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Comparative assessment of prism alternate cover test at near, distance, far distance before and after patching and prism adaptation test in concomitant horizontal strabismus

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ABSTRACT

To provide satisfactory treatment in patients with heterotropia, it is necessary to get an accurate measurement of the deviation in distance and near fixation. In this study, we compared ocular deviation before occlusion, after one hour patch test and the prism adaptation test (PAT) at near(0.33 m), distance (6m) and far distance (12m) through prism alternate cover test (PACT) in patients with concomitant horizontal strabismus. Our study analyzed 30 subjects (14 esotropic and 16 exotropic) which were categorized into three groups: Non-Responders, Patch test responders and PAT responders. Mean esodeviation and exodeviation measurements were found maximum after PAT followed by patch test and minimum after traditional PACT. Following patch test and PAT test, an increase in the angle of deviation was seen in 70% and 76.67% patients at 1/3 m, in 50% and 66.67% patients at 6 m and in 43.33% and 63.33% patients at 12 m respectively. Comparing the maximum angle of deviation, 20 patients were found to be as responder either to patch test or PAT or both. Through this study, we concluded that PAT is useful in determining the largest exotropic and esotropic angle and superior to patch test to estimate the target angle preoperatively.

Keywords: esodeviation, exodeviation, prism alternate cover test, prism adaptation test, patch test.

INTRODUCTION

PAT responders can be defined as those who demonstrate a fusion response at the end of PAT and non-responders as those who unable to show fusion after PAT.[1] It is still the topic of discussion and research, the reason(s) behind the progressive increment in prism power in relation to strabismus. Many hypothesis have been proposed to explain the reasons how PAT uncover the masked angle of deviation. Burian postulated the idea of relief of tenacious fusion over time leading to the increase in near angle of deviation with respect to intermittent distance exotropia.[2]Garretty T hypothesized that same could explain convergence excess esotropia. He stated that PAT eliminates the need for the fusion and thus reveals a larger distance deviation.[3]

Several authors have claimed the significance of PAT in improving the surgical outcomes of strabismus.[1,4] Many studies have showed that PAT could calculate the required prism correction prior to surgery relatively accurate and thus prevent post-surgical over-correction or under-correction.[5,6] Surgery done according to the PAT values also promotes the development of binocular sensory vision.[7,8]

But PAT is a cumbersome and time taking preoperative technique. A surrogate technique is in search which can rapidly measure the ocular deviation prior to surgery. Patch test could be a good alternative in which the dominant eye is patched for 1 hour while the patient is encouraged to focus on distance point.

In this study, we aimed to investigate whether there is significant difference in strabismus measurement at near, distance, far distance before and after one hour patch test and after prism adaptation test in subjects with concomitant horizontal strabismus; and we had tried to see weather patch test is efficient enough in reveling latent angle of deviation in comparison to PAT in concomitant horizontal strabismus.

METHODS

We conducted a 15-month prospective study to investigate whether the angle of deviation measured at a far distance (12m) is different than the angle of deviation measured conventionally at near (33cm) and at distance (6m) after diagnostic monocular occlusion and prism adaptation test (PAT) in patients with concomitant horizontal strabismus.

Subjects with concomitant horizontal strabismus who presented at the ophthalmology outpatient department of ESI PGIMSR, Basaidarapur, were included in the study based on specific criteria. Inclusion criteria required participants to have a best corrected visual acuity (BCVA) of ≥ 6/36 in both eyes and to be cooperative for the testing procedures. Exclusion criteria were a BCVA <

6/36 in both eyes, presence of paralytic or restrictive strabismus, history of squint surgery, presence of ocular diseases other than strabismus, history of ocular trauma, dissociated vertical deviation, inferior oblique overaction, and manifest or latent nystagmus.

Ethics approval was obtained from the ethical committee of ESI-PGIMSR, Basaidarapur, and written informed consent was obtained from all participants.

Each subject underwent a comprehensive ophthalmologic evaluation, which included visual acuity assessment, cycloplegic retinoscopy and acceptance, measurement of squint using the Prism Bar Cover Test, Worth 4-Dot Test, synoptophore examination, and random dot stereogram tests including TNO and Randot.

Procedure Details:

1. Initial Measurement:

- Deviation measurements were taken at near, distance, and far distance before occlusion.

2. Monocular Occlusion:

- The better eye was occluded for one hour. Post-occlusion, measurements were repeated at near, distance, and far distance, ensuring no chance of fusion.

3. Prism Adaptation Test (PAT):

- Equally divided Fresnel prisms were applied to the subject’s spectacles. The next day, deviation measurements were repeated at near, distance, and far distance without allowing fusion.

Data Analysis

Based on the measurements, subjects were categorized into three groups:

- Non-Responders: Subjects who showed similar maximum deviation measurements before occlusion, after occlusion, and after PAT.
- Patch Test Responders: Subjects who exhibited an increase in deviation after occlusion.
- PAT Responders: Subjects who showed an increase in deviation after PAT and achieved stable motor alignment.

The study results were recorded and analyzed to determine the differences in deviation angles across different measurement conditions and their implications for the management of concomitant horizontal strabismus.

Statistical analysis

Statistical testing will be conducted with the statistical package for the social science System version SPSS 17.0. Continuous variables will be presented as mean SD or median (IQR) for non-normally distributed data. Categorical variables will be expressed as frequencies and percentages. The comparison of normally distributed continuous variables between the groups will be performed using ANOVA. Difference between continuous variables will be assessed using paired T-test. Nominal categorical data between the groups will be compared using Chi-squared test or test as appropriate. Non-normal distribution continuous variables will be compared using Kruskal Wallis test and further paired comparisons will be done using Mann Whitney U test. For all statistical tests, a p value less than 0.05 will be taken to indicate a significant difference.

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RESULTS

A total of 30 subjects (18 male, 12 female) met the inclusion criteria, out of which, 14 were esotropic and 16 were exotropic. There were 12 subjects in the age group of 0-15 years, 13 subjects in the age group of 15-30 years and 5 subjects in the age group above 30 years.

Twelve (40%) of our subjects (7 esotropes and 5 exotropes) had a deviation of 20-40 PD, 12 (40%) subjects (5 esotropes and 7 exotropes) had a deviation of 40- 60 PD, 5 (16.67%) subjects (1 esotrope and 4 exotropes) had a deviation of 60-80 PD and 1 (3.33%) subject (1 esotrope) had a deviation of 80-100 PD. p-value being 0.36, there is no significant difference between the esotropes and exotropes.

Details of changes to deviation at entry level, post-patch test and post-PAT are in **Table 1 and 2 & Graphs 1, 2 and 3**.

Patient number	PACT before Patch Test & PAT			PACT after Patch Test			PACT after PAT			Change to near angle pre- and post-Patch Test	Change to distance angle pre- and post-Patch Test	Change to far distance angle pre- and post-Patch Test	Change to near angle pre- and post-PAT	Change to distance angle pre- and post-PAT	Change to far distance angle pre- and post-PAT
	N	D	FD	N	D	FD	N	D	FD						
1	85	85	85	85	85	85	85	85	85	0	0	0	0	0	0
2	75	75	75	75	75	75	75	75	75	0	0	0	0	0	0
3	60	60	60	60	60	60	60	60	60	0	0	0	0	0	0
4	40	40	40	45	45	45	50	50	50	5	5	5	10	10	10
5	35	35	35	35	35	35	35	35	35	0	0	0	0	0	0
6	45	50	50	50	50	50	50	50	50	5	0	0	5	0	0
7	2	2	25	3	3	30	3	3	35	5	5	5	10	10	10

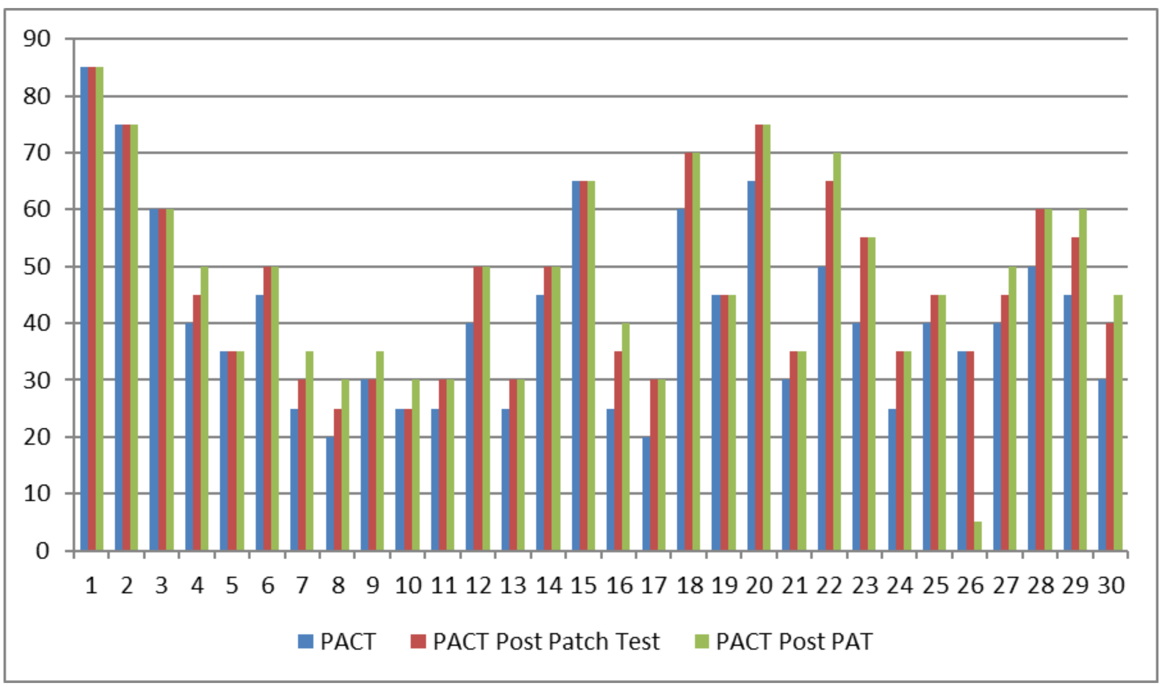
	5	5		0	0		5	5							
8	20	25	25	25	25	25	30	30	30	5	0	0	10	5	5
9	30	30	30	30	30	30	35	35	35	0	0	0	5	5	5
10	25	25	25	25	25	25	30	30	30	0	0	0	5	5	5
11 23	25	20	20	30	30	30	30	30	30	5	10	10	5	10	10
12 24	40	45	45	50	50	50	50	50	50	10	5	5	10	5	5
13	25	25	25	30	30	30	30	30	30	5	5	5	5	5	5
14	45	45	45	50	50	50	50	50	50	5	5	5	5	5	5
15	65	65	65	65	65	65	65	65	65	0	0	0	0	0	0
16	25	30	30	35	35	35	40	40	40	10	5	5	15	10	10
17	20	20	20	30	30	30	30	30	30	10	10	10	10	10	10
18	60	65	70	70	70	70	70	70	70	10	5	0	10	5	0
19	45	45	45	45	45	45	45	45	45	0	0	0	0	0	0
20	65	70	70	75	75	75	75	75	75	10	5	5	10	5	5
21	30	35	35	35	35	35	35	35	35	5	0	0	5	0	0
22	50	55	60	65	65	65	70	70	70	15	10	5	20	15	10
23	40	50	50	55	55	55	55	55	55	15	5	5	15	5	5
24	25	30	30	35	35	35	35	35	35	10	5	5	10	5	5
25	40	45	45	45	45	45	45	45	45	5	0	0	5	0	0
26	35	35	35	35	35	35	35	35	35	0	0	0	0	0	0
27	40	45	45	45	45	45	50	50	50	5	0	0	10	5	5
28	50	55	55	60	60	60	60	60	60	10	5	5	10	5	5
29	45	55	55	55	55	55	60	60	60	10	0	0	15	5	5
30	30	35	40	40	40	40	45	45	45	10	5	0	15	10	5

Table 1.Change to angle of deviation following patch test and prism adaptation test (PAT) (Δ). Patient from serial number 1 to 14 are esotropic and from 15 to 30 are exotropic. PACT = prism alternate cover test, PAT = prism adaptation test, N = near (0.33 m), D = distance (6m), FD =far (12 m).

Patient Number	Maximum deviation measured by PACT before occlusion	Maximum deviation measured by PACT after occlusion	Maximum deviation measured by PAT	Difference in post patch test and the PACT measurements before occlusion	Difference in PAT and the PACT measurements before occlusion	Category of the patient
1	85	85	85	0	0	NR
2	75	75	75	0	0	NR
3	60	60	60	0	0	NR
4	40	45	50	5	10	PR <PATR
5	35	35	35	0	0	NR
6	50	50	50	0	0	NR
7	25	30	35	5	10	PR < PATR
8	25	30	35	5	10	PR < PATR
9	30	30	35	0	5	PATR
10	25	25	30	0	5	PATR
11	25	30	30	5	5	PR = PATR
12	45	50	50	5	5	PR = PATR
13	25	30	30	5	5	PR = PATR
14	45	50	50	5	5	PR = PATR
15	65	65	65	0	0	NR
16	30	35	40	5	10	PR < PATR
17	20	30	30	10	10	PR = PATR
18	65	70	70	5	5	PR = PATR
19	45	45	45	0	0	NR
20	70	75	75	5	5	PR = PATR
21	35	35	35	0	0	NR
22	55	65	70	10	15	PR <

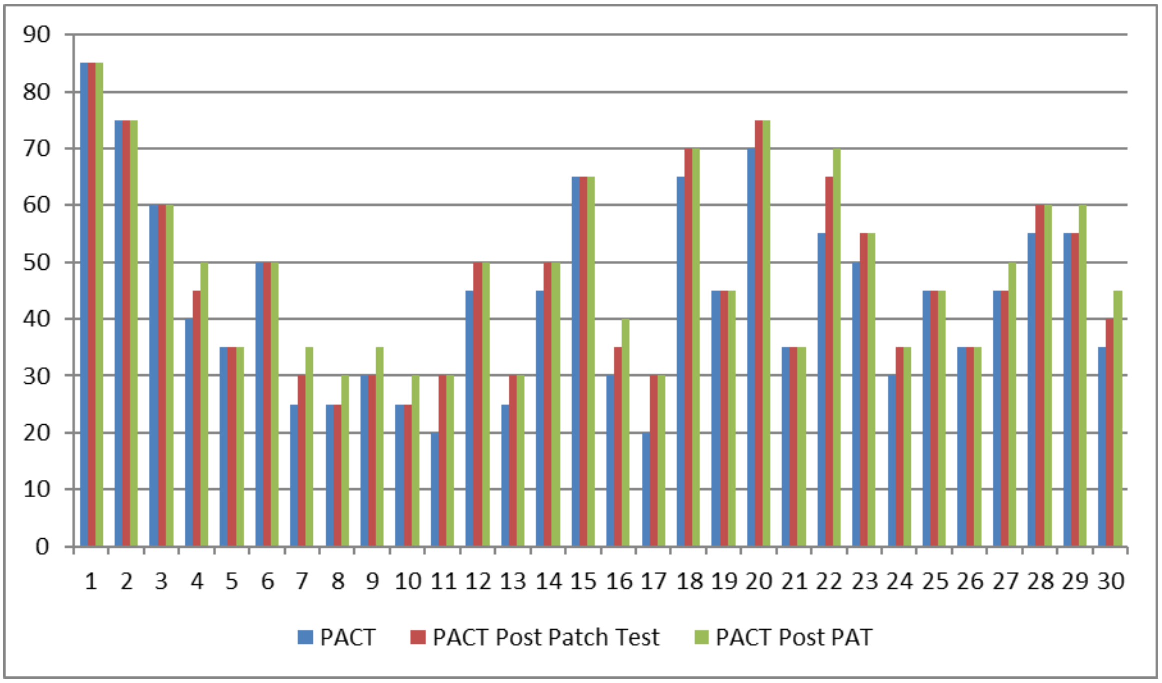
						PATR
23	50	55	55	5	5	PR = PATR
24	30	35	35	5	5	PR = PATR
25	45	45	45	0	0	NR
26	35	35	35	0	0	NR
27	45	45	50	0	5	PATR
28	55	60	60	5	5	PR = PATR
29	55	55	60	0	5	PATR
30	35	40	45	5	10	PR < PATR

Table 2. Change to maximum angle of deviation following patch test and prism adaptation test (PAT) (Δ) and categorization of patents on the basis of response following patch test and PAT (Δ). Patient from serial number 1 to 14 are esotropic and from 15 to 30 are exotropic. PACT = prism alternate cover test, PAT = prism adaptation test, NR = Non-responders, PR = Patch test responders and PATR = PAT responders

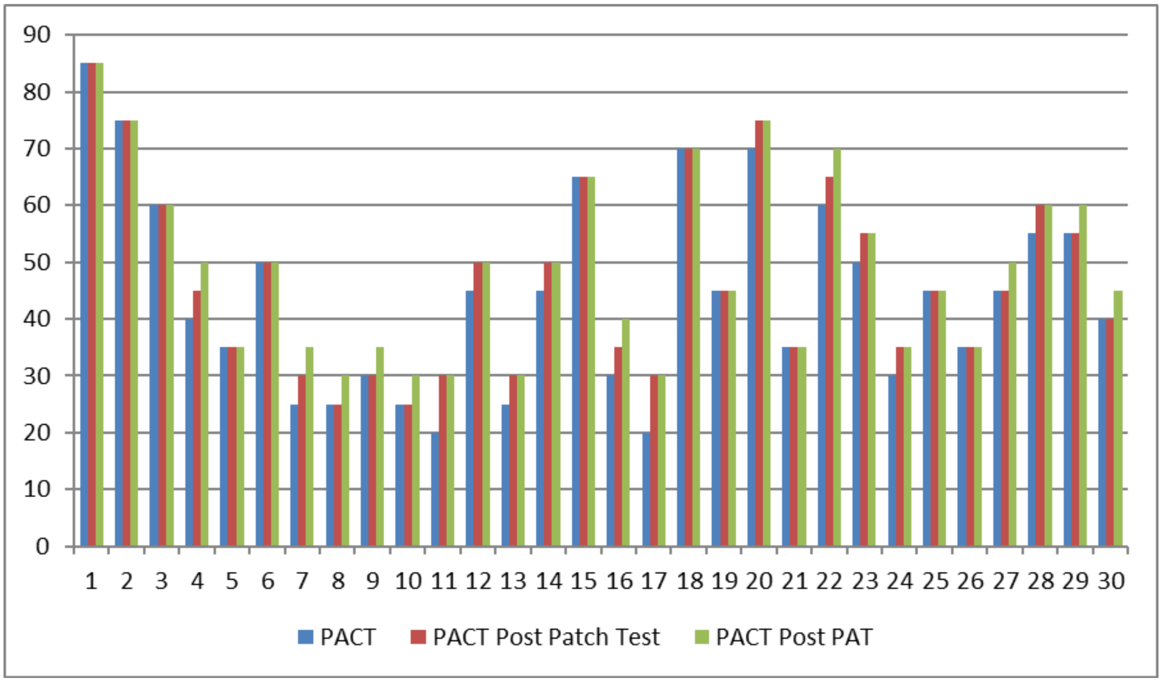


Graph 1.Deviation measurements after PACT prior to patch test, PACT post patch test and PACT post prism adaptation test (PAT) measurement of the deviation at near (0.33 m) (Δ).

Patients from serial number 1 to 14 are esotropic and from 15 to 30 are exotropic. PACT = prism alternate cover test, PAT = prism adaptation test.



Graph 2. Deviation measurements after PACT prior to patch test, PACT post patch test and PACT post prism adaptation test (PAT) measurement of the deviation at distance(6m) (Δ). Patients from serial number 1 to 14 are esotropic and from 15 to 30 are exotropic. PACT = prism alternate cover test, PAT = prism adaptation test.



Graph 3.Deviation measurements after PACT prior to patch test, PACT post patch test and PACT post prism adaptation test (PAT) measurement of the deviation at far distance (12 m) (Δ). Patient from serial number 1 to 14 are esotropic and from 15 to 30 are exotropic. PACT = prism alternate cover test, PAT = prism adaptation test.

Difference in measurements at near and distance by PACT before occlusion was 5Δ in in 4 esotropic and 10 exotropic subjects (47%); 10Δ in 2 exotropic subjects (7%) and the remaining 14(47%) subjects didn't show any difference. This difference was statistically significant (p= 0.038). Difference in measurements at near and far distance before occlusion was 5Δ in 4 esotropia (13.33%) and 7 exotropia subjects (23.33%), 10Δ in 5 exotropia subjects (16.67%), rest 14 (46.67%) didn't show any difference. This difference was statistically significant (p=0.013). Difference in measurements at distance and far distance before occlusion was 5Δ in 3 exotropia subjects (10%) but in 27 (90%) there was no difference (p= 0.138).

When comparing the largest PACT measurements before and after occlusion, 14 subjects (46.67%) were unaffected by patching, increase of 5Δ deviation was observed in 14 subjects

(46.67%) (7 esotropic subjects and 7 exotropic subjects), while 10Δ increase in deviation was noted in 2 exotropic subjects (5%) only while no subject showed an increase of 15 PD or more (p=0.551).

When comparing largest PACT measurements before occlusion and after PAT, 10 subjects (33.33%) did not show any difference (PAT non-responder), increase of 5Δ deviation was observed in 13(43.33%) subjects (6 esotropic and 7 exotropic subjects), 10Δ increase in deviation in 6 (20%) subjects (3 esotropic and 3 exotropic subjects) and 15Δ increase in deviation in 1 (3.33%) exotropic subject (p=0.3). Difference in measurements after occlusion and after PAT, 20 (66.67%) subjects did not show any difference, increase of 5Δ deviation was observed in 10 (33.33%) subjects (5 esotropic subjects and 5 exotropic subjects) (p=0.4).

Comparison of maximum deviation measured at near and far distance by the three methods, PAT showed maximum difference of 48.83±15.68 (30-85) followed by PACT after occlusion {47.17±16.28 (25-85)} and PACT before occlusion {44.17±16.82 (20-85)} (p=0.04).

The mean esodeviation as measured before occlusion were 41.1±19.8Δ at near, 41.8±20.0 at distance and 41.8±20.0Δ at far distance. After Patch Test, mean esodeviation were 44.3±18.8Δ at near, 44.3±18.8Δ at distance and 44.3±18.8Δ far distance; thus measurements had increased by 3.2±1.0Δ at near, 2.5 ± 0.2 at distance, 2.5 ± 0.2 at far distance. After PAT, mean esodeviation were 46.1±17.6Δ at near and 46.1±17.6Δ at distance and 46.1±17.6Δ at far distance; thus, esodeviation measurements had increased by 5.0±2.2Δ at near, 4.3±2.4Δ at distance, 4.3±2.4Δ at far distance.

The mean exodeviation before occlusion were 41.6±14.0Δ at near, 45.9±14.4Δ at distance and 46.9±14.9Δ at far distance. After patch test, mean exodeviation were 49.3±14.4Δ at near, 49.4±14.4Δ distance and 49.4±14.4Δ at far distance; Thus, measurements had increased by

7.7±0.4Δ at near, 3.5±0.02 at distance, 2.5±0.5 at far distance. After PAT, mean exodeviation were 50.9±14.4Δ at near, 50.9±14.4Δ at distance and 50.9±14.4Δ at far distance; thus, measurements had increased by 9.3±0.4 Δ at near, 5.0±0.1Δ at distance, 4.0±0.5Δ at far distance.

Following patch test, an increase in the angle of deviation was seen in 21 of the 30 (70%) patients at 1/3 m, in 15 of the 30 (50%) patients at 6 m and in 13 of the 30 (43.33%) patients at 12 m (Table 1). Following PAT test, an increase in the angle of deviation was seen in 23 of the 30 (76.67%) patients at 1/3 m, in 20 of the 30 (66.67%) patients at 6 m and in 19 of the 30 (63.33%) patients at 12 m (**Table 1**). Comparing the maximum angle of deviation, 10 patients were found to be non-responders and 20 patients as responder either to patch test or PAT or both (Table 2). Out of 20 responder patients, 6 patients showed equal response to patch test and PAT, 10 patients showed higher increment in angle of deviation to PAT while 4 patients showed response only to PAT (**Table 2**).

DISCUSSION

Our study demonstrates that post-PAT values can vary significantly, ranging from minor or no change to a substantial alteration in the angle of deviation. This variability underscores the importance of PAT in accurately quantifying both the manifest and maximum angles of deviation in patients with convergent and divergent concomitant horizontal squint. The ability of PAT to reveal these variations is particularly valuable in the surgical planning process, as it provides critical insights into the true extent of ocular misalignment.

The substantial changes in the angle of deviation observed in some patients post-PAT suggest that this test can be instrumental in guiding a more assertive surgical approach. Surgeons can operate with greater confidence, knowing that the enhanced angle detected by PAT reduces the risk of overcorrection. This finding aligns with existing literature, which highlights the utility of

PAT in fine-tuning surgical corrections. [5,9-13] By offering a more precise assessment of the deviation angle, PAT helps mitigate the risks of both under- and overcorrection, thus improving surgical outcomes. [5,9-13]

Previous studies, such as those by Ohtsuki et al. [13] and Dadeya[5] et al., have emphasized the value of preoperative PAT in achieving favorable surgical outcomes for exotropic patients, particularly when the surgery is guided by the changes in the angle of deviation following PAT. Ohtsuki et al. [13] found that among their cohort of intermittent exotropic patients, 10 (8%) were PAT responders, while 118 (92%) were non-responders, using a criterion of 10Δ as a significant response on PAT.

In our study, we observed a higher proportion of PAT responders within our exotropic subset. Specifically, 11 out of 16 patients (68.75%) at 1/3 m, 4 out of 16 patients (25%) at 6 m, and 3 out of 16 patients (18.75%) at 12 m were classified as PAT responders. Although our percentage of responders is notably higher compared to the Ohtsuki et al. [13] study, it is important to consider that our sample size is significantly smaller.

The discrepancy in the proportion of PAT responders between our study and that of Ohtsuki et al.[13] may be attributed to several factors, including differences in patient selection criteria, the specific methodology used for PAT, and the thresholds for defining a significant response. Additionally, the smaller sample size in our study might result in a higher variability and potentially less generalizable results. Future studies with larger sample sizes are necessary to validate our findings and to better understand the factors contributing to the variability in PAT responsiveness.

Kiyak Yilmaz et al. [14] demonstrated an increase in the angle of deviation from 31.2 ± 7.7Δ to 36.3 ± 8.1Δ after PAT in patients with primary exotropia. Their study showed significantly better functional binocular single vision results in PAT-positive patients compared to PAT-negative patients, although the improvement in motor alignment was better but not statistically significant.

In our study, we observed that the mean exodeviation before occlusion was 41.6 ± 14.0Δ at near, 45.9 ± 14.4Δ at distance, and 46.9 ± 14.9Δ at far distance. After PAT, these values increased to 50.9 ± 14.4Δ across all distances. This notable increase underscores the impact of PAT in revealing a larger angle of deviation, which is critical for surgical planning.

Kiyak Yilmaz et al. [14] reported that 72.2% of their esotropic patients (13 out of 18) exhibited an increase of ≥5Δ in the angle of deviation at 6m on PAT. In our study, 66.67% of the patients (20 out of 30) showed a similar increment at the same distance. The slightly lower percentage in our findings may be attributed to differences in sample characteristics, methodology, or the specific criteria used for measuring response to PAT.

The higher mean exodeviation observed in our study after PAT suggests that this test is effective in detecting significant latent deviations that might not be evident in a standard preoperative assessment. Moreover, the difference in response rates between our study and that of Kiyak Yilmaz et al.[14] highlights the need for standardized protocols and larger, more diverse patient samples to better understand the variability in PAT responsiveness.

Our findings align with those of Zahavi et al.[15], who also observed a significant difference in ocular deviation measurements taken at baseline and at the end point for both distance and near in their cohort of 33 exotropic patients. In contrast, Shippman and colleagues[16] reported that PAT was not useful in managing exotropic strabismus. This discrepancy highlights the variability in PAT responsiveness among different patient populations and suggests that the utility of PAT may be influenced by specific clinical characteristics or methodological differences. It is possible that variations in patient selection criteria, the definition of a significant response, or the precise execution of PAT protocols could account for these divergent findings. The contrasting results between our study and that of Shippman et al.[15] suggest a need for further investigation to delineate the factors that contribute to the effectiveness of PAT. Such factors might include the type and severity of strabismus, adherence to testing protocols, or even subtle differences in the testing environment. Understanding these nuances is essential for optimizing the use of PAT in clinical practice.

Altman et al. [17] and Akbari et al. [18] reported PAT response rates of 52% and 50% respectively in patients with acquired esotropia. The surgical success rates for PAT responders in these studies were notably high, at 90% and 100% respectively. These findings highlight the potential efficacy of PAT in improving surgical outcomes for esotropic patients. However, the study by Akbari et al. also cautioned that these favorable results might not be applicable to patients with a smaller angle of deviation, specifically those with <30Δ. This caveat suggests that the effectiveness of PAT may vary based on the severity of the initial deviation, indicating the need for tailored approaches in different patient subgroups.

Furthermore, another study reported a significant increase in deviation of ≥10Δ in 79.6% of convergence excess esotropic patients at 1/3 m and in 83.7% at 6 m following PAT. [3] The high percentage of patients exhibiting significant deviation increases suggests that PAT can be a valuable tool for assessing the true extent of ocular misalignment, particularly in cases of convergence excess esotropia.

In the study by Clare Quigley et al.[19], partially accommodative esotropic patients who underwent surgery based on the PAT-adapted motor response had a surgical success rate of 73%. While this success rate is commendable, it is slightly lower than the success rates reported in studies by Repka et al.[20] and Hwang et al.[21], which showed success rates of 90% and 88% respectively for

PAT responders. This slight variation in success rates highlights the complexity and variability in surgical outcomes for esotropic patients.

Repka et al.[20] demonstrated a high success rate of 90% in PAT responders, emphasizing the effectiveness of PAT in optimizing surgical outcomes. Similarly, Hwang et al.[21] reported an 88% success rate in PAT responders, which was statistically comparable to the augmented surgery group that achieved an 81% success rate. This comparison suggests that while PAT is highly effective, augmented surgical approaches also yield substantial success, indicating multiple viable strategies for managing partially accommodative esotropia.

The Prism Adaptation Research Group[22] demonstrated an impressive 89% success rate in esotropia squint surgeries when the surgical approach was guided by the increased angle of deviation observed under the influence of prisms. This finding underscores the importance of PAT in preoperative planning, as it allows for a more accurate assessment of the deviation angle, which in turn facilitates more effective surgical corrections. Several studies have corroborated these findings, indicating that an increase in esodeviation following PAT is a reliable predictor of successful surgical outcomes and functional benefits. [12,23,24] Wygnanski-Jaffe et al.[11] also highlighted the efficacy of PAT in determining the target angle for surgery in cases of convergence excess esotropia, further supporting the utility of this diagnostic tool.

However, not all studies have found PAT to be universally beneficial. For instance, Hwang et al.[21] conducted a randomized controlled trial that found no statistically significant difference between preoperative PAT and augmented surgery in hypermetropic esotropia. This suggests that the effectiveness of PAT may vary depending on specific clinical contexts and patient characteristics.

In our current study, we observed a clear distinction between PAT responders and non-responders based on their initial angle of deviation. All PAT non-responders had an entry angle of >35Δ, with 70% of these patients having an entry angle >45Δ. Conversely, among the PAT responders, 70% had an entry angle of <45Δ. This suggests that patients with smaller entry angles may have a larger latent angle that becomes apparent only after occlusion or PAT. This finding aligns with the hypothesis that PAT is particularly useful in unmasking significant latent deviations in patients with smaller initial deviations.

Our analysis also revealed that measurements taken at far distances (12m) did not show any additional changes in the angle of deviation before the patch test, after the patch test, or after PAT. This indicates that measuring deviations at far distances may not provide additional diagnostic or prognostic value in the context of PAT.

While PAT is a valuable tool in assessing deviation angles, its complexity and lengthy duration may pose challenges in clinical practice. As an alternative, the patch test offers a potential solution to address these drawbacks. Previous studies have demonstrated that a one-hour patch test can be as efficient as PAT in certain contexts.[9,25] For example, Burian et al.[2] recommended short-duration monocular occlusion for differentiating between true divergence excess and pseudo-divergence excess types of strabismus. Similarly, in another study, a one-hour patch test was effective in eliminating fusion, highlighting its utility in providing accurate measurements of deviation angles.[26]

Additionally, Kushner[27] found the one-hour patch test to be considerably valuable in estimating the angle of deviation preoperatively in intermittent exotropia. However, it is important to note that not all studies have yielded positive results for the patch test. For instance, Han et al.[28] did not find diagnostic monocular occlusion useful in determining the target angle in the basic type of exotropia.

In our study, we investigated the efficacy of the patch test compared to PAT in detecting latent angles of deviation. Our findings suggest that while the patch test may be effective in some cases, it was either unable (n=4) or inferior (n=6) to PAT in detecting latent angles of deviation in a significant proportion of responders. Specifically, in 50% of responders, the patch test was unable or inferior compared to PAT. This highlights the limitations of the patch test in certain scenarios and underscores the importance of considering alternative diagnostic approaches, such as PAT, when assessing deviation angles in strabismus patients.

These findings contribute to the ongoing discussion regarding the optimal diagnostic strategies for evaluating deviation angles in strabismus. While the patch test offers certain advantages in terms of simplicity and time efficiency, its efficacy may vary depending on the specific clinical context and patient population. Further research is warranted to better understand the factors influencing the performance of the patch test and to identify the patient subgroups most likely to benefit from its use.

While the patch test holds promise as an alternative to PAT, our study and others suggest that its efficacy may be limited in certain cases. Clinicians should carefully consider the strengths and limitations of both diagnostic approaches when evaluating deviation angles in strabismus patients, with the ultimate goal of optimizing patient care and treatment outcomes.

CONCLUSION

Our findings suggest that the Prism Adaptation Test (PAT) can be a valuable tool in identifying the largest exotropic and esotropic angles in patients with concomitant horizontal strabismus. The higher rate of PAT responders in our study underscores the potential for PAT to uncover significant deviations that might otherwise be underestimated in a conventional assessment. This aligns with the notion that PAT can aid in fine-tuning surgical corrections, thereby reducing the risks of both under- and overcorrection. However, we found that the patch test did not serve as an effective substitute for preoperative PAT. Additionally, measurements taken at far distances did not contribute any significant changes to the angle of deviation.

Based on our study, we recommend considering the enhanced angle obtained after PAT when planning surgical interventions, particularly for patients who present with a small initial deviation angle. While our results highlight the potential utility of PAT, further research with larger sample size is needed to validate these findings and explore their implications for broader clinical practice.

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