Introduction
Almost all squint surgeries have good cosmetic results. The functional results are poor at the same time, in majority of cases. In children below 2 years of age, after surgery they will develop good binocular vision. The majority of the aged, remain aligned, but has only single vision at the expense of binocular vision. A small percentage may suffer an intractable diplopia.

Calculation of the exact angle of deviation is the important matter of concern in the treatment of strabismus. This study involves the measurement of deviations, diplopia responses and the angle at which these responses were elicited using prisms.

Aim and objective
The good result from treatment of strabismus patient is fusion, no suppression, good fusional amplitudes and no symptoms. The prism adaptation test is a pre-operative diagnostic test to identify the potential for fusion and predict the risk of diplopia in patients without the potential for binocular single vision, before embarking on cosmetic surgery on presenting angles of deviation. The aim of the test can be listed as follows.

To identify the potential for fusion
To predict the risks of post-operative diplopia by pre-operative examination.
To prepare the patient for sensory environment that he would face post-operatively.

Materials & Methods
Sample size
This is a prospective study of 20 patients who were seen at the Orthoptic department of Little Flower Hospital during a period of last one year. They were categorized according to age, sex, age of onset of deviation, visual acuity, refractive error, sensory state, previous treatment etc.

Exclusion criteria
1 infants and young children.
2 vertical squint
3 paralytic squint
4 Duane’s retraction syndrome
5 patients with gross refractive errors.
6 very large angles of deviation
7 Behavioural and neurological abnormalities
8 lack of compliance with diagnostic procedures

There are several methods to find out the angle of deviations including synoptophore, prism cover test, Maddox rod with tangent scale etc. to get uniformity we adhered to a single method of examination that is prism cover test.

Target:
For the prism adaptation test to be a realistic predictor of post-operative diplopia, both the target used and testing environment need to be adapted to real life conditions. Patients showed more diplopia response, within the region under investigation when an illuminated target was used than with a non-illuminated target. We followed this and the target was a torch light with a slit for near and a small spot light for distance.

Prism cover test
It is an accurate and reproducible method for measuring deviations. The fixation light fixed by fovea of the straight eye falls on the extrafoveal region of the retina of the deviating eye. The physiological basis of prism cover test measurement is the displacement of fixation light in the deviated eye from the extrafoveal area to the fovea, with prisms. The deviation is measured with and without the patient wearing glasses, both at near and distance positions.

Original Article
Prism adaptation test to predict post-operative diplopia after strabismus surgery
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ORBIS STUDY
With the prism bar the angles were diplopia was felt, for near and distance. Was noted , The observations are as follows.

a) The ability to recognize diplopia but inability to see single even with prisms

b) Partial correction of deviation eliciting diplopia.

It is possible to divide the patients undergoing the test into two groups,

That is those who were aware of diplopia at some times and those who are not. Patients who were once aware of it were expected to respond more precisely. Those unaware of diplopia often require clear advice for realizing what is actually being “looked” for. They were not always able to give a clear response to the question,” Do you see double?”.

The following were the responses

1. No diplopia is appreciated at any time during the test.
2. Diplopia may be appreciated at some point during PAT and may not disappear. The prism strength was recorded were diplopia was appreciated.

Observations

| No of patients | - 20 |
| Sex           | - 9 females - 11 males |
| Age in years  | - range from 5-30 |
| Age of onset of deviation | - congenital 14 below 10 years – 4 after 10 years –2 |
| Visual acuity | - lowest FCF in one eye |
| Refractive error | - no error – 16 with error 4 highest error 4.50 Dcyl x 10^8 in one eye |
| Previous treatment | - second stage surgery – 6 first stage surgery 14 |

Table: 1

<table>
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<tr>
<th>No</th>
<th>Age</th>
<th>Sex</th>
<th>Age of onset of deviation</th>
<th>Prism cover</th>
<th>Diplopia response</th>
<th>Diplopia response for distance</th>
<th>Diplopia in seconds</th>
<th>Sensory status</th>
<th>Visual acuity</th>
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<td>Alternating suppression</td>
<td>6/9/6</td>
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<td>Alternating suppression</td>
<td>6/6/6</td>
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</table>
### Result

This study included 20 patients. 14 of the patients had a congenital onset squint and 7 were late onset squint patients. The result could be summarized as follows.

1. All the patients were given a chance to experience the sensory environment that they would face postoperatively.

2. All those congenital cases with alternating suppression experienced diplopia for few seconds. Some experienced it at the angle of deviation, some for few dioptres of undercorrection and some for few diopters of over correction. Except in one case, diplopia disappeared.

3. The one case with persistent diplopia preoperatively showed the same response postoperatively. But that too was not intractable and disappeared within 6 weeks.

4. All congenital cases with one eye suppression did not show any diplopia response.

5. With late onset squint the duration of diplopia was more. The later the onset, the longer was the duration of diplopia of response preoperatively.

### Discussion

The suppression theory is of ancient origin. It was clearly described by da Tour 1768 before there was any knowledge of depth perception due to disparity of retinal images. Correspondence of retinal elements is completely rigid and unchanging. One of a pair of corresponding points always suppress the other. Where there is a contour, the suppressing power of retinal elements on each side of it is enhanced. Where there is disparity of contour, then in the one eye retinal elements on both sides of this contour will suppress corresponding points in the other eye. If the extent of
suppression is smaller than the disparity between the contours then diplopia occurs, but depth perception is possible. If the extent of the suppression is greater than the disparity between the contours, one contour is suppressed and single vision occurs with depth perception. The contour of one part of the image may be dominant in one eye and that of another part may be dominant in other eye.

Asher had shown that in binocular stimulation one pair of corresponding elements always suppressed the other. As soon as squint occurs, the eyes become dissociated and the immediate effect is to produce diplopia. This is obviously an intolerable situation, one image must be suppressed. Since visual acuity at the pseudomacula is less than that at the macula, the image on pseudo macula is suppressed.

The longer the child is left squinting, the more firmly fixed the adaptive mechanisms and it is therefore of the utmost importance to treat the patients at the earliest possible movement after the onset of squint. Costenbander (1959) suggests that the age of 12 to 18 months might be a suitable time for operations in such patients. Surgery and sensory adaptation by GTW Cashell deals with it.

Suppression and post operative diplopia in relation to sensory pattern by Mary Marsh says that suppression and diplopia may be regarded as the two sides of the same medal. In this study, was an attempt to determine whether pre-operative suppression has any bearing on the development of post operative diplopia. Cases of lasting diplopia after surgery seem rate. The study classified diplopia depending on duration.

a) transient- from a few hours to a few weeks
b) Lasting - upto 6 month
c) Intractable - a year or more

In this study, the result was that with unilateral suppression there was no pre-operative diplopia. All patients who responded pre-operative diplopia, had alternating suppression. In that sense, considering sensory status, pre-operative diplopia response is a positive sign, that the patient is using his other eye also. But in the first case he is almost at the loss of one of his eyes, he is suppressing it.

Observations show that duration of pre-operative diplopia response in congenital squint is much less than in late onset. It should mean that the sensory adaptation, that is, suppression has become more deep seated in early onset than in late onset deviations. In this study, the one patient with post-operative diplopia had a late onset squint.

Prism positioning is an important factor. Thompson and Guyton (1985) defined frontal plane position as the best practical way “where the posterior face of prism is perpendicular to the direction of fixation object along the line of sight”. For accuracy in near measurements the prism should be rotated nasally.

Conclusion

Despite the relatively small numbers included in this study and the time period allowed for the test, pre-operative prism adaptation is an effective diagnostic tool to determine the potential for fusion and the angle of deviation. With cases undergoing operations for cosmetic reasons, the diplopia test with prisms give a reasonably accurate idea about the largest change in angle that could be made during surgery without causing diplopia.

Suggestion

Seeing single after squint surgery does not mean a hundred percent success, they are doing it at the expense of their potential for binocular single vision. Cosmetically the surgery is a success, but functionally not. So embark on a surgery for squint at the earliest age possible, provided there are no other contra indications. Pre operative Prism adaptation make patients aware of sensory environment that they would face post-operatively. Those who were at a risk of diplopia could be warned, particularly those aimed at cosmosis, who could never tolerate diplopia after surgery. So prism adaptation test should be included in the routine orthoptic procedures.
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3 G K Von Noorden – Binocular vision and ocular motility


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**Cont. from pg. 191...**

<table>
<thead>
<tr>
<th>Congenital</th>
<th>Ocular</th>
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<tr>
<td><strong>Age</strong></td>
<td>Onset during 1st 6 mo. After birth</td>
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<tr>
<td><strong>Head position</strong></td>
<td>Passive or voluntary straightening of head is difficult or impossible</td>
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<tr>
<td><strong>Neck muscles</strong></td>
<td>Palpation reveals hardening of sternocleidomastoid muscle</td>
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<tr>
<td><strong>Vision</strong></td>
<td>No visual disturbances</td>
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<td><strong>Effect of occlusion</strong></td>
<td>Torticollis not influenced by occlusion of either eye</td>
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