

# INTERMITTENT EXOTROPIA: A Major Review

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Exodeviations or divergent squint occurs as a result of certain obstacles to development or maintenance of binocular vision and/ or due to defective action of the medial rectus muscles. Small exophorias are found in high frequency in the normal population and 60-70% of normal newborn infants have a transient exodeviation that resolves by 4-6 months of age (1-3). Intermittent exotropia is an exodeviation intermittently controlled by fusional mechanisms. Unlike a pure phoria, intermittent exotropia spontaneously breaks down into a manifest exotropia.

**Prevalence** - Exodeviations are much more common in latent or intermittent form than are esodeviations. Of all the exotropia intermittent exotropia comprises about 50-90% of the cases and is usually preceded by a stage of exophoria (4,5). It usually affects about 1% of the general population. Exodeviations occur more commonly in the Middle East, subequatorial Africa and the Orient than in the United States 5. Jenkins made the interesting observation that the nearer a country is to the equator the higher the prevalence of exodeviations (6).

**Natural History of Intermittent Exotropia** -The natural history of intermittent exotropia remains obscure due to lack of longitudinal prospective studies and only a few retrospective studies of untreated intermittent exotropia. In some cases, an exophoria progresses to an intermittent exotropia that eventually becomes constant. Such deviation usually occurs first at distance and later at near fixation. They may be influenced by decreased tonic convergence with increasing age, the development of suppression, loss of accommodative power and increasing divergence of orbit with advancing age 5. Nevertheless, not all intermittent exotropia are progressive. In some cases, the deviation may remain stable for many years, and in a few cases, it may even improve. Thus the patient should be followed over time to determine whether their exotropia is stable or deteriorating. Von Noorden found that 75% of 51 untreated patients showed progression over an average follow up period of 3.5 years while 9% did not change, and 16% improved 5.

Factors to be recorded for progression:

- Loss of fusional control as evidenced by increasing frequency of the manifest phase of strabismus.
- Development of a secondary convergence insufficiency.
- Increase in size of basic deviation.

- Development of Suppression.

Calhoun et al described four phases of exodeviations starting as divergence excess type and progressing as shown in Table 1.

**Table 1:** Phases of exodeviation and clinical presentation

I. Exophoria at distance, orthophoria at near. Asymptomatic
II. Intermittent exotropia for distance, orthophoria/ exophoria at near. Symptomatic for distance.
III. Exotropia for distance, exophoria or intermittent exotropia at near. Binocular vision for near, suppression scotoma develops for distance.
IV. Exotropia at distance as well as near. Lack of binocularity.

## ETIOLOGY

### Innervational Factors and Mechanical Factors

Duane championed the view that exodeviations are caused by an innervational imbalance that upsets the reciprocal relationship between active convergence and divergence mechanisms 7. Bielschowsky questioned Duane's claim that the majority of exodeviations are based on hyperactive tonic divergence. According to him Duane's theory did not take into account the abnormal position of rest associated with exodeviations. This abnormal position is determined by anatomic and mechanical factors such as orientation, shape and size of the orbits, size and shape of globes, volume and viscosity of reterobulbar tissue, functioning of the eye muscles as determined by their insertion, length, elasticity anatomical and structural arrangement and condition of fascias and ligaments of the orbits 5. Most current theories on the etiology of exodeviations combine the ideas of Duane and Bielchowsky and are of the concept that exodeviations are caused by combination of mechanical and innervational factors, the innervational factors consisting of variation of convergence innervation or disturbed equilibrium between convergence and divergence 8,9.

### Role of defective Fusion

Exodeviation or divergent squint occurs as a result of certain obstacles to development or maintenance of binocular vision and/or due to defective action of the medial rectus muscles. Although exophoria is almost universal, manifest exodeviation or exotropia are fortunately rare due to good fusional convergence reserves. Worth, in 1903 developed a theory that the essential cause of squint is a defect of the fusion faculty and indeed is a congenital total absence of the fusion faculty 10. He stated that when the fusion faculty is

inadequate the eyes are in a state of unstable equilibrium, ready to squint either inwards or outwards on slight provocation.

### **Role of AC/A Ratio**

The possibility that a high accommodation convergence to accommodation (AC/A) ratio could have a role in intermittent exotropia has been discussed at length by Cooper and Medow 11. These authors concluded that the AC/A ratio is either normal or just slightly higher than normal in patients who have intermittent exotropia. Kushner in 1988 found that approximately 60% patients with true divergence excess had a high AC/A ratio, and 40% had a normal AC/A ratio 12.

### **Theory of Hemiretinal Suppression**

Knapp and Jampolsky have postulated a theory that probably there occurs a progression from exophoria to bilateral, bitemporal hemiretinal suppression to intermittent exotropia 13,14. This theory holds that the ability to suppress temporal vision allows the eye to diverge.

### **Role of Refractive Errors**

In addition to interplay between the convergence and divergence mechanisms, refractive errors may further modify the innervational pattern that influences the position of the eyes. In a patient with uncorrected myopia, less than normal accommodative effort is required during near vision thus causing decreased accommodative convergence. According to Donders this constant under stimulation of convergence may cause an exodeviation to develop 15. Similarly in patients with high degree of uncorrected hypermetropia no effort is made to overcome the refractive error by an accommodative effort and clear vision is unattainable 16. This may lead to development of an exodeviation on the basis of an under stimulated and thus under active convergence mechanism that causes the AC/A ratio to remain low. Thus refractive errors through their effect on accommodation are undoubtedly one of the prime causes of misalignment of the eyes. Jampolsky et al emphasized that anisomyopia and anisoastigmatism bear distinct relationships to exodeviation 17. Unequal clarity of retinal images may present an obstacle to fusion, facilitate suppression and therefore contribute to the pathogenesis of exotropia.

### **Sensory Adaptation**

- As a rule during the phoric phase of intermittent exotropia, the eyes are perfectly aligned and the patient will have bifoveal fusion with excellent stereoacuity ranging between 40-60 second arc. This excellent bifoveal fusion develops because the eyes are well aligned in early infancy when the critical binocular cortical connections are being established and the deviation is intermittent, allowing reinforcement of fusion.

- During the tropia phase when the exotropia is manifest most patients will show large regional suppression of the temporal retina.
- Anomalous Retinal Correspondence during the tropic phase and Normal retinal correspondence during the phoria phase has also been demonstrated in some patients with intermittent exotropia.
- A minority of patients with intermittent exotropia may have the monofixation syndrome and do not develop normal bifoveal fixation with high grade of stereopsis.
- A rare patient may even have a significant amblyopia.
- Patient with late onset exotropia after 6-7 years of age may experience diplopia because the exotropia occurs after the loss of plasticity that allows suppression.

### Classification Systems

Intermittent exotropia has been divided into four groups according to the classification system proposed by Burian 18. This system is based upon the concept of fusional convergence and divergence and relies on measurements of the distance and near deviations.

1. *Basic Intermittent exotropia*: is present when the deviation in the distance is within 10 prism diopters of the near deviation. Patients with basic deviation have a normal tonic fusional convergence, accommodative convergence (normal AC/A ratio) and proximal convergence.
2. *Divergence Excess*: is present when the distance deviation is 10 prism diopters greater than the near deviation, even after performing the patch test. Kushner found that approximately 60% patients with true divergence excess had a high AC/A ratio, and 40% had a normal AC/A ratio. The group with a high AC/A ratio is prone to postoperative over correction if the distance measure was used as a target angle.
3. *Convergence Insufficiency*: is present when the near deviation is 10 prism diopters greater than the distance deviation.
4. *Simulated or Pseudo-divergence Excess*: is present when the patient has a larger exotropia for the distance than near but the near deviation increases within 10 prism diopters of the distance deviation after 30-60 min. of monocular occlusion. This occurs because patients with pseudo-divergence excess have increased tonic fusional convergence that acts more at near. The prolonged monocular occlusion dissipates tonic fusional convergence thereby disclosing the full latent deviation.

Kushner has attributed disparity between distance and near deviation in intermittent exotropia to proximal vergence after effects and to alterations in AC/A ratio 12. The term “*tenacious proximal fusion*” has been used to describe the fusional after effects that explain the distance near disparity in patients previously classified as pseudo-divergence excess type. These patients with reduced angle of strabismus at near appear to have a slow to dissipate proximal fusion mechanism that prevents them from manifesting their true near deviation during a brief cover test. Although Kushner’s system is complex it can be used to guide patient evaluation and management.

Similar to Burian's classification system, distance and near measurements must be obtained. In addition, if a disparity exists between the distance and the near measurement, the AC/A ratio is obtained using the lens gradient method. This is done by using a -2.0 D lens at distance, or by using a +3.0 D lens at near after fusion has been suspended by using 60 minutes of occlusion.

<b>Type</b>	<b>Description</b>	<b>Percent</b>
Basic	Distance and Near Measurements are equal	37
Tenacious Proximal Fusion	Distance measurement initially exceeds near, but the near measurement increases after 60min. of occlusion	40
High AC/A ratio	Distance measurement exceeds near measurement, and a high AC/A ratio is present	5
Proximal Convergence	Distance measurement exceeds near measurement, even after 60min. of occlusion. AC/A ratio is normal	4
Low AC/A ratio	Near measurement exceeds distance measurement. A low AC/A ratio is demonstrated.	11
Fusional Convergence Insufficiency	Near measurement exceeds distance measurement. Patients have poor fusional convergence amplitudes.	<1
Pseudo-Convergence Insufficiency	Near measurement exceeds distance measurement, but distance measurement increases with 60 minutes of monocular occlusion	<1

## **Characteristics of Intermittent exotropia**

Intermittent exotropia is the most common type of exodeviation and is usually first observed by the parents in early childhood.

### **Genetics and Risk factors**

Although heredity appears to play a role in exodeviations, the etiology of this disorder is probably multifactorial. A positive family history is often noticed (18). Children born with craniofacial anomalies and those with neurologic defects are more likely to exhibit exotropia. Maternal smoking during pregnancy and low birth weight are significant and independent risk factors for the development of horizontal deviations (19).

### **Age of Onset**

The onset of majority of exodeviations is shortly after birth. In a series of 472 patients with intermittent exotropia, the deviation was present at birth in 204 and appeared in 16 at 6 months of age and in 72 between 6-12 months of age (9). In only 24 of the patients exotropia develop after 5 years of age. Burian and Spivey reported 63% of their patients

having an age of onset less than 5 years of age (18). Thirty-five percent to 40 % of cases are seen before the second year of life (20). Jampolsky noted that with rare exceptions, exodeviations begin as an exophoria that may deteriorate into intermittent and constant exotropia as suppression develops. He considers suppression the key that unlocks the fusion mechanisms (21).

### **Sex Distribution**

Most studies describe a preponderance of female patients in exotropia.

### **Precipitating factors**

The tropia phase of intermittent exotropia is most noticeable when the child is tired or sick or when they are day dreaming. Adult patients may manifest exodeviation after imbibing alcoholic beverages or taking sedatives.

### **Symptoms**

Patients with intermittent exotropia rarely complain of symptoms. The surprising absence of symptoms is related to a well-developed suppression mechanism. In addition patient may exhibit normal retinal correspondence when the eyes are aligned but abnormal retinal correspondence on sensory testing when one eye is deviated. The various symptoms seen in intermittent exotropia are as follows:

- **Transient Diplopia:** Some patients report occasional transient horizontal diplopia, others will have a vague sense of discomfort when their eyes are deviated.
- **Asthenopic symptoms** may occur in initial phases, when fusion begins to succumb and the eyes deviate momentarily from the orthoposition. Some patients may notice symptoms like eyestrain, blurring, headache and difficulty with prolonged periods of reading. However, soon the children become asymptomatic due to the development of sensory adaptation.
- **Micropsia:** Some patients may complain of micropsia that may occur due to the use of accommodative convergence to control the exodeviation.
- **Diplophotophobia** One symptom that deserves a special comment is closure of one eye in bright sunlight. Bright sunlight dazzles the retina so that fusion is somehow disrupted, causing the deviation to become manifest (22). Thus one eye is closed in order to avoid diplopia and confusion.

### **Assessing Control of Intermittent Exotropia**

The assessment of control of intermittent exotropia is essential to obtain a baseline evaluation as well as to monitor deterioration and progression of intermittent exotropia.

### **Subjective Methods**

Home Control: The parents may be told to keep a chart noting the control of deviation at home in terms of the percentage of waking hours the manifest deviation is noticed at home.

Office Control:

*Good Control:* Patient “breaks” only after cover testing and resumes fusion rapidly without need for a blink or refixation.

*Fair Control:* Patient blinks or refixates to control the deviation after disruption with cover testing.

*Poor Control:* Patient who breaks spontaneously without any form of fusion disruption.

## **Objective Methods**

Distance Stereoacuity: It provides an objective assessment of both control of the deviation and the deterioration of fusion that occurs early in this disorder. Normal distance stereoacuity indicates good control with little or no suppression. The Mentor B-Vat II BVS assesses distance stereoacuity using both contour circles and the random dot E test from 240 to 15 seconds of arc disparity (23,24,25).

Near Stereoacuity: In a study it was shown that near stereoacuity does not correlate well with the degree of control in intermittent exotropia and that performance in this test is only minimally affected by surgery (26).

## **Measuring the Angle of Deviation**

Due to the variable angle of deviation, measurement in a patient with intermittent exotropia can be difficult by routine alternate cover prism testing. A prolonged alternate cover testing should be used in patients with intermittent exotropia to suspend tonic fusional convergence. If after prolonged alternate cover testing, there is significant angle variability or a significant distance/near discrepancy, then a patch test is indicated. The patients who show consistent measurements and no significant distance-near disparity do not need the patch test. Monocular occlusion should be used before +3.00 D lenses to measure near deviation, to avoid misdiagnosing a high AC/A ratio (12). The + 3.00 lenses suspend normal accommodative convergence, whereas monocular occlusion relaxes fusional convergence mechanisms.

- **Patch Test** - The patch test is used to control the tonic fusional convergence to differentiate pseudo-divergence excess from true divergence excess and to reduce the angle variability. Contrary to the earlier practice of patching one eye for 24 hrs it is now found that patching the eye for 30 min. is sufficient to suspend the tonic fusional convergence and thus reveal the actual amount of deviation (27).

- **+3.0 D near add test (lens gradient method)** - This test has been devised to diagnose the patients of divergence excess type who have true divergence excess due to high AC/A ratio. This test uses the lens gradient method to measure the AC/A ratio. These patients are the ones who will continue to have a distance-near disparity post-operatively, and may require bifocal spectacles after surgery for a consecutive esotropia at near. This test should be resorted to in patients who have a distance deviation greater than near deviation of 10 prism diopters or more after the patch test. After the patch test while still dissociated, re-measure the deviation at near with a +3.0 add. If the exodeviation at near increases by 20 prism diopters or more the diagnosis of high AC/A ratio true divergence excess intermittent exotropia is made.
- **Far distance measurement** - Measuring the deviation by fixating a far object reduces measurement variability and helps uncover the full deviation by reducing near convergence. Combining the patch test and far distance measurement can greatly reduce under-corrections and has improved the overall result. In a prospective randomized trial, 86% of patients who underwent surgery for the largest angle had a satisfactory outcome, compared with 62% who were operated on for the standard 6 meter distance deviation (28).

## Management

### *Non-surgical Treatment*

Although the non-surgical treatment for intermittent exotropia is not very effective but it may be preferred in patients with small (<20pd) deviations, very young patients in whom surgical overcorrection could lead to amblyopia or loss of bifixation, and in patients who otherwise cannot be taken up for surgery (29). Additionally, patients with a high AC/A ratio may be responsive to non-surgical methods.

Management options include the following:

- **Spectacle Correction of Refractive Errors:** Anisometropia, astigmatism, myopia and even hyperopia can impair fusion and promote a manifest deviation. A trial of corrective lenses based on cycloplegic refraction is often warranted (30). Myopes, in particular, will often regain control of their strabismus and become phoric if given corrective lenses.
- **Overcorrecting minus lens therapy:** This technique is based on the principle that stimulating accommodative convergence can reduce an exodeviation (31). This is particularly useful in patients who have a high AC/A ratio.
- **Part time occlusion:** This technique has found some use in very young children. It is a passive anti-suppression technique as opposed to the active techniques involving diplopia awareness. Part time patching of the non-deviating eye for four to six hours daily may convert an intermittent exotropia to a phoria. Although the benefit is usually temporary, occlusion can be used to postpone surgical intervention in responsive patients (32). Alternate occlusion may be used in

patients with equal fixation preferences. Initially the results are evaluated after 4 months of occlusion. If the angle of deviation is decreased the occlusion should be continued and assessment made every 4 months until no further change occurs. In case there is no improvement for 4 months, it is discontinued.

- **Prismotherapy:** Some strabismologists recommend a use of base-in prisms to enforce bifoveolar stimulation. Prisms are rarely a long-term solution in patients with intermittent exotropia, but can be used to improve fusional control, or as a temporizing measure, either pre or postoperatively.
- **Orthoptics:** Knapp summarized the opinion of most strabismologists by stating that orthoptics should not be used as a substitute for surgery but rather as a supplement. The aim is to make the patient aware of manifest deviation and to improve the patient's control over it (33). Active anti-suppression and diplopia awareness techniques can be used in cases with suppression. Convergence exercises may be helpful in patients who have a remote near point of convergence, or in whom poor fusional convergence amplitudes are demonstrated.

### *Surgical Treatment*

**Indications for surgery** - As with any strabismus the indications for surgery include preservation or restoration of binocular function and cosmesis. In intermittent exotropia one of the important indications for therapeutic intervention is an increasing tropia phase, since this indicates deteriorating fusional control. If the frequency or duration of the tropia phase increases, this indicates diminished fusional control and the potential for losing binocular function. Progression should be monitored by documenting the size of the deviation, the duration of manifest deviation and the ease of regaining fusion after dissociation from the cover-uncover test. Deteriorating fusional control is an indication for surgery.

**Table 3:** Signs of Progression of Intermittent Exotropia

- Gradual loss of fusional control evidenced by the increasing frequency of the manifest phase of squint
- Development of Secondary convergence insufficiency
- Increase in size of the basic deviation
- Development of suppression as indicated by absence of diplopia during manifest phase
- Decrease of Stereoacuity

**Timing for Surgery** - There is a controversy about the management of children less than 4 years of age because in contrast to infantile esotropia these children have intermittent fusion and excellent stereopsis. Knapp and many other workers advocated early surgical intervention to prevent development of sensory changes that may prove intractable later (34-37). However they do caution that in visually immature children a slight undercorrection should be attempted to prevent occurrence of monofixation syndrome from consecutive esotropia (38). Jampolsky advocates delayed surgery, citing advantages like accurate diagnosis and quantification of the amount of deviation and to avoid

consecutive esotropia and development of amblyopia. Although one study reported better outcomes in children who were under the age of 4 years (37), most studies have failed to show that age at time of surgery makes any difference in outcome (39-41). Thus it is now believed that the surgery in this age group is reserved for patients in whom rapid loss of control is documented. In the interim, minus lenses or part time patching may be used as non surgical methods and these patients followed closely for signs of progression (42,43).

**Type of Surgery** - Several surgical approaches have been used successfully. Classic teaching has been that divergence excess type should be treated with bilateral lateral rectus muscle recessions. Simulated divergence excess and basic types should be treated with unilateral lateral rectus muscle recession/medial rectus muscle resection and convergence insufficiency type should be treated with bilateral medial rectus muscle resections. However recently it has been shown that for all types of exotropia except the convergence insufficiency type bilateral lateral rectus recessions work well (44). Symmetric surgery is usually preferred over monocular recession/resection procedures, since a recession/resection procedure may produce lateral incomitance with a significant esotropia to the side of the operated eye. In adults, this incomitance can produce diplopia in side gaze, which may persist for months to even years. In general, surgeons should operate for the largest distance deviation that can be repeatedly documented (28). Operating for the greatest measured deviation appears to produce the best surgical outcomes. In case one eye is amblyopic, the surgeon often chooses unilateral surgery which can sometimes be a challenge in previously operated eyes. Adjustable suture techniques are helpful in cooperative patients (24,25)

**Lateral Incomitance** - Lateral incomitance is a difference in size of the deviation on lateral gaze. Moore has shown that patients with preoperative lateral incomitance are much more likely to be overcorrected with surgery (45). For this reason, some surgeons have suggested reducing the amount of recession in patients with lateral incomitance, especially if the deviation in lateral gaze is 50% less with the deviation in primary position.

**Goal of Surgery** - The goal of strabismus surgery for intermittent exotropia is to restore alignment and to preserve or restore binocular function. It is believed that long-term success requires deliberate short-term overcorrection, since eyes tend to drift out over time. Thus, many advocate targeting an initial overcorrection ranging from 4 to 10 prism diopters (46-49). Postoperative diplopia is used to stimulate the development of fusional vergences and stabilize postoperative alignment (5). One must keep the age of the patient in mind when planning surgery, since consecutive esotropias in a visually immature infant can have the consequences of amblyopia and loss of binocularity. In older children and adults who develop intermittent exotropia after age 10 years, diplopia is usually present with little or no suppression. In these patients, the surgical goal should be orthotropia on the first postoperative day, not intentional overcorrection (42,43). In addition adults with longstanding intermittent deviations will often tolerate undercorrection, but will have symptomatic diplopia when overcorrected.

**A-and V-patterns: Oblique overaction** - Intermittent exotropia may be associated with inferior or superior oblique overaction and thus A- and V-pattern. For inferior oblique overaction with a significant V-pattern weaken the inferior oblique at the time of the horizontal surgery. If significant superior oblique overaction and an A-pattern is present, consider an infra placement of the lateral rectus muscles or superior oblique weakening procedure. It is generally not required to alter the amount of horizontal surgery when simultaneous oblique surgery is performed. Small vertical deviations associated with intermittent exotropia should be ignored since these vertical phorias less than 8 prism diopters usually disappear after surgery. Another point of caution is that with long standing exotropia a pseudo A and/or V pattern may be noticed due to tight lateral rectus muscle which causes slippage of the globe under the tight muscles in extreme vertical gazes. This upshoot and downshoot of the eyeball will mostly be corrected by recessing the tight lateral rectus and does not require any surgery on the oblique muscles.

**Post-operative treatment** - The post-operative treatment depends on the position of the eyes postoperatively. The eyes may be in orthoposition, may show residual exodeviation (undercorrection) or may show consecutive esodeviation (overcorrection).

- **Orthoposition:** Immediately after surgery a small consecutive esotropia of upto 8-10 prism diopters is desirable in children. There is always a tendency of the eyes to diverge postoperatively thus for long term success if immediately postoperatively an orthoposition is noted it is extremely important to strengthen the positive fusional convergence with orthoptic exercises in order to improve control of the newly acquired bifoveal single vision. As mentioned before adults who develop intermittent exotropia after age 10 years usually present with diplopia and in these patients orthotropia in the immediate postoperative period is desirable.
- **Consecutive esotropia (Overcorrection):** As mentioned before a small consecutive esotropia of up to 10 prism diopters is a desirable postoperative result in children. Even a moderate consecutive esotropia of up to 20 prism diopters may resolve without further surgery. The parents and or the patients should always be warned before the surgery that postoperative diplopia might occur so that they are not surprised. Nonsurgical management of overcorrection should be tried for at least a month rather than re-operating because of the high likelihood of spontaneous resolution (50). An unusually large overcorrection with gross limitation of ocular motility noted on the first postoperative day is possibly due to lost or slipped lateral rectus muscle. Such cases should be taken up for surgery as soon as possible.
  - **Children:** In visually immature age group even a small esotropia is associated with a danger of developing amblyopia thus these patients require special care. Any refractive error especially a hypermetropia should be fully corrected. Bifocals may be prescribed if the deviation is greater at near. In children under 4 years of age, part-time alternate patching of each eye helps prevent amblyopia and may facilitate straightening of the eyes. If a residual esotropia persists past 3 weeks, then the patient should be treated with prism glasses to neutralize the esotropia.

Prescribe just enough power to allow fusion, but leave a small residual esophoria to encourage divergence. If after 6-8 weeks the esotropia persists, then a reoperation should be considered. In case of a limited adduction or lateral incomitance, advancement of the lateral rectus is indicated. Otherwise, bimedial recession is usually the procedure of choice for a consecutive esotropia, especially if the esotropia is greater at near.

- **Adults:** In patients in the visually mature age group with an overcorrection of more than 20 prism diopters, nonsurgical measures may be tried till 6-8 weeks after which a re-surgery should be planned if the deviation persists.
- **Residual Exotropia (Undercorrection):**
- **Small residual exotropia (<15 Prism diopters):** should be primarily managed by non-surgical measures. Any refractive error especially myopia should be fully corrected. In hypermetropic or emmetropic patient cycloplegics may be instilled twice a day to stimulate accommodative convergence. Orthoptic exercises in the form of antisuppression exercises and fusional convergence exercises should be continued till the proper alignment is achieved. Prismotherapy in the form of base in prisms may be tried in some patient.
- **Large residual exotropia (>15 Prism diopters):** Patients with a residual exotropia over 15 prism diopters in the first postoperative week will probably not improve and many will require additional surgery. It is better to wait 8-12 weeks before re-operating on the residual exotropia. If the primary surgery was bilateral lateral rectus recession of 6 mm or less, re-recession of the lateral rectus may be resorted to. If the primary recession was greater than 6 mm, then perform bilateral medial rectus resections with a conservative approach, as overcorrections are common after resecting against a large recession.

### *Prognosis*

Due to lack of a standard definition for a successful outcome, variability in classification systems, multiple treatment approaches, and a paucity of long-term data it is difficult to determine the true outcome of currently available treatments for intermittent exotropia. The success rate of intermittent exotropia is dependent on the length of follow-up. Longer the follow up higher the incidence of undercorrections. Short-term studies with 6 months to 1 year follow-up reports a success rates of approximately 80%, whereas studies with 2-5 year follow-up have shown a 50-60% success rate with one surgery. In recent studies, the reported success rate in all types of intermittent exotropia has been about 60-70% (39,48,49,51,52). In most of these reports, success was defined as alignment within 10 prism diopters of orthophoria, and mean follow-up was no greater than 4.5 years. Kushner studied surgical outcomes relative to classification of intermittent exotropia, surgical technique and surgical dosage (12,28). The conclusions drawn from his data are:

- A high AC/A is an indicator of a poor surgical prognosis and most of these patients have a consecutive esotropia at near.
- Tenacious proximal fusion is an indicator of a good surgical prognosis.

- If a patient shows an increase in the size of distance deviation when measured after monocular patching or when viewing a far distance target, the surgery should be performed for the largest deviation that can be documented consistently.

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