery, 46% of patients became orthotropic in near and 48% in far. After one month, it increased to 66% of patients. This improvement may be due to disappearance of oedema and pain which occur after surgery also some of cases (18 cases in far about 58%, and 20 cases in near about

60.6% who developed consecutive esotropia became ortho one month after surgery.

Six months after surgery, 64% of patients became orthotropic in near and 61% in far. Some of the patient with esotropia (5 patients) became orthotropic with conservative management as alternating patching. However, deterioration of some orthotropic patient (7 cases in near and 10 in far) also occurred, they became exotropic).

The large percentage of cases that had IXT in our study as we recorded all cases with IXT even those having deviation less than 10 PD. unlike Kang and Lee [11] defined that the surgical success rate occurs when ocular alignment occurs between 5 PD esodeviation and 10 PD exodeviation in the primary position at the first visit.

Ing *et al*. [12] that stated in a study for the outcome of BLR for IXT in children that (62%) of the patients were successfully aligned by the initial procedure performed for a mean of 25 PD of preoperative deviation.

Our study showed significant improvement in sensory fusion after surgical correction of IXT. One week postoperatively, 69% of patient had fusion, 29% had suppression, and 2% had diplopia. One month postoperatively, 75% of patient had fusion, and 25% had suppression. The patient with diplopia developed suppression. Six months postoperatively, fusion was present in 78% of patient, and suppression was present in 22% of patient. Huh J, Ha SG,and Kim SH. [13] found in a study investigating recovery from suppression when the target motor alignment is achieved following surgery for IXT that preoperative suppression status included 23 (9.7%), 55 (23.2%), and 159 (67.1%) patients who showed no, alternate, or constant suppression, respectively. 90.7% of patients obtained the target motor alignment by the final visit. Of the 144 patients who demonstrated constant suppression preoperatively but achieved the target motor alignment postoperatively, 12 (8.3%) patients demonstrated residual suppression. All 12 of these patients had a preoperative angle of exotropia of greater than 20 PD. Most patients undergoing surgery for IXT obtained both successful motor alignment and fusion postoperatively.

Many studies compare between preoperative and postoperative stereoacuity in patient with IXT. Sharma *et al*. [14] found that the mean distance stereoacuity of patients at 6 months postoperatively became similar to that of normal subjects. Peng T *et al*. [15] found that distance stereopsis improved to the same level as that of the normal controls at the 6- or 12-month follow-up. But near stereoacuity remained poorer in the patients at the last follow-up when compared with that in the controls; however, it improved after surgery and this was the same as Sharma *et al*. [14].

Our study also confirmed that stereoacuity is improved after surgical treatment of IXT.as the mean preoperatively was 2.22 ± 0.20 log sec of arc (167 sec of arc) and six months postoperative it became 1.88 ± 0.21 log sec of arc (76 sec of arc).

Our study revealed that patient with good alignment gained fusion (96.9% of orthoptic patient in near and 96.7% of orthoptic patient in far).

Huh J *et al*. [13] found that successful motor alignment did not guarantee recovery of suppression when the preoperative angle of exotropia was greater than 20 PD. Yildirim and her colleagues [16] demonstrated that better distance stereoacuity and central fusion before surgery are frequently associated with better surgical success in IXT.

Beneish and Flanders [17] found that overcorrection of poor preoperative stereopsis resulted in significant improvements in the surgical success rate and suggested that individuals with poor preoperative stereopsis may have good long-term alignment stability postoperatively.

In our study we found that the preoperative stereo-acuity as measured by Titmus, TNO and Frisby did not affect the postoperative motor outcome in near. But there was significant effect of preoperative stereo-acuity on surgical success rate in far. We found that better preoperative stereoacuity is associated with better postoperative motor outcome and alignment stability.

In the study by Haggerty and colleagues [18] supported that surgical intervention should be attempted in the patients with a Newcastle score of more than three as it provides better results than observation. Jewsbery and Watts [19] found that the number of patients that had good surgical result was nearly equal in those with a low (less than 5) preoperative NCS and a high (more than 6) preoperative score (P = 0.84).

In our study, the NCS ranged from 4 to 7 (mean 5.54±0.78). We did not find significant relationship between the degrees of the preoperative control of IXT as evaluated by the NCS and the final motor outcome in far and near.

Limitations of this study included that the sample size was relatively small. The study was in a single center. So, we recommended that further studies should be done with larger number and for longer term follow up to assess stability of this improvement. Additionally, whether the improvement in the stereopsis has an effect on the improvement in the post-operative motor success or whether the improvement in the angle of deviation after surgery affects the improvement in the stereopsis needs more confirmation in further randomized prospective studies.

Conclusions

Exotropia often disturbs the binocular functions. During the tropic phase, most patients have large regional suppression of the temporal retina. Bagolini test is less dissociative than worth four-dot test. Surgical correction of IXT causes improvement in sensory fusion. Successful motor alignment improves stereoacuity. Better stereoacuity before surgery is frequently associated with better surgical success in IXT and alignment stability. There is no significant relationship between the degrees of the preoperative control of IXT as evaluated by the NCS and the final motor outcome in far and near.

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Nil.

Conflict of Interest

Nil.

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