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Original Article

Comparison of Angle of Deviations Measured From Synoptophore and Prism Cover Test in Horizontal Deviations

Heber Anandan[1], Lional Raj[2], J L Dhanisha[3], J Mohamed Ali[4], John Abraham[5]

[1]Senior Clinical Scientist, Department of Clinical Research, Dr. Agarwal's Eye Hospital, Tirunelveli, Tamil Nadu, India, [2]Regional Medical Director, Department of Ophthalmology, Dr. Agarwal's Eye Hospital, Tirunelveli, Tamil Nadu, India, [3]Clinical Research Associate, Department of Clinical Research, Dr. Agarwal's Eye Hospital, Tirunelveli, Tamil Nadu, India, [4]Associate Professor, Department of Clinical Optometry, Dr. Agarwal's Eye Hospital, Tirunelveli, Tamil Nadu, India, [5]Senior Consultant, Department of Ophthalmology, Dr. Agarwal's Eye Hospital, Tirunelveli, Tamil Nadu, India

Abstract

Introduction: While the synoptophore is primarily an instrument for the investigation of binocular visual functions, prism cover test (PCT) is the most frequently used method to measure the angle of deviation in patients with strabismus. Since the important clinical decisions are taken based on the angle of deviation of squint, these readings must be accurate.

Aim: This study compares the angle of deviations measured from synoptophore with PCT in patients with horizontal deviations.

Methods: Data from 32 patients (n = 32) were retrospectively collected and analyzed. Subjects who had horizontal deviations were included in the study. Subjects who had vertical deviations were excluded from the study. The angle of deviation was measured with both synoptophore and PCT. Mean and standard deviations of the angle of deviations measured from both methods were found. A paired t-test was done to compare the measurements of the angle of deviations from both methods.

Results: Out of 32 subjects, 17 were male and 15 were female with a mean age of 10 ranging from 6 to 13 years. About 72% of the population had a congenital squint, at least 61% of the population had normal birth weight. About 40% of the children had esotropia and 60% had exotropia. About 22% had nystagmus. About 12% of the children were amblyopic. Paired sample t-test showed P = 0.259, indicating that there is no statistically significant difference between both the methods of measuring the angle of deviation. The mean value of angle of deviation from PCT for 32 subjects was –6.50 ▲ ± 36.35 ▲ and the mean value of angle of deviation measured from synoptophore was –5.53 ▲ ± 35.61 ▲.

Conclusion: Although synoptophore overestimates the convergence and underestimates the divergence, there is no statistically significant difference between synoptophore and PCT.

Key words: Prism cover test, Prisms, Squint, Strabismus, Synoptophore

INTRODUCTION

While the synoptophore is primarily an instrument for the investigation of binocular visual functions, it can also measure strabismic deviations. It is essentially a refined stereoscope set for distance fixation and accommodative demand is eliminated by the presentation of the targets in the focal plane of a +6.5 diopter lens. It has long been advocated, however, that the accuracy of the device is affected by the artificial viewing conditions it provides and the patient's awareness of its proximity, which results in an increase in the angle in esotropia and a decrease in exotropia.[1,2] There is a disadvantage of synoptophore in that its over-convergence is usually attributed to proximal convergence and called "instrument" or "machine" convergence.

The alternate prism cover test (PCT) is the most frequently used method to measure the angle of deviation in patients with strabismus, but it can only be used when both eyes have sufficient vision for fixation. Hence, we would like to compare both the methods of measurement of the angle of deviation.[3]

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Corresponding Author: Dr. Lional Raj, Department of Ophthalmology, Dr. Agarwal's Eye Hospital, Tirunelveli, Tamil Nadu, India.

It is very important to calculate the angle of deviation accurately before giving any treatment, especially before squint surgery. The only recourse for the ophthalmic surgeon aiming to restore or establish alignment of the visual axes lies in changing the position of the peripheral muscle ends relative to the ocular globe. To this end, the surgeon determines the clinical data (the parameter or parameters) on which the surgical strategy is to be based.[4] Hence, the exact squint measurement is very important before squint surgery.[5]

MATERIAL AND METHODS

This retrospective study was conducted patients with horizontal deviations in the tertiary ophthalmic hospital at Tirunelveli. Data from 32 patients (n = 32) were retrospectively collected and analyzed. There were 13 esotropes and 21 esotropes, each having no vertical deviation. All had constant deviations for distance fixation and were included regardless of their primary, consecutive, or residual nature. The subjects who had ocular disease other than squint were excluded from the study. Subjects who had vertical deviations were excluded from the study. The angle of deviation was measured with both synoptophore and PCT. A PCT measurement was taken at a 6 m fixation distance in the primary position. These were performed in the usual way by one examiner (Examiner I) on the same visit. The patients wore their prescribed refractive correction and accommodation was controlled using a small Snellen optotype for fixation, or detailed foveal simultaneous perception slides with the synoptophore. With both methods, care was taken to not allow binocular interaction during the measurements.[4,6,7]

There was another examiner who was there to hold the stack prisms so that the measuring examiner does an accurate measurement. The patient's age, gender, and birth history were extracted from the medical records. The birth history included the weight of the child at the time of the birth, consanguinity among parents, congenital or acquired squint, the birth was normal, or cesarean was noted from the records. Visual acuity, diagnosis, and the type of squint were noted. The angle of deviation measured using synoptophore and PCT was noted. The mean and standard deviation of angle measurements measured from synoptophore and PCT was found. Statistical significance was tested using a paired sample t-test with the angle measurements measured from synoptophore and PCT.

RESULTS

A total of 32 subjects were included in this study. Seventeen are male and 15 were female with a mean age of 10 ranging from 6 to 13 years. The distribution of the number of subjects in the different age groups is listed in Table 1.

In this study out of 32 strabismus children, 11 children (61%) had birth weight ranging between 2 kg and 3 kg. The distribution of birth weight is mentioned in the following table. For others, the data of birth weight are not available [Figure 1, Table 2].

Out of 32 children, for 23 children, the squint was noted at birth only [Figure 2]. Out of 32 children, 9 children were born with cesarean delivery [Figure 3].

The mean value of the absolute value of angle of deviation from PCT for 32 subjects was 35.63 ▲ ± 8.50 ▲ and the mean value of the absolute value of angle of deviation measured from synoptophore was 34.22 ▲ ± 9.55 ▲.

Comparison of angle measurements from synoptophore and PCT was done using paired sample t-test that showed $P = 0.095$, indicating that there is no statistically significant difference between both methods of measuring the angle of deviation.

When we apply the negative sign for exodeviations and the positive sign for esodeviations, the mean value angle of deviations is mentioned, as shown in Tables 3 and 4.

Table 1: Age distribution

Age	No. of patients
1–5	0
5–10	15
10–15	17

Table 2: Birth weight

Birth weight (kg)	No. of patients
1–2	4
2–3	11
3–4	3

Table 3: Distribution of diagnosis

Diagnosis	No. of patients	%
Esotropia	13	40.6
Exotropia	19	59.4

Table 4: Pair *t*-test

Group	Mean in prisms	*n*	Standard deviation	*P*-value
Pair 1				
PCT reading	–6.50	32	36.35	0.259
Synoptophore reading	–5.53	32	35.61	

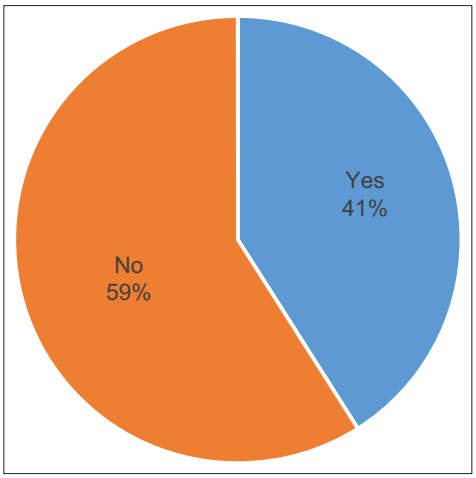

Figure 1: Consanguinity in marriage, out of 32 strabismus children, 13 children were in the group of consanguinity marriage

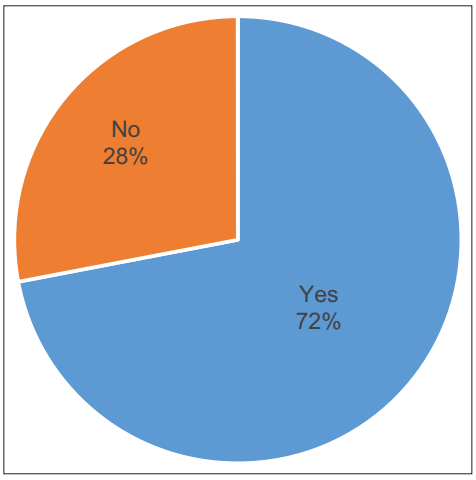

Figure 2: Congenital versus acquired squint, out of 32 children, 23 (72% of the population) had a congenital squint

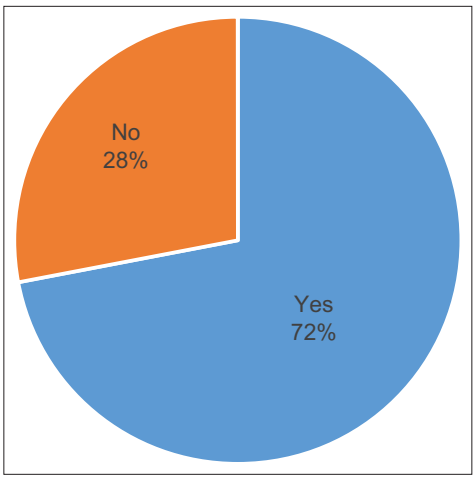

Figure 3: Normal versus cesarean delivery, 40% of the children had esotropia and 60% had exotropia. About 22% had nystagmus. About 12% of the children were amblyopic

DISCUSSION

In individuals with normal binocular function, visual feedback ensures accurate fixation on targets so that the eyes maintain a state of nearly perfect alignment. In strabismus, the inability to fuse images means that one eye is not directed at a target. Without a target, the deviated eye is more unstable in position than the fixating eye. Numerous studies have documented the variability of ocular misalignment in strabismus. It is very important that the angle of deviation is to be measured accurately.[3,8-12]

It is expected that the synoptophore overestimates the convergence and underestimates the divergence. Certainly, a (psycho) physiological basis for the phenomenon of over convergence at the synoptophore remains vague and questionable. In light of the results in the present study, the author contends that instrument convergence is not a consistent nor relevant clinical entity. Indeed, there is little support for the largely anecdotal reports that the synoptophore exaggerates the angle in ET and understates it in exotropia. This is not necessarily the case at all. Allowing for the accepted error margin of objective clinical measurement, it was found that over-convergence with the synoptophore by comparison with the PCT was just as likely to occur as under-convergence. Furthermore, it is notable that the variability between the two measurement methods was not greater than the interexaminer variability for the PCT. It would have been ideal to have Examiner 2 also perform measurements using the synoptophore so that interexaminer reliability for both tests and intertest reliability for both examiners could have been compared in more detail.[11]

The results that we see in our study are in line with the results of the study by Georgievski *et al.* We have also noticed that the synoptophore overestimates the esodeviations and underestimates the exodeviations as we shown in Table 4.

CONCLUSION

Valid measurements of both esotropia and exotropia can be obtained using both the synoptophore and PCT. Although synoptophore overestimates the convergence and underestimates the divergence, there is no statistically significant difference between synoptophore and PCT.

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