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Understanding the importance of axes and angles in modern era of Ophthalmology by the case series of pseudo squint. The case series of pseudo squint

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ABSTRACT :**Background:** At the time of recruitment in many government jobs after passing the written test candidates undergo medical examination. Each job has different standards for fitness.Candidates undergo detail systemic examination by a panel of medical team. If a candidate is lacking in few criterion they are declared as unfit for post. He /she has right to appeal for further examination. Squint is one of the finding if detected, makes the candidate unfit for few jobs.**Case presentation**: Three candidates were declared unfit during first examination of pre-employmentcheckup due to squint.On further examination it was found they had pseudo squint. On examination both eyes had vision 6/6 with normal anterior and posterior segment. During Hirschberg test, corneal reflex (firstpurkinge image) was not appearing in the center simulating squint.Orthopic work up of cases showed there was no true squint present in all three candidates. **Conclusion:** All the suspected cases of squint should undergo detail orthoptic work up to rule out pseudo squint especially in pre-employment examination and advance refractive surgeries.

Key words :Angle alpha, Hirschberg test, Pre-employment examination, Pseudo squint, Squint

I. INTRODUCTION:

Squint is misalignment of visual axis when eyes are at rest while Pseudo strabismus is an optical illusion. Pseudosquint is impression of misalignment created by certain morphological features of the face inspite of orthotropia [1]. The pseudo strabismus can appear as eso, exo, hypertropia in which the eyes appear to be deviated inward, outwards and vertically respectively. Pseudosquint can be due to telecanthus, hypertelorism, high myopia, large angle alpha,negative angle kappa,large epicanthalfold[1]. It can be ruled out by test like cover test, convergence measurement (RAF Rule), worth four dot test, 4 D prism test, maddox wing and maddox Rod, Synoptophore (table-1).Presence of squint is one of the criteria for unfitnessof candidates in many jobs. Screening tests are used like Ischihara test for colour vision and Hirschberg test to detect squint. If any abnormality detected in these test, candidates are declared disqualified. After that either they are sent to higher board directly for further examination or after appeal. If a person is diagnosed as a case of squint on primary examination with the Hirschberg test a complete and thorough systematic examination should be done to confirm the presence of true squint.

II. CASE SERIES:

Three male candidates of the age 22, 23,26 years came for examination in our tertiarycenter over a period of one year during different course of time as they were disqualified due to squint during primary examination of pre-employment medical test(Fig.1, Fig. 2).There was no history of diplopia,false orientation, vomiting,headache,eye acheand use of spectacle.No history of trauma or surgery. Vision was 6/6 in both eyes,no refractive error detected. On examination no abnormal head posture present.During Hirschberg test, corneal reflex (firstpurkinge image) was not appearing in the center simulating squint.In first candidateIt was present medially on the pupillary margin of left eye giving appearance of 15-degree exotropia. In second and third candidate it was laterally on pupillary margin in right eye.

Hirschberg's light reflex test is the screening method of estimating the relative position of the eyes in routine examination. Corneal light reflex is used in assessing ocular alignment. The Hirschberg method is based on the assumption that 1 mm of decentration of the corneal light reflection is equal to 7°/ 15Δ of deviation. If light reflex is at the pupillary margin is about 2 mm from the pupillary (with a 4-mm pupil), corresponds to 15°, or approximately 30Δ,

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of deviation. A reflex in the mid-iris region is about 4 mm from the pupillary center, which is roughly 30°, or 60Δ, of deviation; similarly, a reflex at the limbus is about 45°or 90Δ, of deviation [2].
A detail orthoptic work was done with cover test, maddoxrod,maddox wing, worth four dot, RAF rule.(Fig. 3,Fig. 4, Fig. 5, Fig.6, Fig. 7,)Result all testswere pointing towards orthophoria (Table-2)

III. DISCUSSION:

Understanding the opticsof eye is important to analyze the cause for pseudo squint(Fig. 8).There are three principle axes and three angles. **Nodal point** of eyeball is just anterior to posterior capsule of lens (N).**Fixation point** is the point which is being seen with fovea at any particular moment (F).**Pupillary line:** a line perpendicular to the apex of the cornea passes through the center of the pupil(OP).**Fixation Axis:** This is a straight line joining the center of rotation of eyeball with fixation point(OC).**Optical Axis**: The optical axis is a lineperpendicular to the corneal apex that passes through the nodal points and the centers of curvature of the refracting elements of the eye (AR). **Visual Axis**: Visual axis is defined as a line passing from the center of the pupil (actually the entrance pupil) to the object of visual attention (OF)the visual axis is angled 5.2 degrees nasally and slightly inferior to the optical axis. The visual axis does not necessarily pass through the pupil's geometric center. This explains why the corneal reflex from light rays on the visual axis occurs about 0.3 mm nasal and 0.1 mm inferior to the reflex from the pupillary axis. **Fig. 8 showingAxes and angles of eye[3]**
Angle Alpha is the angle formed between optical axis and visual axis. (ONA)
Angle Kappa is the angle formed between visual axis and pupillary axis. (OPA)
Angle Gamma is the angle formed between optical axis and fixation axis. (OCA)

The optical axis assumes that all the optical elements of the eye and pupil are centered relative to each other and in most eyes these elements are slightly displaced. However, its location can be approximated and it serves as a useful reference axis for other axes. The term geometrical axis approximates the optical axis[2].Because the fovea is temporally displaced within the retina, it does not fall along with visual axis. If the optical elements and the pupil in an eye were centered relative to each other, then pupillary axis will coincide with the optical axis.

Previously these axis and angles of eye was important for diagnose the pseudosquint and cosmetic purpose, but in these times became important for not only recruitment pre employment examination purpose but also for refractive surgery technologies, particularly those aimed at correcting presbyopia and putting toric, spherical and aspheric IOLs, multifocal IOLs, corneal inlays. Small deviations from the line of sight could have a large impact on finally attended visual acuity[4 5 6].
Nowadays we can measure angle alpha and kappa with advance technology. liketracey technology,wavefrontaberrometerand orbscan can measure angle alpha [7,8]. The angle kappa has been further measured by different corneal topography systems, including Synaptophore and Orbscan[9].

IV. CONCLUSION:

All the suspected cases of squint should undergo detail orthoptic work up to rule out pseudo squint especially in pre-employment examination.In previous era these axis and angles were not significantly important in day to day ophthalmic practice to draw attention of only optic specialist and researchers.With the availability of advanced refractive procedures offering the best visual outcomes we must attain a clear understanding of the optics of the eye.

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CAPTIONS:

Table-1:**Array of tests forexamination of a squintcase**

S.No.	Name of Test	Inference
1	Cover Test	Rule out pseudo squint, eccentric fixation, to detect type of deviation
2	Convergence measurement (RAF Rule)	To detect convergence weakness or convergence Insufficiency
3	Worth Four Dot Test	To test binocularity
4	4 D Prism Test	To rule out monofixation syndrome, small angle squint
5	Maddox wing and maddox Rod	To confirm and measure heterophoria for near and distance
6	Synoptophore	For Grading of binocular single vision

Table-2: Result of orthoptic work upof patients

	Hirschberg test	Cover test	Worth four dot test	4 D prism Test	Maddox rod test	Convergence measurement (RAF Rule)	Maddox wing test	Synaptophore
Patient 1	15°exotropia	No movement	Binocular single vision (BSV)	No movement	No diplopia	Normal for age NPC-7cm NPA-10D	2Δ	Grade 3 BSV
Patient 2	7°exotropia	No movement	BSV	No movement	No diplopia	NPC-7cm NPA-11D	3Δ	Grade 3 BSV
Patient 3	15°exotropia	No movement	BSV	No movement	No diplopia	NPC-8cm NPA-11D	4Δ	Grade 3 BSV

Figure captions

Fig. 1: patient 1 on Hirschberg test showing left eye exotropia
Fig. 2: patient 2 on Hirschberg test showing left eye exotropia
Fig. 3: cover test
Fig. 4: Maddox rod test
Fig. 5: Maddox wing
Fig. 6: worth four dot test
Fig. 7: RAF Ruler measurement
Fig. 8: axes and angles of eye