Incidence of Binocular Single Vision (BSV) Anomalies Amongst Aircrew in I.A.F.

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Abstract

THE binocular status of 1089 aircrew has been analysed in this study. Rejection rate because of eye disability compared to other disabilities showed significantly higher value in the older age group of aircrew. The important factor amongst these disabilities has been B.S.V. anomalies. Further analysis showed that convergence insufficiency and intermittent squint are the commonest amongst B.S.V. anomalies.

There were 74 cases of visual defects in the aircrew population of 1089. However, only 10 complained of symptoms associated with defects. This is attributed to fear of loosing flying category. It is established that orthoptic exercises can improve most of the B.S.V. anomalies without jeopardising flying category.

The commonest visual defects in general population and the associated symptoms have been brought out by a study on 3150 outpatient department cases.

Introduction

Flying has always been considered a highly technical and skilled job since its inception[7]. It has now reached a stage where the designers and the medical advisers are finding it rather an onerous task to strike a balance between the performance desired by the former and the limitations inherent in the man to achieve the optimum results from this man-machine system. Despite the introduction of automatic controls to relieve the pilot of many activities in the air, the pilot as a controller has to exercise his perceptual and mental capacities to monitor the visual displays in the cockpit as well as the external environment. In certain critical phases of flying this requires his active and prompt comprehension of the ongoing events. Adequacy of visual function is a very important[1] factor in flight.

While vision in itself is a complex phenomenon, binocular single vision (B.S.V.) is even more complex[6]. Significance of binocular single vision in precision task performance like flying is well established. It gives the advantage of enlarged field, compensation of the blind spot of each eye by the other, and higher binocular visual acuity rating.

Accurate assessment of depth perception as a result of stereoscopic vision to another important aspect of B.S.V. This single factor is of great importance in high speed low level flying. It is in this context that a study of incidence of BSV anomalies amongst the aircrew has been taken up. Abnormal binocularity on initial selection and subsequently on trained aircrew, has been investigated in detail in the present study.

Materials and Methods

The subjects in the present study were classified into two groups Viz : Aircrew and outpatient department cases (representing a mixed group of service and civilian personnel). They were further subdivided into two groups based on age Viz : those below the age of 30 years (A) and those above 30 years (B). The distribution of the cases is given in Table I.

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TABLE I

Distribution of Cases

Category of subjects	No. of subjects (A) Below 30 Yrs.	(B) Above 30 Yrs.	Total
Aircrew including NDA candidates	789	300	1089
General population O.P.D.	1050	2100	3150

Routine ophthalmic examinations eg: visual acuity for distance and near vision, ocular muscle balance, cover test, convergence, accommodation, fields, fundus examination and colour vision, were carried out on each subject in the aircrew group. Whenever necessary additional tests like PBCT, Bagolimi, Hess screen, major amblyoscope, fixation pattern, fusion recovery tests and prism vergence reserves, were also carried out. In the O.P.D. group various tests were carried out on the subjects based on the reported symptoms.

Results

The observations on the aircrew and their categorisation as fit or unfit based on ophthalmic examination are given in Table II.

TABLE II

Results of Eye tests on Aircrew

Age group	No. of cases	Fit eye	Unfit eye	% rejection unfit eye	Unfit other disabilities	Total unfit
(A) < 30 yrs	789	575	53	6.7	161	2
(B) > 30 yrs	300	274	21	7.0	5	8

The rejection rate amongst the aircrew due to eye disability in Group (A) is 6.7% and in Group (B) 7. Out of the unfit cases visual defects show a steep rise in Group (B). Distribution of eye disabilities in the aircrew population is given in Table III. Maximum disability in the younger age group is because of substandard vision while in the older age group the important disability is BSV.

TABLE III

Distribution of eye disabilities (Aircrew)

Age group with No of cases	Total eye defects	Substandard vision—No. (%)	B.S.V. defects No. (%)	Defects of colour perception No. (%)
(A) 789	53	27 (50.5%)	18 (33.4%)	8 (15.1%)
(B) 300	28	6 (28.6%)	12 (57.1%)	3 (14.3%)

Further analysis of the B.S.V. defects is given in Table VI

TABLE IV

Distribution of B.S.V. defects (Aircrew)

Age group & No. of cases	Amblyopia No. (%)	Micro-squints No. (%)	Constant manifest squint No. (%)	Intermittent squint No. (%)	Convergence insufficiency No. (%)	Miscellaneous No. (%)	Total No.
(A) 739	2 (11.0%)	1 (5.6%)	4 (22.2%)	6 (33.3%)	4 (22.2%)	1 (5.6%)	18 (100)
(B) 300	Nil	1 (8.6%)	—	3 (25%)	8 (66%	—	12 (100)

In Group (A), six cases had intermittent squint and four convergence insufficiency whereas in Group (B), three cases had shown intermittent squint and eight cases convergence insufficiency. These were particularly noticed in cases who had borderline ocular muscular balance at entry. Amblyopia, microtropia and manifest squints were mostly the features of Group (A). One case of microtropia in Group (B) must have been due to failure of its detection at initial evaluation. By applying new techniques of ophthalmic evaluation, it has been found that the binocular functions evaluation becomes more meaningful and most of the border line cases hitherto being accepted as fit could be spotted out at initial evaluation.

TABLE V

Causes of disturbed B.S.V. (Aircrew)

Group with No. of cases	Sensory factors	Motor factors	Central factors	Mixed	Total cases
(A) 789	6 (33.3%)	4 (22.2%)	6 (33.3%)	2 (11.1%)	18 (100%)
(B) 800	1 (8.4%)	3 (2.5%)	8 (66.6%)	—	12 (100%)

Table V shows that out of 18 cases in Group (A) six cases had sensory defects like opacities of media, refractive errors, retinoneural disturbances and monocular period of viewing especially during the period of flux in childhood. Four cases had motor defects mostly of congenital nature. Six cases revealed central factors like anxiety, physical and mental strain, hyper excitability and inability to learn binocular coordination. Such cases usually have a large degree of basic phoria which gets decompensated under stress situations. They then pass through a stage of intermittent squint to end up in manifest deviation. Two cases were of mixed etiology. In Group (B), three cases were due to motor factors like head injuries and in one out of these three, the impression was that it could have been due to a congenital muscle palsy which remained undetected at the entry stage and had later started showing decompensation. The major defect in Group (B) pertains to cases of disturbed BSV (8 cases) due to central factors.

Distribution of BSV and other optical defects is given in Table VI. Out of 3150 cases seen over a period of one year ending 1976, 20 cases of amblyopia of different grades were found in Group (A) and 8 cases in Group (B). Stimulus deprivation, strabismic and anisometropic amblyopia were the common varieties seen. Very few cases of microtropia were found in both the groups. Out of 14 cases of constant manifest squint, incidence was higher in Group (A) than in Group (B). Intermittent squint also showed higher incidence in Group (A) but convergence insufficiency was higher in Group (B). This was mostly noticed in subjects around 40 years. Two hundred cases in Group (A) and 600 in Group (B) had defective vision requiring corrective glasses. Majority of the latter group were of presbyopic age.

TABLE VI

Distribution of BSV and other optical defects in outpatients attending hospital

Group with No. of cases	Amblyopia	Microtropia	Constant manifest squint	Intermittent squint	Convergence insufficiency	Other optical defects
(A) 1050 < 30 yrs.	30	1	8	18	24	200
(B) 2100 > 30 yrs.	8	3	6	4	64	600

Visual symptoms

Distribution of visual symptoms in O.P.D. cases is given in Table VII. These O.P.D. cases reported with various symptoms for treatment of their visual disorders. In the case of aircrew a total number of 74 visual defects were detected (Table III) ever, only ten cases reported symptoms of e photophobia or diplopia. This may be due pression of symptoms by aircrew due to fear flying category.

TABLE VII

Visual symptoms in O.P.D. Cases

Total No. of cases	Defec-tive	Head-ache	Eye strain	Watering of eyes	Blur-ring	Squint	Diplo-pia	Photo-phobia
3160	1470 (46.6%)	555 (17.7%)	460 (14.7%)	320 (10.1%)	56 (1.8%)	36 (1.1%)	24 (0.8%)	22 (0.7%)

Discussion

The complex mechanism of the co-ordination of the two eyes starts at birth by a series of conditioned binocular reflexes which depend on time and usage for their development. These reflexes are in a state of 'flux' from six months to two years, of diminishing 'flux' from 2-5 years and become fixed by the age of 8-9 years[5]. Therefore the candidates for aircrew selection have their binocular reflexes fully grounded right or wrong at the entry stage. Subsequent training and combat flying stresses together with physiological effects of ageing may adversely effect this binocular visual status of entry and tilt the balance in favour of decompensation.

Ocular muscle poise is a dynamic entity and varies from a perfect balance of orthophoria seen in a small minority to heterophoria, seen in a vast majority[3]. Whenever decompensation of BSV occurs, there is a progressive shift from orthophoria to manifest squint, which may be either intermittent or constant. The former may occur at particular times or in certain positions (ie: near distance and far distance) or in certain stressfull situations. Once the deviation becomes constant, degeneration of binocular functions by way of suppression, poor vision, abnormal retinal correspondence and poor stereopsis starts taking place.

Unpredictability about its occurrence makes the intermittent squint most sought for defect in aviation. Since the degeneration of binocular functions does not take place till the squint becomes constant, it promises good prognosis therapeutically. Therefore, early detection and treatment of cases suffering decompensated heterophoria and intermittent s is of paramount importance. Otherwise the co will deteriorate gradually from intermittent to tant squint.

A-V and X phenomena associated with i mittent squint may bring a horizontal chan alignment of the eyes which occur on looking down [4]. These patterns may be associated phoriac eso-deviation, or exo-deviation in pr position. Compensatory head postures that pr sufficiently improved alignment permits BSV in situations, but for the flier this compensation m at the cost of his flying efficiency.

Such a statement from a pilot, "Doc, I fit and FINE when flying straight and levels but feeling funny and even get double vision looking up, down or in a far distance" may no brushed aside as purely psychological complaints need thorough ophthalmic evaluation.

In the present study we find that visual de mainly consist of declining acuity of vision and anomalies, (Table II and III). This trend can be controlled by raising initial entry visual standa based on modern techniques of ophthalmic exa tion. Break down of BSV defects revealed intermittent squints and convergence insuffici were high in (B) group (Table IV). This could attributed to factors like high degree of initial ph stress situations in flying, changes in emotional be viour and ageing. Congenital musculofacial o

defects which have remained masked and compensated may also become decompensated with advancing age as a result of failure of neuro-muscular control of accommodation, convergence and fusional reserves. Head injury acts as an aggravating cause by affecting all the above factors. It specifically interferes with stereo-acuity which fails to recover if injury is severe[8]. Therefore, these cases remain potentially unsuitable for flying if the head injury is severe. The role of these various factors has been shown in Table V.

Orthoptic exercises play a great role in promoting and consolidating BSV in cases of convergence deficiency, decompensated heterophoria and in intermittent squints. Four cases of intermittent squint and three cases of asthenopia who reported to the orthoptic centre at Air Force Hospital Bangalore in the year 1976 were completely cured by intensive machine orthoptics.

Comparative absence of visual symptoms in aircrew should not be taken as non-existence of visual defects. Probably fear of loosing the flying category is responsible for this state. This can be remedied if confidence is infused by indoctrinating them that the malady is curable, but if left untreated, may not only endanger their flying career but also flying safety[2]. Periodic ophthalmic evaluation including orthoptic assessment by trained para medical staff and institution of appropriate measures in time will go a long way in improving pilots eye care.

Conclusion

Existing ophthalmic evaluation at entry needs change by introducing new techniques for better evaluation and to keep the pilots wastage to a minimum. Absence of visual symptom in flyers is not a true index of the problem. This situation will change when the facilities for treatment are easily available, and their flying career secured. Periodic orthoptic evaluation at SSQ level and institution of appropriate treatment in time will minimise the visual defects in aircrew.

References

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