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VISUAL AND OCULAR MOTILITY PERFORMANCE OF ONE HUNDRED CRICKETERS*

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Abstract

Evidence from the U.S.A. suggest that good standards of vision and general ocular co-ordination are factors in higher levels of skill of baseball players. A similar study has not been conducted on a group of Australian sportsmen. The purpose of this study was to establish the relevance that various ocular standards have on performance skills of a group of cricketers of varying capabilities. The sample population comprised 100 cricketers from 1st grade to 10th grade. The tests performed were: visual acuity, cover test, ocular rotations, fusion, stereopsis and colour vision. The different grades of cricketers were compared with respect to their performance on these tests to ascertain whether or not visual and ocular motility defects were influential factors in performance levels.

The results showed that there was no statistically significant difference ($p < 0.001$) between the ocular status of cricketers in the higher grades as compared to those in the lower grades on the tests performed.

Key words: *Visual performance of sportsmen, vision, ocular rotations, fusion, stereopsis, colour vision, cricketers, ocular muscle balance.*

INTRODUCTION

Recently there has been an increasing interest in sports medicine and within that speciality, an increasing interest in visual function and sport.[1,2] The areas of visual function that have been investigated include static, kinetic and dynamic visual acuity, ocular muscle balance, stereopsis and visual fields, and claims have been made that athletes have better visual abilities than non-athletes, and that good standards of vision and good ocular co-ordination are factors in higher levels of skill.[3,4,5,6] It has been reported that more successful athletes have better ocular muscle co-ordination and stereopsis than less good athletes.[2]

Current research also indicates that certain ocular functions can be improved through visual therapy, as indicated by Stine, Artberton and Stern[2] (with depth perception and phorias), and Burian and Von Noorden[7] (with accommodation). But does this enhance an athlete's performance?

Thus, the question of visual training of athletes using ocular motility exercises needs to be addressed. Publications such as "Sports Vision Highlights"[1] recommend that vision specialists become part of a sport's teams required coaching panel.

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One would expect that the basis of visual training would be based on three assumptions:

1. that athletes have better visual ability than non-athletes;
2. the visual abilities are trainable;
3. that visual training is transferable to improving the performance of athletes.

The aim of this study was not to investigate the effect of visual training but to address the first question — do athletes have better visual ability than non-athletes?

In order to do this, one hundred district and sub-district cricket players were assessed to try to establish the relevance, if any, that various ocular standards have on performance skills and how the visual status of this group of sportsmen compared to the normal population.

SUBJECTS

The study was conducted on one hundred cricketers from several clubs with district and sub-district grades. In Melbourne, district clubs are those from which state players are selected, while sub-district players take part in a suburban competition of a lower standard. However, according to the various coaches, the level at which players participate is not necessarily an indication of their skill level as some players, for example, choose to play in the sub-district competition when they have the ability to be in the district competition. In this study were forty players from a district club from first to fourth grades, with ten from each grade, and sixty players from sub-district level. There are also four grades at sub-district level, so there were ten players at each level and two composite grades of twenty players. They ranged in age from eighteen years to thirty-four years with an average of twenty-six years.

METHOD OF VISUAL ASSESSMENT

One hundred cricketers were surveyed. The tests performed were:

* visual acuity with the Snellens chart at 6 metres
* cover test at 1/3 metre and 6 metres
* smooth pursuit movements to nine positions of gaze at 1/3 metre
* saccadic movements both vertically and horizontally at 1/3 metre (both smooth pursuit and saccadic movements were assessed subjectively by the examiner. Equipment was not available to test these functions objectively).
* convergence measured by the RAF Gauge
* stereoacuity using the T.N.O. and
* colour vision using the Ishihara test.

All tests were administered as defined by Burian and Von Noorden[7] and Stein and Slatt.[8]

Tests were performed with optical correction if the correction was worn during competition.

RESULTS

A major problem in a survey of this type involves the definition of skill ranking. The assumption is that if a player is playing in first grade he is of greater skill than a fifth grader. It was decided for the purpose of this study the best method was to rely on the club's existing selection criteria to grade their players on a normal competitive basis.

A spearman's table correlation was chosen to analyse the results. The SPSS-X version 2.1 statistics model was used to give point biserial correlation to show any significance between grade and performance on ocular testing, the dependent variable being the cricket grade versus performance on visual tests. Percentages of the sample population (cricketers) who failed or those who over achieved the visual tests were also compared to the "normal" population standards.

The criteria for normal values were selected from existing studies and a combination of accepted standards.[9,10,11,12] As Jolly[13] commented in 1985, the number of studies conducted on general populations is limited, and so no direct comparison can be made with a group of similar age. However, it is interesting to also compare these results with Brown[9] who reported on the visual screening of 5,000 kindergarten age children and with those of Jolly[13] who tested forty-three junior athletes.

1. VISUAL ACUITY

The visual acuity results showed that 95% had vision 6/6 or better with both eyes (See Table 1).

TABLE 1
Visual Acuity

	This Study	Jolly	Brown
Vision 6/6 or better both eyes	95%	91.5%	80%
Vision 6/6 or better one eye 6/9 other	2%	4.25%	5.6%
Vision 6/9 both eyes	2%	0	8.1%
Vision one eye less than 6/9	1%	4.25%	6.3%

While these results may suggest better that average vision when compared to the Brown study, there was no statistically significant correlation ($p<0.01$) between the vision of a cricketer and his grading. These results are similar to those of Jolly.

2. OCULAR MOTOR DEVIATIONS

The cover test showed that 4% of the cricketers had strabismus which is consistent with the Brown and Jolly studies, the generally accepted population norm. (see Table 2).

While the incidence of heterophoria (40%) is similar to the Brown study, it is less than that found by Jolly. There are no known population norms for this age group, however as this study is consistent with the larger of the two studies, and as there is no proof that the incidence of heterophoria alters with age, it is argued that this study possibly reflects more accurately an incidence which is similar to that of a normal population. It is also possible that different diagnostic methods could explain some of the differences.

Because the incidence of strabismus and heterophoria is consistent with the Brown study, then the incidence of orthophoria is also similar. However, when cricketers of the various grades were compared, the incidence of orthophoria was significantly higher ($p<0.01$) in players in the top three grades.

An examination of ocular rotations, including saccadic movements and convergence, showed no significant abnormalities as compared to the Brown and Jolly studies nor statistically significant difference ($p<0.01$) between grades. (See Table 3).

TABLE 2
Ocular Motility Defects

	This Study	Jolly	Brown
Orthophoria	56%	21.25%	40.7%
Heterophoria	40%	74.5%	55.8%
Strabismus	4%	4.25%	3.5%

TABLE 3
Ocular Rotations

	This Study	Jolly	Brown
Full movements	60%	56%	—
Abnormal movements	40%	44%	—
Normal conv.	71%	68%	86.4%
Reduced conv. (>6 cm)	29%	32%	13.6%

3. STEREOACUITY

Most subjects (56%) achieved 60 seconds of arc, with the mean value being 90 seconds of arc. Romano, Romano and Puklin[14] have stated that 40 seconds of arc is normal stereoacuity. The most common score of 60 seconds of arc as tested on the TNO can be explained by the fact that this test jumps from 60 to 30 seconds of arc with no 40 seconds of arc test plate. If a player failed one of the two plates at 30 seconds of arc, it was deemed an overall fail, and recorded as 60 seconds of arc.

These results are inconsistent with those of Jolly who found a mean level of 47 seconds of arc, with the largest single group (47%) achieving 30 seconds of arc. The higher levels of stereoacuity were particularly found amongst the tennis players, and it was suggested that "the natural selection operating in sporting activities could be influenced by visual standards." The results of this study are more consistent with those of Frisby, Neilson and Parker[12] who examined sixty-

TABLE 4
Stereoacuity (TNO Results)

	This Study	Jolly
25 seconds	—	5 (10.6%)
30 seconds	22 (22%)	22 (46.8%)
60 seconds	56 (56%)	15 (31.9%)
120 seconds	10 (10%)	3 (6.4%)
240 seconds	—	—
480 seconds	8 (8%)	—
Nil	4 (4%)	2 (4.3%)
Total	100 (100%)	47 (100%)

TABLE 5
Colour Vision

	This Study	Normal Population
Normal	97%	92%
Defective	3%	8%
Total	100%	100%

eight university students whose "mean age was about 20 years". The mean response was 82 seconds of arc.

As with the cover test results it is argued that these findings are more consistent with and therefore reflect the stereoacuity levels found in the "normal" population. There were no significant different ($p > 0.01$) in stereoacuity levels between cricketers in the different grades.

4. COLOUR VISION

Results of the Ishihara test showed 3% of cricketers had defective (red-green deficiency) colour vision, which is less than the 8% reported in an average male population.[16] It is interesting to note that a 2nd grade district player failed the red-green Ishihara section completely. (See Table 5).

CONCLUSION

In conclusion, this study shows that there is no statistically significant difference on visual tests between the different grades. When assessed by the methods stated above, the statistical analysis revealed that the incidence of ocular defects found was similar to that of the normal population and that they were evenly spread over all grades.

The results did show that higher grade players have higher than normal incidence of orthophoria and that cricketers in this sample population had a lower incidence of red-green defects than the normal male population.

While these findings are useful for describing a relationship between two variables, i.e. the cricketing grade and the results of the visual tests, further investigation is required to demonstrate a causal relationship.

However, the tests performed were predominantly of an ocular motor nature, and so far there is no evidence of what level of visual status is required of a cricketer.

Cricketing pundits are often fond of quoting that great batsman "see" or "pick-up" the ball sooner. However, while the demands on the integration of sensory and ocular motor apparatus is high, the importance of ocular motility to this process is questionable. In the closed environment of a cricket ground, the visual demands of a player are defined; the player knows/assumes the moving target is the ball. Does the player's vision system really need the ability to count the stitches on the ball before it triggers the physical response of body movements?

The results of this study indicate that this sample population of cricketers has a similar incidence of ocular motility disturbances to those found in the "normal" population. It found a significant ($p < 0.01$) correlation only between orthophoria and higher grade players.

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