

## Treatment of Congenital Esotropia

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### ABSTRACT

**Aim:** To assess the role of Botox injection and surgery in treatment of Congenital Esotropia.

**Methods:** Retrospective study of Congenital Esotropes who had Botox injection alone or with surgery was carried out. Evaluation included visual acuity, degree of deviation, cycloplegic refraction, amblyopia, fixation, extra ocular movements and fundus examination. Botox injection and surgical correction for macrotropia in congenital strabismus were treatment methods used.

**Results:** 837 patients having Congenital Esotropia were part of this retrospective study. All presented or developed esotropia before 6 months of age. Esotropia ranged from 11 to 50 Prism Diopters. These had average follow up of 8.5 years. 289(34.52%) patients were treated with Botox injection only. 347(41.45%) were treated with Botox injection and bilateral medial rectus recession. 201(24.01%) had bilateral medial rectus recession and one lateral rectus resection. 701(83.75%) had Orthotropia and 136(16.24%) had microtropia at the end of follow up.

**Conclusion:** Botox injection, bilateral medial rectus recession with/without unilateral lateral rectus resection are treatment options of choice for congenital esotropia.

**Keywords:** Esotropia, Botox injection and Bilateral medial rectus recession.

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### INTRODUCTION

Malalignment of visual axes is named as strabismus and should be taken seriously <sup>(1)</sup>. Congenital esotropia is used to describe the manifest, inward deviation of eyes which presents or is noticed in the first 6 months of life. Proper evaluation of such patients is compulsory to diagnose, prevent or treat amblyopia. These patients should undergo complete eye examination and cycloplegic refraction. Congenital esotropia is usually not associated with gross refractive errors or limitation of extra ocular movements. Eyeball examination is commonly normal although may have serious issues. The angle of deviation may be small labelled as microtropia. Larger deviation, macrotropia, is cosmetically not acceptable to parents and medical advice is always obtained for it. The child may have amblyopia. Some patients have cross fixation which restricts movements but safeguards against developing lazy eye. Intervention is very commonly needed for congenital Esotropes at earlier stage. Parents are very much concerned about vision but inclined to accept noninvasive or less invasive procedures. Alan Scott was the person to use Botulinum toxin as an option for treating strabismus in Humans <sup>(2)</sup>. Botox injection abates muscular contraction <sup>(3)</sup>. The mechanism of action of Botox involves inhibition of release of acetylcholine at the neuromuscular junction and thus preventing the signal transmission. Botox injection is not a surgery and does not need extensive anesthesia which is required for bimedial recti recession needed to correct congenital esotropia. All these factors combined together make Botox injection, to treat congenital esotropia, an excellent choice when intervention is needed for esotropia. This retrospective study presents the results of surgery, Botox injection and combination of both methods to treat congenital esotropia when deviation is not acceptable cosmetically.

### MATERIALS AND METHODS

This retrospective study included cases between April 2010 and November 2018, a period of more than 8 and half years. This was carried out at Pediatrics Ophthalmology unit, King Fahad Armed Forces Hospital, Jeddah. Patients who had only congenital esotropia within 6 months from birth were included in this study. Those who had opacity in the refractive media, compromised pupil reaction, retinal abnormalities, drooping of the eye lid or limitation of extra ocular movements were excluded. Premature babies, poor in follow ups and those who discontinued follow up were not part of this research. The patients who had neurological disorder, neuromuscular disorder, nystagmus or hypersensitivity to Botox were excluded from this study. Visual acuity assessment is very basic examination in Ophthalmology but very difficult in infants and young children. Different options, for this purpose, are in practice. Pattern visual evoked potential is very precise method but not used for squint cases. This is available in our setup but needed for patients with ill-defined retinal pathology. Light was used for fixation in infants to know the visual status. Attractive bright targets were used to know the same in slightly older ones by assessing fixation and then following the movements. Covering one eye and observing behavior of child gives strong clues about Amblyopia. Cycloplegic refraction is the rule in children especially for very young. We used Cyclopentolate eye drops 2 hours before Retinoscopy. Retinoscopy was carried out by Ophthalmologist without using sedation. Degree of deviation is the basic examination in strabismus and should be done properly <sup>(4)</sup>. Hirschberg test is used to diagnose and monitor squinting patients. Prisms can help to assess deviation even better. We used Krimsky prism cover test to assess degree of deviation. Less than 10 prism diopters deviation was labelled as microtropia. Congenital Esotropes having deviation ranging from 11 to 50 prism

dipters were properly evaluated and worked up. Monitoring for long duration is needed in such patients and this is reflected by almost 8 and half years of results monitoring. We recorded all the related aspects but are describing results of esotropia correction only. Inferior oblique overaction, Dissociated Vertical Deviation, A-phenomenon and V-phenomenon are not described in this study although they are associations of this deviation. Extra ocular movements evaluation was part of examination in all patients. It was assessed with both eyes open in most of the patients but few needed patching of 1 eye for precise status evaluation. Patching was especially important for those who had large degree of deviation. Ease of carrying out was the criteria but no clear cut off point was observed in terms of degree of deviation. All the patients had intact extra ocular movements and those with limitation were excluded from study. Transparency of refractive media was assessed and then dilated pupil examination of the Retina carried out with Indirect Ophthalmoscope. All those who had opacity of refractive media / and retinal lesions were omitted from this particular study group.

Surgery is usually advocated for congenital esotropia although Botulinum toxin injection in the muscle is an alternate. This injection technique is promising for minor degree of deviation. It can be given with ultrasound guidance or without such guidance. We gave all these injections in operation room, under light anesthesia. We used operating microscope for injection in the belly of muscle maintaining sterilization protocol of squint surgery. 1 International Unit for 10 prism diopters deviation was the calculation for injections. All injections of Botulinum toxin were given without using ultrasound guidance. Same steps were followed in case injection was repeated. Those who were not orthotropic after 2 injections got operated. Bilateral medial recti recession was the surgery practiced in such cases. All the patients were evaluated properly but this study covered horizontal deviation only and remaining aspects not described although recorded.

The results of all types of treatment were assessed by Prism cover test at the end. No eye movement observed in this test indicated orthotropia and thus good binocular vision was supposed. This criteria was necessary as the patients were very young.

**RESULTS**

This retrospective study spanned almost eight and a half years and included 837 patients. Figure number 1 shows the number of males and females included in the study.

All the patients developed Esodeviation at or before the age of 6 months but the presentation age ranged from 2 months to 2 years and 5 months. The follow up was continued till orthotropia was attained using only injections or combined with surgery. Visual acuity was assessed by using light fixation, fixating and following bright attractive targets and covering one eye and observing the behavior of child. Figure number 2 shows the results of Visual Acuity in the patients included in this study.

All the patients had intact/full extra ocular movements but those with more deviation 69 (8.24%) needed one eye to be covered to assess this feature precisely. Both eyes open evaluation was done in 768 (91.75%) patients. The

diagnosis and measurement of deviation was conducted using Hirschberg test but precise measurement was done using prisms and alternate cover test. The patients were divided in 4 groups according to the degree of deviation. The 1<sup>st</sup> group of patients had deviation between 11 to 20 prism diopters. The next section of patients had deviation of 21 to 30 prism diopters. The 3<sup>rd</sup> group had esotropia between 31 to 40 prism diopters. Maximum inward deviation ranged from 41 to 50 prism diopters in this study. The figure number 3 shows the number of patients and degree of deviation recorded.

Most of the patients 803 (95.93%) used movement of eyes to see laterally but 34 (4.06%) had cross fixation. Refractive error was assessed by cycloplegic Retinoscopy. We used cyclopentolate eye drops in all patients 2 hours prior to Retinoscopy. It was done without sedation in our OPD but 13 (1.55%) underwent examination under anesthesia for same evaluation. All the refractions were carried out by ophthalmologist using same Retinoscope. Most patients 794 (94.86%) had no refractive error but 43(5.14%) were having Hypermetropia. None of the patients needed glasses. Refractive or Anisometropia amblyopia was not seen in any patient but 42(5.01%) had amblyopia due to Esodeviation which needed patching to reverse it.

Fig.1: Gender distribution

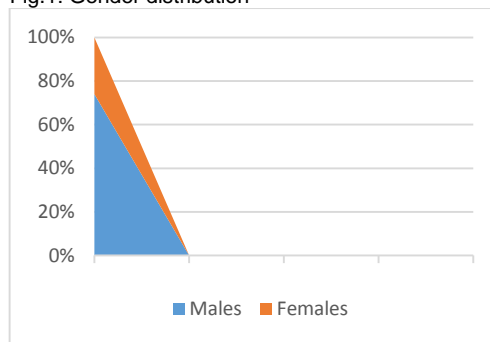
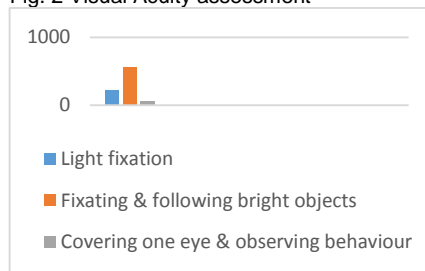


Fig. 2 Visual Acuity assessment



Botox injection in each medial rectus muscle is a good option in the treatment and may be enough as the sole treatment which helped to attain orthotropia. Some patients needed 2 injections to get the same purpose. After 2 Botox injections in medial recti additional bilateral medial recti recession was the next option. Those patients who had gross esotropia needed one lateral rectus resection as well in addition to the procedures described previously. Figure number 4 describes the distribution of patients in these treatment options.

Orthotropia was attained in 701 (83.75%) of patients while 136 (16.24) had residual microtropia which was less than 10 prism diopters.

Fig.3 Degree of deviation

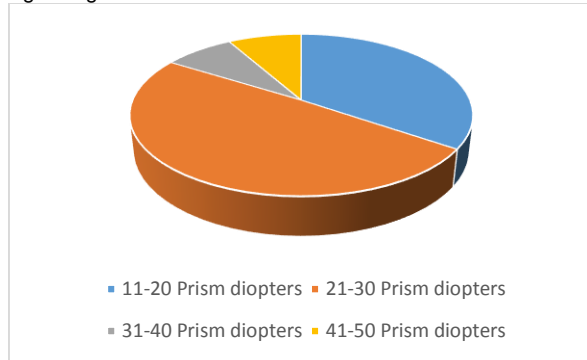
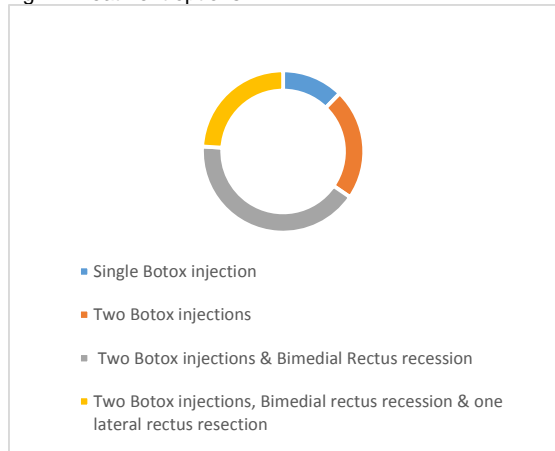


Fig. 4: Treatment options



## DISCUSSION

Deviation of eyes is very common problem which forces the parents to consult Pediatrics Ophthalmology department for their children. This strabismus may or may not be associated with limitation of extra ocular movements. The concomitant type is more common presentation especially in children. The deviation of eyes may be inwards or outwards. The strabismus may be manifest or latent. Congenital esotropia represents the most common type of strabismus<sup>5</sup>. The term congenital is usually used for a lesion which is present at birth but not in case of squint. The manifest inwards deviation of eyes noticed or diagnosed during the first 6 months of life gets the label of congenital/infantile esotropia. The patients with congenital esotropia may have a positive family history. This observation shows that genetics play a role in this condition. Congenital esotropia may be associated with premature birth and perinatal problems<sup>6</sup>. These patients do not usually have gross refractive error. Environmental factors may play their part as well but Essential infantile or congenital esotropia is accepted as idiopathic because the precise mechanism and relationship between different risk factors cannot be established.

Amblyopia, poor learning by CNS<sup>7</sup> is a double edge sword. Strabismus may lead to Amblyopia and Amblyopia may lead to deviation of eyes. Exact cause of poor vision should be searched and level best efforts carried out to treat the cause as well as Amblyopia. Visual acuity at preverbal stage is very difficult to be assessed<sup>(8)</sup> but fixation on light in very young children is helpful to know the visual status. Attracting the child towards bright light and following the movement was also frequently used to diagnose poor vision and then steps taken to overcome the lazy eyes. Managing the Amblyopia will help to improve the prognosis as well as reduce the chances of surgical or non-surgical intervention. As we were assessing Botox injection effectiveness to treat congenital esotropia instead of conventional surgery so special interest was taken to address management of Amblyopia which is mainly in the form of patching.

The congenital Esotropes are very young so cooperation is not that easy to be obtained or even expected. All the patients needed very light anesthesia for Botox injection in medial recti. This anesthesia and its complications cannot be compared with the complete deep anesthesia needed for Bimedial recti Recession. Manipulating the medial recti may lead to oculocardiac reflex which is also known as the Aschner reflex or trigeminovagal reflex<sup>(9)</sup>. The conventional surgery will double the risk as both medial recti are addressed in the same sitting. The injection of Botulinum toxin will not lead to any such reflex and so is a safe procedure. Light anesthesia and lack of oculocardiac reflex excitation make Botox injection to be far safer than surgery.

Perforation of eye ball or sclera is a documented complication when needle is very close to the eyeball. This complication has been reported even during delivery of local anesthesia for surgery. Ultrasound guided injection is one of the solutions for this problem but not compulsory. We did not give any injection with ultrasound guidance but used operating microscope for the exact identification of the medial rectus belly. We did not come across any globe perforation. This risk of globe perforation is associated with squint surgery as well<sup>(10)</sup>. The muscles are inserted at new site by passing through partial thickness of sclera as compared to injection delivery in the muscle which is safer. Perforation may occur during both procedures but distance is more in injection delivery as compared to needle passing through partial thickness of sclera. This aspect again proves that Botox injection is associated with less complications as compared to conventional squint surgery. The amount of muscle recession can be adjusted according to degree of deviation. When medial rectus is recessed for 1mm, it will correct 3 prism diopters. We used one international unit of Botox injection for correction of 10 prism diopters. The calculation is experience based and might be being used elsewhere with some modification. This is a common practice for a relatively new procedure. Botox injection is more recent way to treat congenital esotropia only when compared with bimedial recti recession which is being used for decades. Botox injection has been tried at multiple centers for years and will need more time to come to a decision regarding standard dosage of Botulinum toxin for degree of deviation. Our dosage, one international unit of Botox injection for

correction of 10 prism diopters, worked very well. With ongoing usage and comparing the results, it will be possible to be more confident of precise dosage with passage of time and Botox injection may become the 1<sup>st</sup> choice for congenital esotropia. The surgical correction uses millimeters in round figures for calculation of correction needed for deviation of visual axes. This aspect is most commonly practiced although not compulsory. Botox injection dosage can be modified as well according to the needs. This aspect again shows that both techniques are equally good and adjustable.

Congenital Esotropia involves very young children which itself may be a factor dictating 2<sup>nd</sup> intervention. When patient is treated by chemo denervation with injection, it will always be possible to go for hassle free procedure 2<sup>nd</sup> time. We all know that re-surgery is not easy in all cases of strabismus because of changed anatomy. The fibrosis and adhesions of the previous surgery make it very difficult to get the required results. This is practical problem although can be managed very easily but by experienced surgeons only. Botox injection is very simple for the 1<sup>st</sup> time as well as 2<sup>nd</sup> time. This does not need that much experience and butterflies in the stomach while thinking about redo. The usage of injection does not pose any issues for bimedial recti surgery. The injection can be used to augment the surgery if needed<sup>11</sup>. We used Botox injections as the 1<sup>st</sup> choice only and never needed after recession of muscles.

The commonest practice is to recess both medial recti for congenital esotropia but 3<sup>rd</sup> or even 4<sup>th</sup> muscle may need to be adjusted to get the desired results. More is the number of muscles operated in one sitting, the more will be the chances of anterior segment ischemia. Easy way out is to operate at 2 sittings but then double anesthesia and the complications of anesthesia will come into play. Botulinum toxin injection is free of developing anterior segment ischemia. This will necessarily rule out the need for 2<sup>nd</sup> anesthesia and all the complications reduced which are related with it. Duration of anesthesia and its depth is also remarkably less when injection is used instead of surgery.

Strabismus is mainly a cosmetic blemish for the parents because the young chap cannot complain regarding vision or depth perception. Cosmetic appearance improvement gains the central position in treatment. Recession of the muscles in both eyes may affect appearance if conjunctiva is incised at Limbus to get access to the muscle. This issue can be addressed better if Conjunctival incision is near the inferior fornix or lower part of the eyeball which are normally covered by lower lid. This more acceptable approach needs more experience and more time of surgery to get what planned. The Botox injection is very simple to deliver and excellent regarding cosmetic appearance because manipulation of muscle is almost negligible. The entry through conjunctive is very small and collapses to close as well. All these factors

combined together make Botox injection the 1<sup>st</sup> choice treatment option for very young Esotropes.

Damage to surrounding area is an important issue of each and every intervention. The Botox injection may spill over to surrounding area and lead to ptosis<sup>(12)</sup> and restriction of movements which were never aimed. The risk persists when muscles are operated and adhesions are formed which were never wanted. The outcome of any type of treatment was finally assessed by Prism cover test. No movement at distant fixation while using prism is the indication of good binocular vision. Every effort was made to obtain this goal. Both techniques, Botox injection and surgery, are comparable theoretically. Practically, Botox injection is better because less manipulation will cause less complications.

## CONCLUSION

Botox injection, bilateral medial rectus recession with/without unilateral lateral rectus resection is the best sequence of treatment for congenital esotropia.

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