Occupational Assessment

SPORT VISION

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For The On Site Screening Of Visual Performance In Sport

after D.F.C.Loran

Sport Vision Services Ltd
www.sportvisionservices.co.uk
31 Bird Hill Road, Woodhouse Eaves,
Loughborough, Leicester. LE12 8RP
Telephone/ Fax: (+44) 01509 891089
E-mail:

Lafayette Instrument, Europe,
www.lafayetteinstrument.com
4, Park Road, Sileby, Loughborough,
Leicestershire. LE12 7TJ
Tel (+44) 1509 817700 Fax (+44) 1509 817701
E-mail: lic-uk@lafayetteinstrument.com

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ASSESSMENT SET – CONTENTS

DIAGNOSTIC EQUIPMENT

The Standard on site screening battery contains the following

Pilot Bag - For Small Items And Paper Work
Artists Carrier Case - Portfolio For Test Charts
LogMAR high and low contrast acuity charts
Vernier Acuity Tests (After Andrew Merry)
Prisms / Spheres Flippers - 2.00 Spheres On One Side, 2 Base Out On The Other
1D And 2D Sphere Flippers - Near accommodation facility in presbyopes
Camera Flash - Glare Recovery (Flash Unit, Visor and 3m Snellen chart)
Brock String
Howell Distance And Near Phoria Cards And 6 D Prism
Dynamic Fixator (After Geraint Griffiths)
Tape Measure /Near Point Rule (After James Collins)
Cover Test - Freeman occluder rule
Vergence Trainers Dinosaur cards (after Paul Adler)
Colour Preference Set (after Geraint Grifiths)
Lux Meter
Stop Watch

Additional Mounting and Admin Material not supplied	
Scissors	Scotch Removable tape
Blue Tac	Masking Tape For Distances
String	Pens X10

To which should be added from practice equipment	
Stereopsis (TNO)	Retinoscope
Titmus Fly	Trial Case

Ishihara 14 Plate Maddox Wing	Mallet Unit Near Mallet Unit Dist

ANALYTICAL EQUIPMENT

The advanced screening battery can include the following analytical equipment in addition to the above diagnostic equipment:

- **Peripheral awareness test**
- **Acuvision 1000**
- **Wayne Saccadic Fixator**
- **Hand Eye Co-ordination**
- **Contrast Sensitivity Tester CVS 1000**
- **Dynamic Vision Rotator**
- **Basin Anticipation Timer**

A detailed description of this equipment is beyond the scope of this manual. Each has an important role to play in simulating aspects of sporting performance and subsequently in training and therapy.

Consultancy services are available to help install and explain the use of the equipment, costs on application.

Equipment available from Lafayette Instrument Co (Europe)
+44 (0) 1509 817700
gprescott@lafayetteinstrument.com
www.lafayetteinstrument.com

INTRODUCTION

Sport in arguably the most important consideration in Occupational Optometry.

Half the population is involved in some aspect of sport either as a participant, coach, official, administrator or spectator.

At the extremes, life may depend on visual performance. Avoidance of injury depends on peripheral awareness, contrast sensitivity and eye body response time. At a more mundane level endurance can be influenced by what the eyes see and how easily they see it. Visual performance has been shown to have a direct link to sporting performance (skills and results)

Most occupations have some aspect of visual performance mirrored in sport.

The tests and protocols in this manual have been developed through the work of the Sports Vision Association with many of our national and professional sports teams (see table 1)

Table 1 Elite groups Associated with Sports Vision Association Assessments

The British National Archery squad.	Leyton Orient Football Club Senior Squad.
British Women's Hockey team.	Nottingham Forest U14 Squad.
National and Junior small bore rifle teams.	Manchester City F.C. Football Academy, U13
British Olympic Yachting Squad(Atlanta).	players.
Yorkshire Cricket Team.	The All England Netball Association Panel
The Scottish Cricket Union.	Umpires.
Winter Olympics in Lillehammer	Scottish small bore rifle Association
The British Olympic Summer training camp	English Golf Union
Tallahassee	English and Welsh Ladies Golf Associations
Ipswich Town Youth Team.	Marsh Classic Masters Tennis
The Lilleshall School Of Soccer Excellence	Braintree Clay pigeon shooting club

VISUAL TASK ANALYSIS.

Understanding the visual demands in a sport depends on close questioning of the participants and measurement of visual characteristics which can be very specific.

In the screening situation the visual task analysis requires a detailed questionnaire and a series of tests that are roughly divided into two:

- Analytical
- Diagnostic

The SVS Occupational screening set provides the diagnostic equipment that is not usually available in practice.

The analytical tests can be added later as the practitioner gains experience and can justify further investment in this equipment. Details are available from Sports Vision Services or Lafayette Instrument Co (Europe).

A STRATEGY FOR ASSESSMENT OF VISUAL PERFORMANCE

A clear idea of why and how the screening is done and how the results will benefit the athletes, is fundamental to an understanding of vision in sport.

Correlating visual performance with sporting achievement is scientifically very difficult; the result, the number of runs or goals scored, depends on too many variables (the coach, the weather, lighting, condition of the court, the opposition, diet, sleep and so on). Achievement in blind sport[8] suggests that in any case vision is not the overriding concern. Indeed research from the Olympic games[9] suggests that up to 20% of elite athletes compete with visual problems. (There is also a parallel here with visual standards and driving)

Despite these difficulties an overall measure of vision performance in U14 Soccer players correlates very highly ($p = 0.01$) with an independent subjective assessment of their playing skill by their professional coaches[10]. It could be hypothesised that this correlation will decrease in the senior players, as the visually (as well as physically) disadvantaged youngsters are lost to the game.

But more recent research suggests that even in senior players development of visual deficiencies, which is not uncommon as the accommodative power of the lens decreases, can have a dramatic effect on sporting performance. Research amongst elite tennis masters and clay pigeon shooters (Griffiths GW 2003.The importance of eye dominance in sport. Optometry Today pending publication Summer 03), has established a direct connection between sporting and visual performance.

It is also probably safe to say that poor visual performance can be a barrier to high achievement is sport and that in some sports certain visual skills clearly contribute to success at the game. (See Table 2)

Table 2 Important visual skills in different sports.

Cricket	Anticipation (batting) Hand eye response (fielding)
Football	Foot eye co-ordination Peripheral awareness
Archery	Visual acuity Glare recovery
Sailing	Glare recovery Motility Peripheral awareness
Table Tennis	Motility Hand eye reaction time
Snooker	Stereopsis Vergence facility
Netball	Depth judgement including stereopsis Peripheral awareness
Skiing	Contrast sensitivity Dynamic visual acuity
Hockey	Dynamic visual acuity Hand eye co-ordination
Athletics Track And Field	Visualisation, peripheral awareness

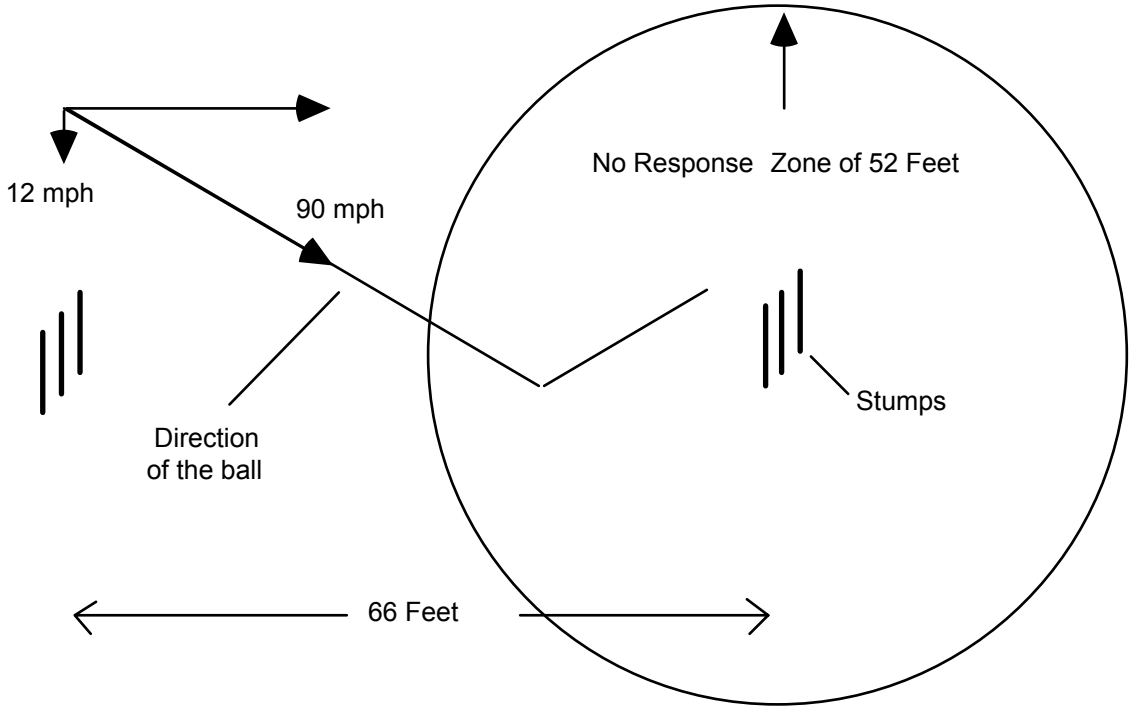
PHYSIOLOGICAL LIMITATIONS

To understand how a visual skill is used in sport, physiological limitations need to be appreciated.

The findings for Hand Eye response time and peripheral awareness[1] have important implications. In cricket for example, response time needs to be related to the speed of the ball and the length of the pitch.

In first class cricket the ball is likely to be delivered by a fast bowler at speeds of up to 90 mph.[11] If the pitch is 22 yards long, it takes 0.5 seconds for the ball to travel from one end to the other. For a response time of 0.4 seconds (corresponds to the best response times on the peripheral awareness test and hand eye co-ordination), there will be a zone of 52 feet in front of the batsman (see Fig 1) where he will not be able to respond to any unexpected change of direction of the ball.

Fig 1 Batting Zone of No Response



ANTICIPATION

By anticipating a course of action, which way the tennis ball will be hit, or the way the cricket ball will turn, response time is improved. Anticipation,can make up for the physiological limitations of reaction time and will be affected by visual skills which are amenable to investigation, correction and therapy. (see Table 3).

Table 3. Visual skills that facilitate anticipation

VISUAL SKILL	**APPLICATION**
Eye movements; pursuit, saccade, vergence and motility.	Pursuit of the bowlers hand and following the ball.
Visual acuity.	Bowlers hand grip.
Contrast sensitivity.	Bowlers hand against the background.
Hand eye response time.	Reaction to speed and direction of the ball.
Accommodation facility.	Speed of changing focus
Glare recovery.	Dealing with different levels of illumination.

MEASUREMENT

Anticipation timing is measured using the Basin Anticipation Timer and a sequenced row of light emitting diodes. Relatively low speeds are used (5, 10 and 15 mph) compared with the speed at which the ball is bowled because the apparent speed of the ball moving straight to the batsman is governed by the rate at which it is falling vertically or swerving horizontally. The components of the speed in these directions are much slower than the actual speed of the ball towards the bat (see Fig 2 batting Zone of No Response). The forward movement of the bat may be more of a simple reaction to the release of the ball from the bowlers hand, but sideways and vertical movement in flight can, up to a point, be followed and anticipated.

STRATEGY

Physiologically the human visual system is limited by the rate at which nerve impulses can be transmitted and to a lesser extent by the physical strength of the player. What marks the difference between the novice and the elite player apart from physical development is the ability to anticipate. Anticipation it would seem depends greatly on rapid interpretation of visual clues. (see Table 4 The relevance of Visual Clues in Competitive sport)

TESTS

Given that visual performance is directly or indirectly important in sport, tests which measure it need to be broadly divided into two (see Tables 5 and 6 Screening strategy, Use of tests); those which represent an important visual aspect of the sport (analytical), and those which break down vision into its component parts (diagnostic). If members of the group do badly in the analytical (sport specific) tests compared with their peers, then this could be a reason for poor performance.

Table 4 The relevance of Visual Clues in Competitive sport

VISUAL CLUE	SPORTING RELEVANCE
Ball spin	**Cricket.** Swing of the ball in the air, direction off the ground **Rugby.** Direction of bounce
Direction of gaze	**Badminton.** Eye movement may signal the competitors intention, or it may be a bluff
Speed and direction of bat	**Table tennis.** Fast upward movement will impart top spin, fast forward movement a smash

Pattern of play off the ball	**Football.** Fast movement on the wings would precede a pass from the centre
Body movement	**Judo, Football.** May indicate nervousness, fluidity, being off balance.
Wind direction	**Archery, Rifle Shooting.** Direction of wind indicators, flags or trees are critical to the execution of the shot.
Facial expression	**Weight lifting.** Expressions of defeat or confidence can have a psychological effect on competitors.
Skin colour	**Athletics.** Excessive redness might be a sign of vulnerability or fatigue
Speed of approach	**Cricket.** Bowling too fast trying too hard. Too slow has given up
Angle of racket head	**Tennis.** Direction of the ball after being hit
Hand grip	**Cricket.** Spin of the ball
Condition of the playing surface	**Skiing.** At 90mph the quality of the snow and eveness of the surface are of critical importance

Table 5 Screening Strategy

TESTS		
Analytical	**Diagnostic**	
Anticipation Timing	Retinoscopy	Vision logMAR
Stereopsis	Dynamic Fixation	Glare Recovery
	Vergence Facility	Eye Hand Dominance
	Accommodation Facility	Brock String
	Contrast Sensitivity	Muscle Balance

The results in the diagnostic tests then give an indication of which aspect of visual performance may be at fault.

Table 6 Use and significance of diagnostic screening tests in the Sports Vision Association battery.

TEST	SIGNIFICANCE
Retinoscopy	Looking for gross errors, anisometropia, astigmatism.

High and low contrast logMAR vision	Facilitates statistical analysis to give an accurate measure of changing and different performances.
Dominant eye. (See Photo 1 confirmation of ocular dominance)	Ocular dominance can cause problems in aiming sports where an arrow is aimed at a target or a foot is aimed at a ball.[1]
Accommodation and vergence facility	The durability of these systems[2] is more important in sport than a one off measurement in the office of positive relative convergence.
Brock string	Measures fixation disparity in the sporting context. Raises underlying visual problems to a conscious level
Glare recovery	The ability to deal with glare from stadium lights or a low sun varies considerably in normal eyes. The differential effects of UV light on blue and brown eyes[3,4].
Colour vision and colour preference	Optical properties of tints need to be matched with underlying psychological preference. Recent research in dyslexia migraine[5] and colour deficiencies[6] needs consideration
Dynamic Fixation. (Photo 2) Measures eye speed by a combination of vergence and motility	May give a measure of sporting preference and innate abiliy[7]
Stereopsis	For confirmation of basic ability time taken as well as level achieved.
Muscle Balance	Decompensated vertical and horizontal phorias will affect hand eye co-ordination

Using the Scottish Cricket Union as an example,[12] anticipation (which seems important in batting) was taken as the main analytical test. The performance of individual players who did worst on this test, (Mean Anticipation Timing > + / - 10 and / or Standard Deviation > 5) are summarised on table 7. Where the same players results in the diagnostic test are below average, these are also shown. The blank spaces are results which are average or above.

Table 7 Summary of significant data Anticipation Timing at 5mph

ANALYTICAL **DIAGNOSTIC**

Subject	Anticipation Timing		Stereo	Domin	Brock
	Mean (x100)	Stdev			
M	10.16		120	L Cross	-0.33
D		7.56		R Cross	-1
B	-11.2			L	1
G	29.38	21.39		L Cross	-0.11
A	11.38	19.33		L Cross	-0.33
K	-22.6	23.53	120	L Cross	-0.22

DIAGNOSTIC (Contin)

	Ret	Dyn Fix	Verg	Focus	CS	Vision	Glare
					Eye Reduced		
M	+0.75				L	R	11
D			17	8			
B							
G			18	10		R	
A	+1.5				R	R	
K		25.76				R	

EXPLANATION OF TERMS AND MEASURES

Anticipation timing

Using the Basin Anticipation timer (see above) a late response (measured to the nearest 100th of a second) is given a positive value and an early response a negative value.

Stereopsis

Measured with the TNO

Dominance

This gives the characteristic for each player. For instance, "L Cross" means left eye dominant but bats or bowls right handed. "L" on its own means left eye dominant and left handed for batting and bowling.

Brock String.

It is not possible to quantify individual observations on the Brock String only whether the strings cross in front of, behind, or at the bead. There were three beads on the string which was held in front of the player in three different

positions, up, down and straight ahead. If the strings appeared to cross in front of the bead (esophoria) this was assigned a value of +1. If it was behind the bead the response was given a value of -1 and at the bead , 0. For each player there were 9 results and to give an indication of overall tendency the average of the assigned values was taken. Someone who always saw the string in front of the bead would have 9 assigned scores of +1 and an average of +1.

Retinoscopy Estimate of refractive error

Dynamic Fixation[7] is a measure of eye speed and is the average in seconds of three sets of three cycles on the instrument.

Vergence Facility
Is the number of times the subject can converge on letters at 6m through a pair of 2 base out lenses, which are repeatedly placed in front of the eyes for a duration of one minute.

Focus or Accommodation Facility.
This is the same as Vergence Facility except -2.00 spheres are used instead of prisms.

Contrast Sensitivity
Indicates where an eye is greater than two standard deviations worse than the average for the group in one of the four levels of spatial frequency. (measured on the Vector Vision CVS 1000).

Vision
This is measured as the player presents, as they would be on the field of play. It shows where there is a difference between the eyes, the eye with the poorer vision at high or low contrast is recorded (all these eyes are within the defined range of average which is between + and - one standard deviation of the mean).

Glare

This is time in seconds to recover, to a 6/9 line of letters, from disability glare caused by a camera flash held at 2/3 of a metre.

INTERPRETATION OF RESULTS

Anticipation

Late anticipation (+) corresponds to exophoria on the Brock string (-) in all but one case. The exception was K whose poor eye speed and inconsistent results (SD 23.53 for anticipation) indicate poor muscle control. Reduced stereopsis and vision (R) may also be significant. Poor timing seems to be associated with reduced stereopsis in two subjects. In the group as a whole 11 subjects (73%) had anticipation times at 5mph which corresponded to the opposite sign in Brock String, this suggests a trend but is not statistically significant.

Ocular Dominance

All the players with poor anticipation were cross dominant (eg right eye left hand or vice-versa) or totally left dominant (left eye left hand). This compares with the remainder of the group (9) with no problems where only 2 (22 %) were cross dominant (see Table8a).The incidence of dominance is different in cricket compared with archery (Table 8b)

Table 8a Incidence of cross dominance with anticipation timing problems

ANTICIPATION

Problems		**No Problems**	
Dominance	*Incidence*	*Dominance*	*Incidence*
L Cross	4	R Dom	7
R Cross	1	L Cross	2
L Dom	1		
(Cross Dom 83 %)		(Cross Dom 22 %)	

Table 8b Incidence of Hand-Dominance % 26.10.98 20.5.98

Dominance		**Cricket**	**Archery**		**Meeting Delegates**	
Eye	Hand	Scottish National N = 15	Internationals N = 16	Coaches N =70	Northern Optical Soc N = 65	SVA Members N = 25
Right	Right	46.7	62.5	84.3	78.5	48
Left	Left	6.6	18.75	10	1.5	12
Right	Left	6.6	6.25	2.85	0	8

Left	Right	40	12.5	2.85	20	32
% Cross Dom		46.6	18.75	5.70	20	40

In the National squad of fifteen players, all four of the specialist batsmen were right eye, right hand dominant (uncrossed) and favoured a full on stance and straight head. (unlike the sideways stance favoured in base ball). It seems that binocular vision is important in batting and the dominant right eye should not be hindered by facial features or head tilt[13] as it would be in a sideways stance. The incidence of cross dominant players (46.7%) compared with archery (18.7%), suggests that at least one aspect of the game favours this configuration (the side on delivery of the bowler?)

Implications

Using the cricketing example the results suggest that binocular vision and eye dominance are important and that the diagnostic data will indicate which elements of visual function are defective. Poor vergence or focus facility which could affect anticipation timing, might need exercises to improve them using exercises with stereo vectograms or prism and sphere flippers.

In two subjects problems may be solved by correcting hyperopia with contact lenses to reduce esophoria, correct anisometropia and improve vision. Anisometropia and hyperopia can affect stereopsis.

Susceptibility to discomfort glare because of hypo-pigmentation in the iris and retina[14], aberrations from a large pupil, or fluorescence of blue and UV light in the ocular media, could be helped with an appropriate tint[15]. A course of action would be confirmed after a full eye examination. Poor recovery from disability glare may not be associated with eye colour. In fact a blue eye that is used dealing with light seems to recover more quickly than a brown eye in subdued light, which is suddenly surprised by a camera flash.[1]

DISPENSING CONSIDERATIONS

Seeing as clearly as possible can make up for the physiological limitation of the human nervous system. This has important clinical implications in the dispensing of sports vision appliances.

TYPE OF SPORT

The type of appliance varies considerably with the sport for which it is needed. Sports can be divided roughly into two types (see table 9)

Table 9 Sport Type

Dynamic	Non-dynamic
Athletics	Archery
Soccer	Bowls
Yachting	Shooting
Squash	Darts
Hockey	Snooker

As the balance in a sport shifts from the dynamic to the non dynamic, from the physical to the cerebral, so dispensing considerations change. In sports like ice hockey and tennis, things happen very quickly and there is a great risk of trauma. In chess there is very little movement and a lot of thought, so less risk of eye injuries. The intensity of competition in both these sports however should not be underestimated.

In chess for example, what are the effects of prolonged concentration at the near focal point, how does the light reflect off the board, what is the effect of the ambient light, is it harsh fluorescent or tungsten? What is the level of illumination; information about muscle balance, individual ocular refraction, eye colour and age become very important. These considerations occur to varying degrees in all sports.

SPORTS VISION APPLIANCES

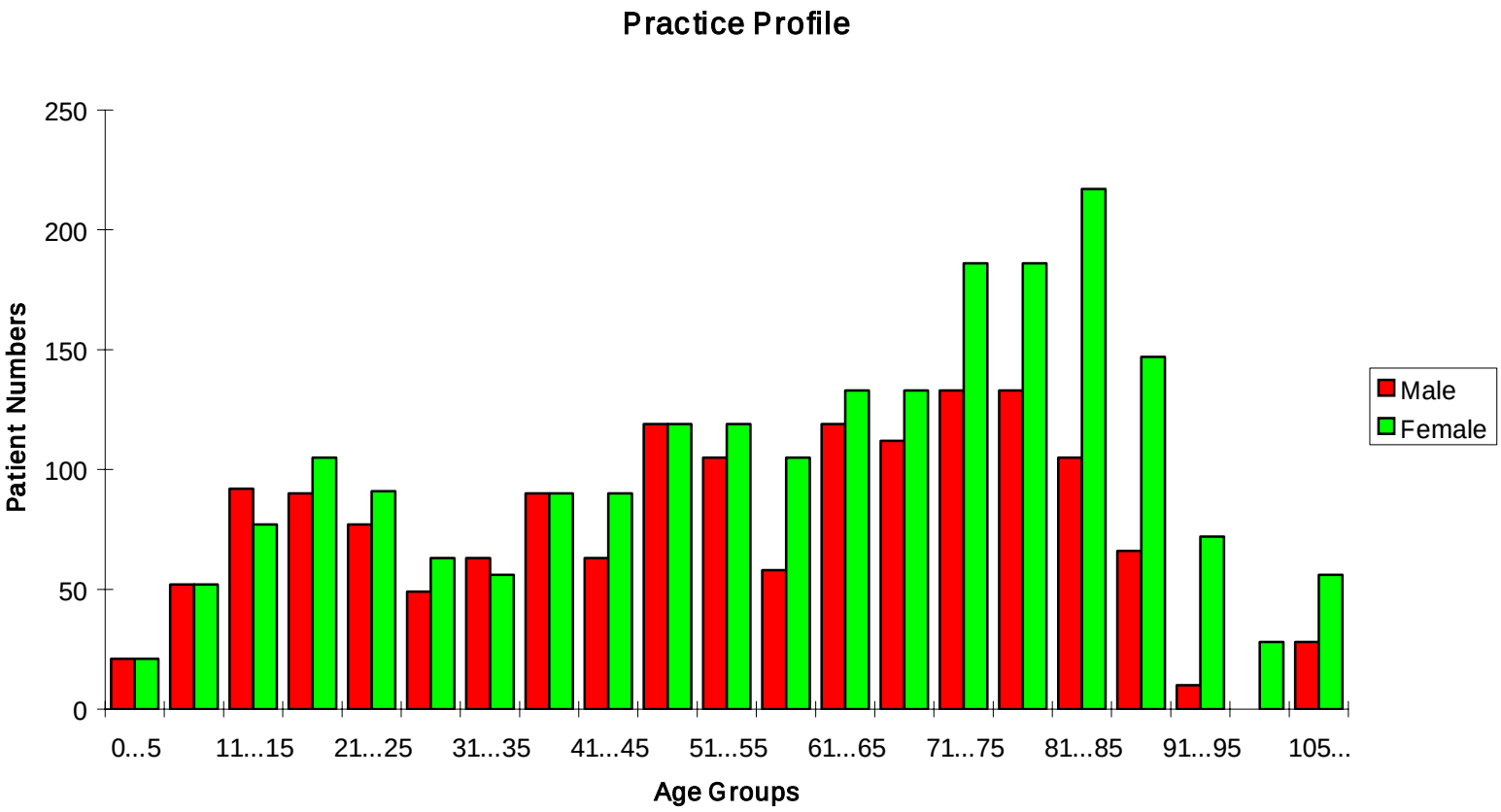
Safety is a primary concern in sport and although there is resistance from players to wearing eye protectors most optometrists have no difficulty justifying them. The problems arise when practitioners are unaware of their patients sporting interests and the potential hazards in specific sports. The new British Standard in squash and racket sports[16] makes an interest in sport and close questioning during history and symptoms even more important.

The ophthalmological significance of eye injuries is self-evident. Optometrically is could be said that good vision and peripheral awareness helps to avoid them. Seeing the cricket ball early gives time to take evasive action, seeing the movement of a squash racquet in peripheral vision might help to avoid serious injury. It follows that a post injury reduction in visual

performance will make subsequent injury more likely and diminish future enjoyment of the sport. (poorer performance seems to encourage reduced participation in competitive sport)

The most active age group, 15 - 39[18], is the least likely to attend for an eye examination see Fig 2.

Fig 2 Practice Profile (Courtesy Debbie Burns 21 9.95)



CLINICAL CONSIDERATIONS

The shape, size and type of appliance may be governed by the overriding safety requirements and the risks should be emphasised to the player. Design and cosmesis also play an important part in peer approval; but above all vision in all its different ways need to be maximised. Sport at all levels would logically seem to need sustained, clear and comfortable vision. Refractive findings become important and even small prescriptions may be significant in the sporting context. (see table 10)

Table 10 Visual components affected by spectacle Rx

• Contrast sensitivity • Binocular balance • Accommodation vergence facility • Depth perception • Peripheral vision (lens size, material and design) • Glare (inappropriate use or non use of tints, scratched lenses) • Asthenopia	• Dominant eye (eg. when the non dominant eye takes over from a dominant eye, compromised by short sight or obstructions - the string of a bow in archery). • Speed of eye movement (differential prismatic effects caused by poor centration or anisometropia)

VISION IN SPECS

Given the visual requirements of sport and the importance of the refraction, lens materials, coatings and filters become an important consideration. (see table 11)

Table 11 Clinical Reasons For Lens Specifications.

Multi anti-reflection coat	Contrast sensitivity by improves with lens transmission and reducing surface and internal reflections.
Tint -Contrast -Visible light	Improve contrast sensitivity, reduce discomfort and possibly disability glare.
Scratch resistance	Prolongs good light transmission
Peripheral distortion -Aspherics, Lens size	Maintains peripheral awareness
Water repellent	Maintains lens transmission in rain and spray
Cleaning	Keeps anti reflection coat effective, maintains contrast sensitivity.
Fit	Maintains effective power, keeps appliance stable, prevents vertical prismatic effects.
Comfort	Prevent distractions
Weight	Help to maintain fit and keep comfortable in the active, hot sporting situation
Protection -trauma -Non ionising radiation	Built in protection with polycarbonate frames and lenses.[16] Address possible hazards to ocular and surrounding tissue health [3,4]

CONTACT LENSES

Contact lenses are usually the correction of choice in sport but their effect on the tear layer and the cornea needs consideration (see table 12). In shooting and archery small movements on blinking can be unacceptably distracting.

Table 12 Contact Lens Considerations

SPECIFICATIONS	MAINTENANCE
Fit (reduce movement) Aspherics (correct low cyls, Nissel) Bio compatible (comfort) Water content (reduce dehydration) Gas permeable or soft (What are visual requirements) UV protection (long term health of the eye, compare with specs) Tinting (visual glare, protection. Lunelle)	Wearing Time Stability protein build up Dehydration Replacement Disposable Adaptation Exclusions? • Archery (maximise acuity) • Swimming (keep clean, stick in fresh water *)

* **Soft contact lenses stick to the cornea in fresh (hypotonic) water. This is probably an osmotic effect, not a marginal tightening of the lens. A lens that has been splashed is unsafe to remove for at least 20 minutes after leaving the pool. In salt water (hypertonic) soft lenses float as freely as they would in a tearing eye.[19,20]**

APPLIANCE EXAMPLES

Clinical, cosmetic and functional factors can now be translated into appliances for specific sports. (See table 13)

Table 13 Sports Vision Appliances[21]

SPORT	CONSIDERATIONS
Squash	Safety, weight, peripheral vision, acuity, glare
Archery/ shooting	Eye dominance, occlusion, acuity, Safety
Billiards snooker	Optical centres, refraction, binocular balance, reflections, frame.
Clay pigeon	contrast, safety, glare.
Flying	Peripheral vision, UV filters, contrast enhancement.
Skiing	UV protection, visible light reduction, safety, acuity.
Cycling	Sun, optical centres, foreign bodies, wind protection

CONCLUSION

Effective prescribing of sports vision appliances comes from an understanding of the clinical reasons for their use and matching this to the visual needs of sports men and women.

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PROTOCOL

The first team visual assessment or screening can be a steep learning curve, but certain principles have been established through the Sports Vision Associations work with elite groups.

PRELIMINARIES

Fees

Funding needs to be established at the outset, for on site screening. It is important not to undervalue this service, even if it is paid for out of the practice marketing budget, or by sponsors.

Consent

The consent form need to be understood by the club manager, before detailed arrangements are made, so that individual athletes can agree to the screening on the day.

Tests / Location

Before the testing day the site needs to be assessed to make sure that there is enough space and lighting. On the day it is helpful to number the stations to correspond to the number of the test on the data sheets.

DATA SHEEETS / QUESTIONNAIRE

Examples of these and the consent form, are shown below.

ANALYSIS OF DATA AND REPORT PRESENTATION

The complexity and scale of the report depends on what is required to meet the club and practitioners objectives. This can vary from a report on an individual athlete to a full screening.

Sports Vision Screening Consent Form ©

Name of Project	
Screening supervisor	
Name of Sponsor	
Athletes Name	

Nature of Screening

This screening is intended to be a broad assessment of visual performance in the sporting context, it is not a full eye examination. Recommendations may be made about the need for further investigation or the supply of sports optical appliances. A summary of the results will then be given to each athlete.

Use of Data

The confidentiality of individual results will be respected at all times, but the broad conclusions may be used by the Sports Vision Association and your sport for the benefit of eye care practitioners and sportsmen alike.

Where the screening has been made possible by sponsors, photographs and reports may be made available to the news media.

I agree to taking part in this Sports Vision visual assessment.

Signed Date

Individual Report

Name

Date

Visual Correction (estimate)	
R	L

SCALE	VISUAL ABILITIES												
	Vision High		Vision Low		Stere	Vernier	Phoria		Verge	Focus	Dyn Fix	Glare Recovery	
	R	L	R	L			Dist	Near				Visor	No Visor
Excellent													
Above Average													
Average													
Below Average													
Needs Attention													

Score …….

Rank ……..

RECOMMENDATIONS

Reference: Dr Paul M Planer 1994 International Academy Sports Vision.

Questionnaire

Date

Name		Sport	
Age	Level of Play	Dominance (Hand & Foot)	Eye Colour
Position (s)			

Any Previous Visual Examination √	Glasses Worn? √			
When /Who	Near	Far	Both	For Sport

Do you wear contact lenses ? √				
Soft	Rigid	Disposable	Daily	Sport

Injury Have you ever had an injury, surgery, infection disease involving your eyes. Have you ever had a head injury √ Describe: N^{o}, Minor (1), Serious(3)		Visualisation (This is the ability to imagine and mentally rehearses sporting actions and responses. Deficits can hinder the best response in the game situation and make it difficult for the athlete to learn from mistakes.) √
Eye	Head	

Difficulties? Are you experiencing any visual difficulties playing soccer Any difficulties recognising your own or opponents team colours, if so which. √	Colour Vision Ever been tested √

How Important do you think Vision is to your sport 1= not important, 3= important, 5 = extremely important √				
1	2	3	4	5

Data Sheet (1)

Name

1

Retinoscopy (please state unaided, with specs or contacts)	
R	L

2

Vision (as subject plays sport) (please state unaided, with specs or contacts)		
		Contrast
Eye	90%	10%
R		
L		
Binocular		

3 **4** **5**

	Stereopsis (TNO)	Vernier Acuity	Colour Vision √
Level			Normal
Time			Defect

4

Eye Dominance Trials			
1	2	3	4

	Muscle Balance		
		Near	Distance
5	Cover Test		
6	Howell Card		
7	Mallet		

Data Sheet (2)

Name

8 **9**

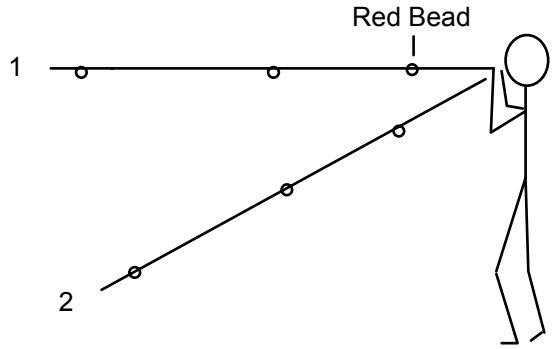
Vergence (Time 60 Secs, 2 out prism rock)		Accommodation (Time 60Secs, - 2.00 Lenses) Cycles			
Static (cm)	Dynamic (Cycles)	Static (Dioptres) R	L	Binoc	Dynamic (Cycles)

(Take static readings first)

Brock String **10**

	Bead		
Position	Red	Blue	Green
1			
2			

Red bead nearest nose



11

Dynamic Fixation Reading			
1	2	3	Mean

12 /13

	Glare Recovery		Tint Preference	
	With Visor	Without Visor	Best	Worst
Time				

This protocol jointly compiled by UMIST and the Sports Vision Association was first used at the Screening of the U14 squad of Nottingham Forest Football Club, 26.11.96

ON SITE VISUAL HEALTH AND PERFORMANCE ASSESSMENT AND LECTURE FEES

Fee Guidelines 12.10.98

Cost of instrument hire / insurance	**£100 a day**
SVA Team Leaders professional fees	**£120 a day** **(£60 per session)**
Accommodation if necessary	**£45 / night**
Travelling expenses by car (Team Leaders, SVA Supervisors)	**First 60 mile@30 p / mile** **15p / mile thereafter**
Travelling expenses (assistants)	**@10p/ mile**
Report production for shared publication rights	**£400**

Administration, postage, copying. **£500**
Lecture Fees **Per hour £75**

We suggest that a minimum of two SVA consultants should be involved to supervise a standard on site visual assessment. Each subject will take 45 minutes to assess, the time includes filling in questionnaire.

Preparation, setting up equipment, organisation of subjects and assistant training is likely to need a full session. Most visual assessments would be completed in one day up to a maximum of 32 subjects (requires 2 consultants and 8 assistants)

I agree to abide by the SVA guidelines for the cost of the Sports Vision Assessment.

PROJECT	*Date*
Signed	*(Project Organiser)*

These guidelines are intended a starting point only to give a rough idea where the costs are and what level of remuneration is likely initially.

THE TESTS

INTRODUCTION

There is increasing interest in the chain of preparation for top class sport, psychological, physiological, nutritional and coaches are becoming aware that sensory input, of which the eye is the most important part, is a missing link.

The pages that follow describe the tests (some of which have been developed through the work of the Sports Vision Association) and the norms that have been established. They are based on the routine eye examination, but are adapted to measure speed of reaction, endurance and ability to perform

under difficult circumstances (rain, mist, mud, low flood lights, bright sun and fatigue). Comparing individual players with others in the group and existing norms, can highlight potential weaknesses.

Therapy, which is beyond the scope of this manual, would be used to address residual problems not related to normal corrective procedures. (consider “Binocular Anomalies, diagnosis and vision therapy” Griffin JR and Grisham J published Butterworth Heinemann)

RETINOSCOPY

Evaluates

Refractive errors, such as long and short sight anisometropia (difference between the eyes) and astigmatism.

Instrument

The Retinoscope, is normally available to Optometrists. If experienced Optometrists are not available for screening an Auto refractor will help to provide the information in the screening situation.

Position Of Subject

Sitting at 50 cm or according to the practitioners' normal working distance.

Illumination

Dim light (10 -30 Lux)

Critical Factors

The refractive error is assessed as the subject habitually presents for sport, whether this is over the subjects normal correction, spectacles or contact lenses, or without any optical aid.

Experience in the use of the Retinoscope is necessary for it to be useful in the screening situation.

Instructions

Just relax and look at the far wall over my shoulder.

Record

The approximate refraction for each eye . For statistical analysis, astigmatism is converted into mean sphere, but the raw data is important for advising the subject.

Normative Data

N = 13

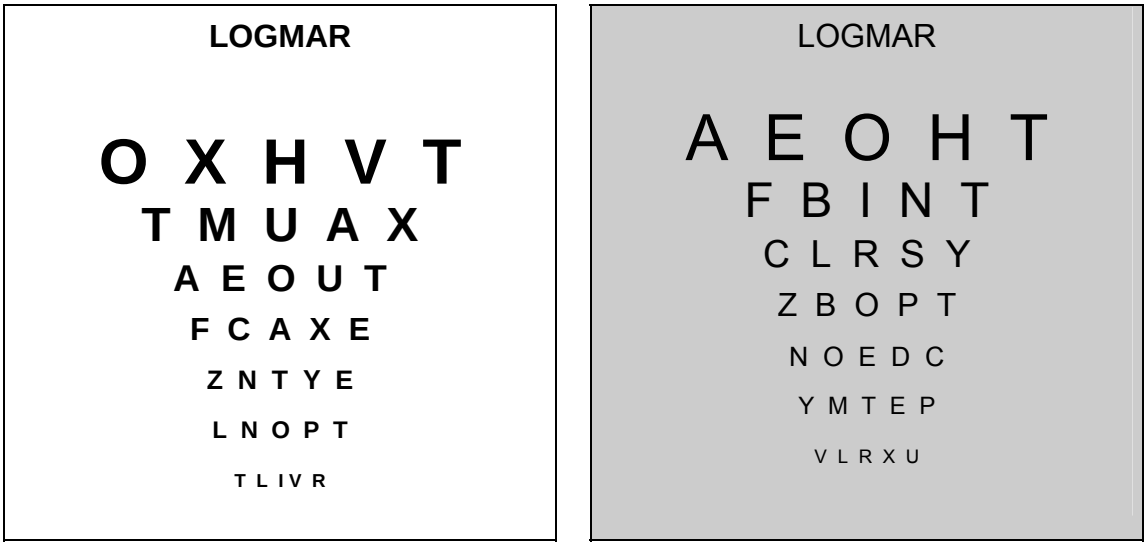
MEAN		**STANDARD DEVIATION**	
Right	**Left**	**Right**	**Left**
+ 0.13	+ 0.21	0.88	0.41

Reference: Wallis and Griffiths 1995 British Olympic Yachting Squad Prior to The Atlanta Olympics.

VISION

(Not to scale)

High contrast Low Contrast



Logmar Charts, for Measuring High and Low Contrast Vision

Interpretation of the Results

Snellen		logMAR	
6/38	RDEZN	0.8	
6/30	ZFVDR	0.7	Partial
6/24	PUDRH	0.6	Sight
6/19	HVUPN	0.5	
6/15	NPZHD	0.4	
6/12	ENFUP	0.3	
6/9.5	RHDEV	0.2	
6/7.5	FUHVR	0.1	Average
6/6	DVFZE	0.0	Sight
6/4.8	ZNPUR	-0.1	
6/3.8	UFRPV	-0.2	Exceptional
6/3	DNFRP	-0.3	Sight
6/2.4	NZEHD	-0.4	

Evaluates

High and low contrast vision as the athlete presents, with contact lenses, unaided or with specs. In this context it is not used to measure visual acuity. The low contrast chart can show up short sight, lazy eyes and dirty contact lenses.

Instrument

Bailey - Lovie high and low contrast LogMAR charts

Test Distance

6 metres

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Standing facing the charts at 6m

Critical Factors

Monocular visions as well a binocular visions important. Vision not to be confused with visual acuity, which is a measurement specified by date and the controlled conditions in the consulting room, after a full refraction.

You will need a hand held record of the levels of vision that correspond to the letters on the chart, to record the result. Vision is measured as the subjects presents, ideally as they would play sport.

Instructions

After occluding the left eye , "please tell the smallest letters you an see on the dark chart." Repeat with the right eye occluded and then binocularly. Follow the same procedure for the Low contrast chart.

Record

The lowest line seen, adding 0.02 for every letter missed.

6./6 -2 becomes 0.04.

6/7.5 -3 becomes 0.16

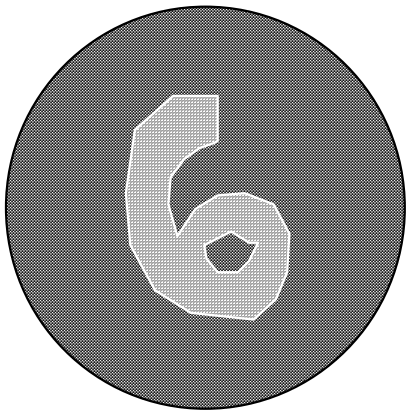
Normative Data N = 19

High Contrast 90 %			**Low Contrast 10 %**		
R	L	Both	R	L	Both
0.03 +/- 0,09	0.10 +/-0.16	0.03 +/- 0.09	0.3 +/- 0.12	0.32 +/- 0.13	0.19 +/- 0.13

Reference: C Rosen, D.F.C.Loran, G.W.Griffiths 1997. Visual Health and Performance Assessment Leyton Orient Football Club. Available from the Sports Vision Association

COLOUR VISION

Ishihara Colour Vision Test



Evaluates

Red / green colour deficiencies and the ability to tell different colours apart, which often needs to be done quickly in sport.

Instrument

The Ishihara test for red green defects.

Test Distance

40 cm

Illumination

Normal daylight if possible, or daylight corrected internal illumination (360 - 850 Lux)

Position Of Subject

Sitting

Critical Factors

Colour deficiency can make it difficult for athletes to recognise other players, if the shirt colour is inappropriate, or follow moving objects.

Instructions

Tell me what numbers you see

Record

Colour defective or not

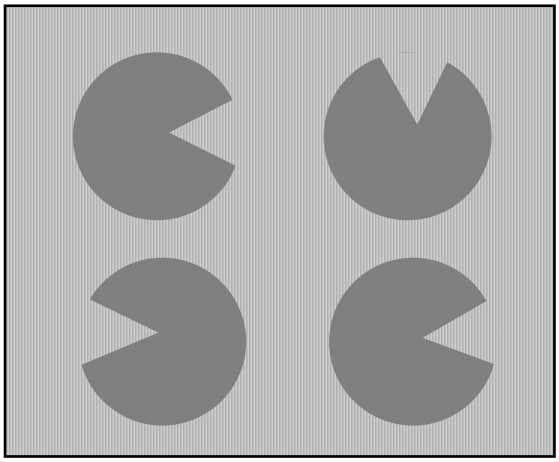
Normative Data

Colour deficiency is usually inherited and 8% of males are affected (0.1 % of females).

STEREOPSIS (Depth Perception)

TNO Test

120



60

Evaluates

The ability to judge distances using binocular vision during sporting activities. Poor depth perception can cause you to misjudge where you are on the field of play and the distance of balls, and opponents.

Instrument

TNO Stereo test, one of the pages illustrated above. Red and green goggles

Test Distance

40 cm

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Sitting, chart on the lap

Critical Factors

Distance can be judged effectively with one eye by colour, size and the relative movement of near and far objects in people who are well adapted. If there is an acquired defect in one eye then depth judgement might be affected.

The time taken to see the stereoscopic images is taken by counting under the breath, "one hundred and one, one hundred and two ..... etc," as each page is turned. You have to do this for every page because it is not known where the limit of stereopsis is, but only the time for the best level is recorded.

Instructions

Put on the red and green goggles and point to where you think the missing segments are. Please do not actually touch the page.

Record

Best level of stereopsis achieved and the time taken to do it

Normative Data

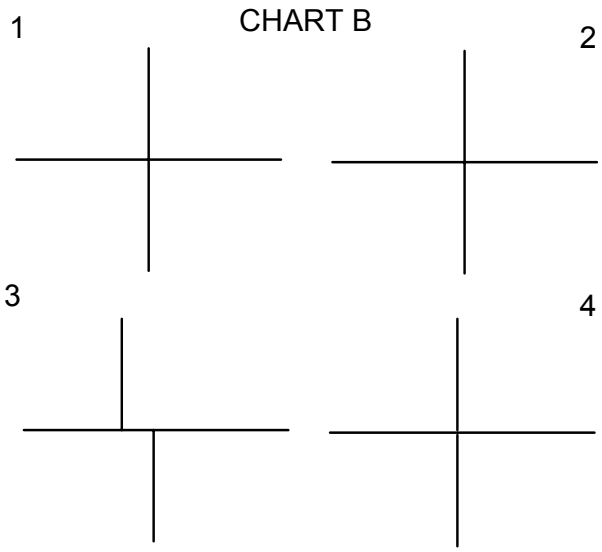
Scottish cricket team, see reference above, 60 Seconds of arc +/- 43.73
@ 4.55 Seconds of Time +/- 3.21 N = 15

Also from a Leicester Recreational Tennis Club, in Griffiths G.W. 1996 Dynamic Fixation, Its Use In The Measurement Of Athletic Potential. MSc Dissertation, Dept of Optometry University of Manchester, Faculty of Technology.

N =31

LEVEL	NUMBER OF SUBJECTS	%
> 240	4	12.9
60	22	70.9
30	4	12.9
15	1	3.3

VERNIER ACUITY TEST



Evaluates

Ability to discriminate fine displacements of one object relative to another. It is particularly relevant to target sports.

Instrument

Six Vernier Acuity charts (after Andrew Merry) from A to F with increasing levels of Vernier Acuity from 1 to 6, where six is the best. Level 2 chart B is illustrated above.

Test Distance

6 metres

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Standing facing the charts at 6 m

Critical Factors

Keep a hand held record to check the subjects responses

Instructions

Looking at the 6 charts starting with letter A tell me which of the four crosses is displaced vertically 1, 2, 3 or 4

Record

The letter of the last correctly seen chart.

Normative Data

4.71 +/- 1.27

N = 15

Reference: Morwood R, Griffiths G.W. 1997 Visual Health and Performance Assessment Scottish Cricket Team. Available Sports Vision Association.

EYE DOMINANCE

Evaluates

Which eye is dominant

Test Distance

Three metres

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Standing facing the coach

Critical Factors

Strong eye dominance is important in ball sports and it is useful to know which eye is the reference eye and whether there is any cross dominance, for example right eye, left foot. This information may have a bearing on positional play and training. It would be unusual in highly skilled players to find no strong eye dominance, but corrective measures may need to be taken to establish it, for instance correcting short sight in a dominant eye. Look for any hesitation or a mixture of results on the four readings

Instructions

Hold your arms down in front of you and place the right over the left to leave a triangular gap between the crossing thumbs and index fingers.
Keeping the arms straight look through this gap and line it up with my nose. Lower the hand sand now place the left hand over the right and repeat the exercise. Do this two more times right over left and left over right.

Record

The eye that appears through the gap in the subjects hands on each of the four occasions.

Normative Data N = 19

OCCURRENCE OF EYE DOMINANCE

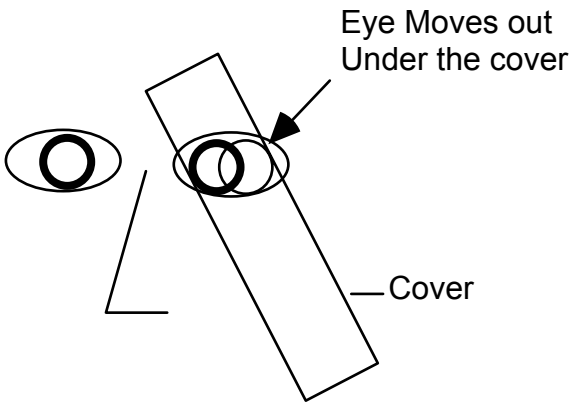
Right	Left	None

68.4 %	21.1 %	10.5 %

Reference: C Rosen, D.F.C.Loran, G.W.Griffiths 1997. Visual Health and Performance Assessment Leyton Orient Football Club. Available from the Sports Vision Association.

COVER TEST

Cover Test



Evaluates

How well the eyes work together by measuring the amount an eye moves in or out when it is covered.

Test Distance

Near is at 33 cm and distance is at 6m

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Sitting looking at the required distance

Critical Factors

Large amounts of movement may indicate a problem in the eyes' ability to co-ordinate together. At worst this can cause double vision, but more commonly it can lead to headaches, loss of sharpness of vision and visual fatigue after a hard game.

Instructions

Distance: Please look at the smallest letter you can see on the distance chart.
Near: Please look at the tip of my pen or similarly small fixation object.

Record

Estimate of phoria in prism dioptres at distance and near. Minus signifies exophoria and plus signifies eso phoria.

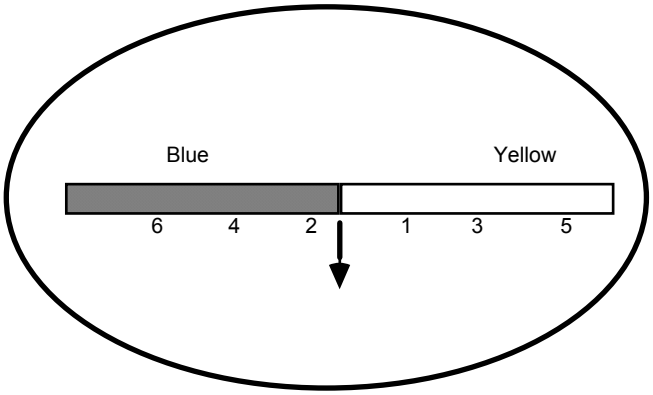
Normative Data N = 13

% EXOPHORIA		% ESOPHORIA	
Near	Dist	Near	Dist
33	15.5	67	84.5

Reference: C Rosen, D.F.C.Loran, G.W.Griffiths 1997. Visual health and Performance Assessment Leyton Orient Football Club. Available Sports Vision Association.

HOWELL PHORIA CARDS

Howell Phoria Card



Evaluates

Horizontal phorias at distance and near under more natural conditions than the cover test and Maddox Wing

Instrument

Howell Phoria Cards distance and near.

Test Distance

Distance card 3 m, near card at 33 cm

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Standing or sitting at the required distances

Critical Factors

Dissociation is achieved with a 6 base down prism in front of the right eye, preferably in a trial frame or a purpose built lens support. With base down right dissociation, the blue even numbers indicate exophoria and the yellow odd numbers indicate esophoria.

Instructions

Indicate the number on the bottom line that is nearest to the top arrow.

Record

Near and distance phorias in prism dioptres.

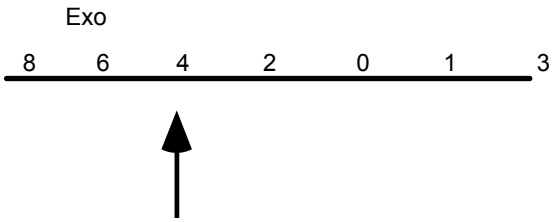
Normative Data

Distance (3m)	Near (33cm)
0 (ortho)	0 -2 EXO

MADDOX WING

Maddox Wing

Evaluates
Dissociated, near muscle balance



Instrument
Maddox Wing

Test Distance
Controlled by the instrument, about 30 cm

Illumination
Standard room light (360 - 850 Lux)

Position Of Subject
Hand held sitting position.

Critical Factors
Record the subject first impression before the eyes become too dissociated.
Confirm which numbers the subject is looking at, odd or even.

Instructions

Tell me which number the white arrow is pointing to.

Record

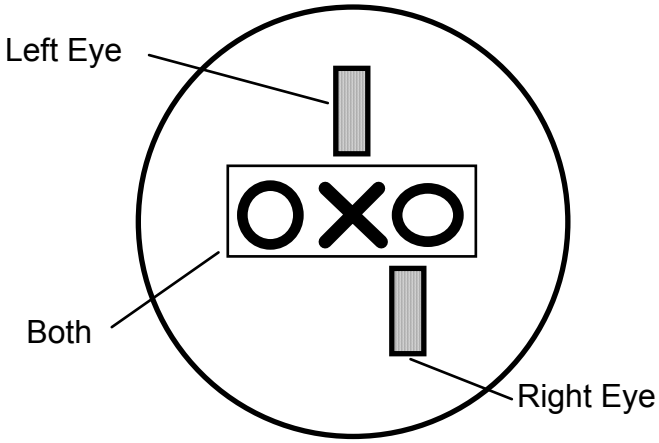
The near muscle imbalance in prism dioptres

Normative Data

-1.63 +/- 2.96, Leyton Orient Football Club 19.8.97 as above N = 19
(minus = exophoria / divergence)

MALLET TEST

Mallet Test Showing Decompensation



(Shows dominant left eye and right eso -phoric slip)

Evaluates

How well the eyes are controlled and the significance of any muscle imbalance found on the cover test.

May give useful information about the effects of fatigue on muscle control

Instrument

Near Mallet unit, preferably with the large target which can be viewed up to three feet, or a distance Mallet for longer distances

Test Distance

Depends on the distance which is most important to the athlete. The height and angle of the instrument can also be varied, if overhead shots are a concern or shot from the side

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Again should be varied according to the need of the sport. If only the standard near Mallet unit is available , the test is carried out in the sitting position at 40cm.

Critical Factors

Gives and indication of eye dominance , fatigue suppression, as well as decompensated eso , exo and hyper - phoria . Green nonius bars may be difficult to see in Deuteranopia (green deficient colour blindness.). Red bars in Protanopia.

Instructions

1. Can you see the **OXO.**
2. Can you see the green / red line.
3. Is it above the **X** ..... or below the **X** ..... or both.
4. Is it in line with the **X**.
5. Follow the manufacturers instructions to measure the decompensation.

Record

1. Which eye sees the slip. Is there suppression (intermittent or total) or instability.
2. The prism required to compensate the muscle imbalance.

Normative Data

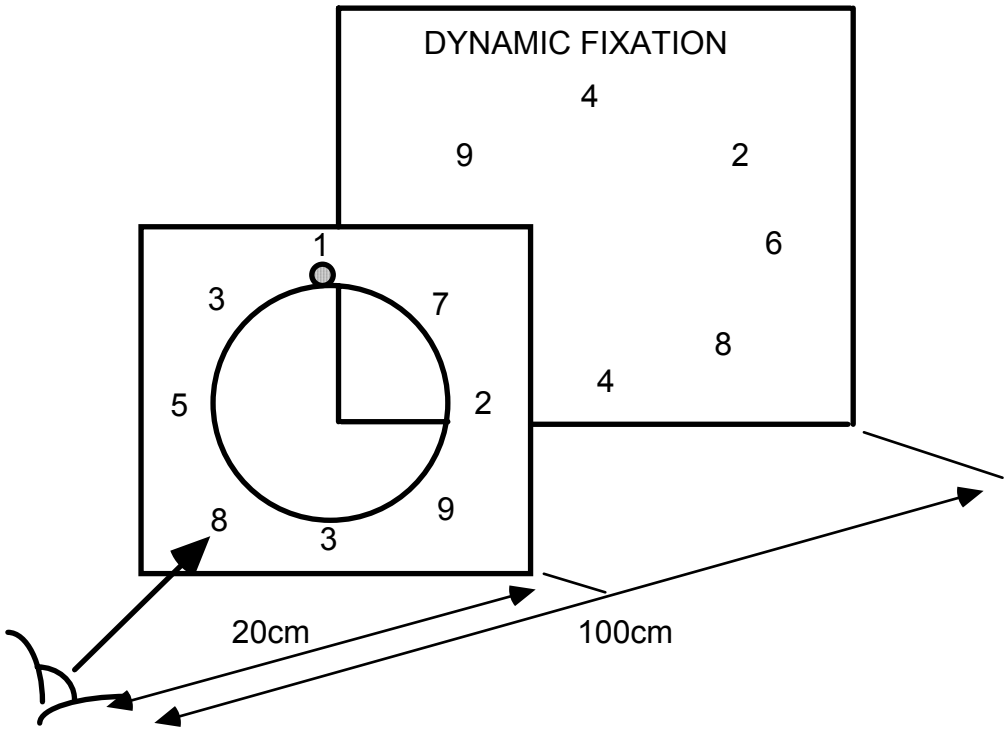
Near Mallet test, Slip not quantified. N = 16

31%	(5 players)	Divergent Slip
6.25%	(1 player)	Convergent Slip.
6.25%	(1 player)	Vertical Slip.

Reference: Loran D.F.C., Griffiths G.W. 1997 Visual Health and Performance Assessment Nottingham Forest FC U14 Squad. Available From the Sports Vision Association.

DYNAMIC FIXATION

Prototype Dynamic Fixation Cards



Evaluates

The ability to move the eyes rapidly from one position of gaze to another. Deficits can affect concentration and relaxation. Its speed and accuracy can vary from one sport to another.

Speed of eye movement, endurance, consistency and mental strategy may all indicated by the results of this test. A more detailed appraisal is supplied with the instrument.

Instrument

DFT Test illustrated above

Test Distance

Distance card at one metre, near at 20 centimetres

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Standing with the distance card at eye level and the near card positioned so that all the numbers on the distance card can be read by both eyes without moving the head or the near card.

Critical Factors

Speed is not always the critical factor, consistency may be more important in some sports. The eyes need to be watched during the test to see if the fixation is precise or peripheral.

The subject needs to be fairly familiar with the test before times are recorded and a there should be a final trial run with the stop watch before the official timings are taken.

Instructions

This test consists of the two cards shown above . The near card is held by the subject and the distance card is suspended on a wall one metre away.

The subject reads from the near card through the hole to the distance card, reading out alternate numbers, near and distance in a clockwise direction.

Three circuits of the cards are timed with a stopwatch, starting and finishing as the subject reads out the near number one.

Record

Three trials, the time for the third trial is statistically, the most significant.

Normative Data

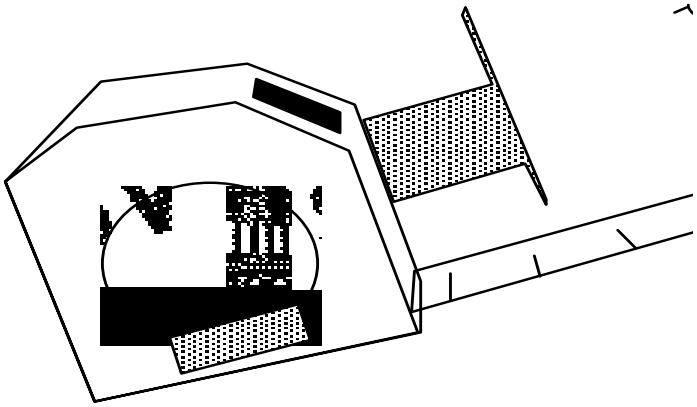
SUBJECTS	**Mean**	**Standard Deviation**

International Track and Field Athletes (16)	15.81	3.05
Club T&F Athletes (12)	16.33	1.64
Recreational Sports People (19)	18.68	4.31
International Archers (13)	18.20	3.76

Reference: Griffiths G.W. 2002 Eye speed motility and athletic potential. Optometry Today Vol 42:12 p 34- 37

NEAR POINT RULE

Static Accommodation and Near Point Rule



Evaluates

Monocular accommodation and near point of convergence

(After James Collins, Sussex Vision)

Instrument

Near point rule and working distance measure.

Test Distance

As required

Illumination

Average room lighting (360 - 850 Lux)

Position Of Subject

Sitting

Critical Factors

The rule has been designed specifically for the screening situation, to double as a near point and accommodation measure and a means of setting up the screening clinic and accurately measuring working distances.

The normative data below has not been taken with this new instrument.

Instructions

With the Left eye occluded, "Holding the end of the ruler on your nose tell me when the letters go blurred as I bring the chart towards you." repeat with the right eye occluded.

Both eyes together, "tell me when the line goes double as I bring the chart towards you.

Record

Accommodation right and left and near point of convergence.

Normative Data

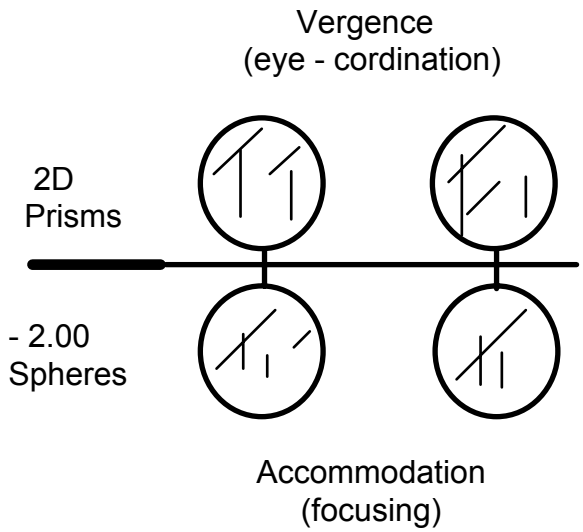
Near point of convergence: 5 cm is within normal limits.

ACCOMMODATION

Age (Years)	Mean Accommodation (Dioptres)
8	13.8
25	9.9
35	7.3
40	5.8
45	3.6
50	1.9
55	1.3

Reference: Vaughan D., Asbury T. 1980 General Ophthalmology (After Duane). Pub Lange

FLIPPER LENSES



Evaluates

Accommodation and vergence facility

Instrument

SVA flipper lenses as illustrated, a combination of prisms and spheres designed specifically for screening purposes. the flipper is actually two separate tests, spheres for accommodation facility and prisms for vergence facility.

Test Distance

6 metres, looking at the line above the one that can just be seen comfortably with both eyes.

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Sitting in front of the chart

Critical Factors

Accommodation Facility:

Age has a significant effect on speed of focusing , so its important that subjects are reasonably age matched before conclusions are drawn from differences in performance on this test.

Vergence Facility:

Some subjects are unable to make the double image single at all. This can be a characteristic performance and may be related to small amounts of short sight. These results need to be eliminated for a full statistical evaluation of the group because of their adverse effect on descriptive statistics (EG mean and standard deviation)

Instructions

Using the afocal prisms first (Vergence Facility), hold the flipper in front of your eyes until the letters become clear and single. Lift the lenses to just clear your eyes and wait till the letters are clear again, count 1 .

Place the lenses in front of your eyes again and repeat the process, count 2.

I will be timing you to see how many times you can do this in 60 seconds.

Repeat using the minus lenses (Accommodative Facility).

Record

The number of cycles achieved in 30 Seconds

Normative Data N = 15

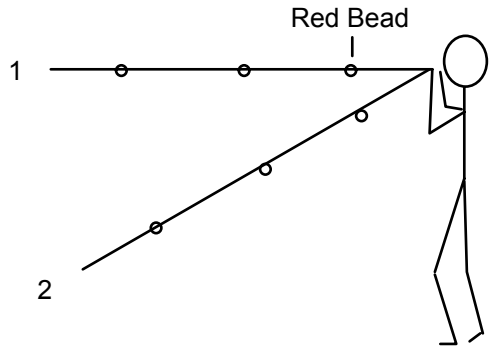
Cycles in 60 Secs

VERGENCE FACILITY	ACCOMMODATION FACILITY
23.43 +/- 5.20	20.14 +/- 7.55

Reference: Morwood R, Griffiths G.W. 1998 Visual Performance In Cricket. Optician V215 p21 - 26

BROCK STRING

Red bead nearest the nose



Evaluates

Decompensated phoria and supression

Instrument

Three metre length of string with three coloured beads on it

Test Distance

The beads can be set to the distance which is important to the particular sport.

Illumination

Standard room light (360 - 850 Lux)

Position Of Subject

Depends onthe requirements of the sport actual head movements and ball positions should be simlated.

Critical Factors

Crossing Of Strings In Relation To The Bead

At the bead	**In Front Of**	**Beyond**	**Left Side above**	**Right Side Above**
Orthophoria	Eso Phoria	Exophoria	Right Hyper	Left Hyper

Instructions

Hold the string to your nose and look at the bead, how many strings do you see (confirms physiological diplopia) do the strings appear to cross at the bead, in front of it or beyond it. Does one string appear to be higher.

Repeat for all the positions of the beads and string.

Record

The conditions of the test, position of the beads and string and any one of the following responses:

Eso	**Exo**	**Ortho**	**Right Hyper**	**Left Hyper**	**Right Suppression**	**Left Supression**

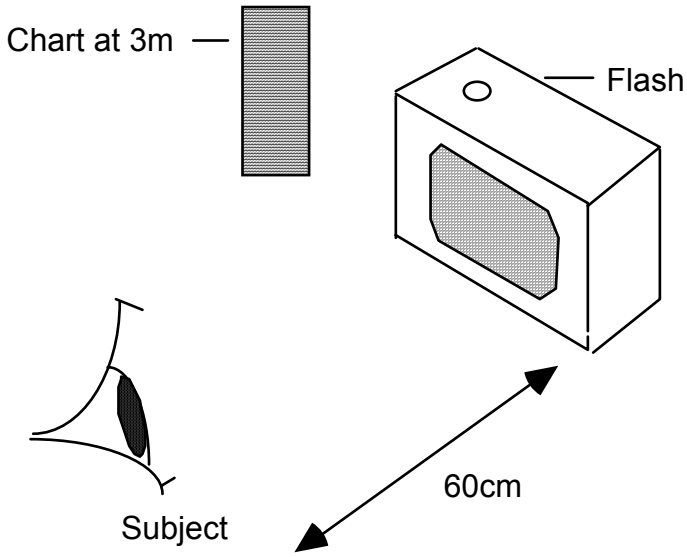
Normative Data

Grade	**Criteria**

5	Immediately and exactly accurate meeting of both strings at the point of fixation, no detriment of this performance with speed of shift from fixation point to fixation point, or distance /direction of the fixation points; all the while utilixing divided attention.
4	Same as above, but with a hint of slower speed
3	Same as above, but with the strings not meeting exactly at the point of fixation constantly.
2	Same as above, but more inaccurate fixatiions noted.
1	Some suppressions, inaccuraciesoften

Reference: Dr Paul M Planer 1994 Sports Vision Manual International Academy Sports Vision.

GLARE RECOVERY



Evaluates
The time taken to recover from the direct effect of a camera flash. This may give an indication how the subject copes with glare from the sun, moving from bright light into shade or looking up into floodlights.

Instrument,

Flash gun: Vivitar 530 FD c/r. Flash duration one thousandth of a second
Colour temperature, 6000 degrees Kelvin

Test Distance
Flash held at 60 cm, test chart at 3 m
Illumination
Standard room light (360 - 850 Lux)

Position Of Subject
Body facing the test chart head turned towards the flash looking directly into it.

Critical Factors
Important that the subject fixates the flash properly times which are quicker without the visor than with are likely to be inaccurate.

The chosen letters need to be as small as can comfortably be seen before the flash is fired, the 6/7.5 line is a guide.

Instructions
Ordinary camera flash gun held at 2 feet, subject is asked to look straight into the flash as it is set off and then asked to read a 6/7.5 line of letters on a three metre chart as soon as the after image clears.
The time is taken first with a visor and then without, by the coach counting under the breath one hundred and one, one hundred and two ..... etc.

Record
Time taken to start reading the given line of letters.

Normative Data

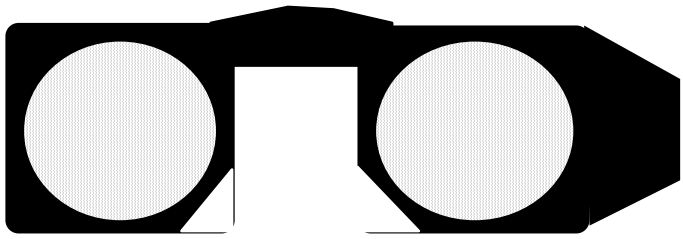
(Visor courtesy Bausch & Lomb, "X Ray," green polysphere with water clear, scratch resistant toughened lens with non colour distorting tint)

	LIGHT EYES		DARK EYES	
	Visor	**No Visor**	**Visor**	**No visor**
N =	12	9	4	2
Mean	7.08	9.49	7.80	13.61
Std Deviation	4.54	4.55	7.88	9.35

Reference: Loran D.F.C., Griffiths G.W., Bennett L. 2001. Visual performance and soccer skills in young players. Optometry Today Vol 41: 2 p32 - 34

COLOUR PREFERENCE AND LIGHT SENSITIVITY

Colour Preference Lorgnette



Evaluates

Colour preference
Discomfort glare
Light Sensitivity

Instrument

Colour Preference Lorgnette set (7colours)

Test Distance
As required

Illumination
Average room lighting (360 - 850 Lux)

Position Of Subject
Sitting

Critical Factors
The test chart needs to be internally illuminated if carried out in the consulting room ideally with ceiling fluorescent light. On site colour preference is measured in the prevailing conditions.
Watch for strong feeling immediate removal of head from behind lorgnette or saying this makes me feel sick.

Instructions
I am going to show you a set of coloured lenses to check your colour preference. Tell me if you like the feel of the lens or dislike it or something in between. I would like you to look at the chart and the ceiling light (or on site some suitable distant object illuminated by the ambient light).

Place the favoured tints in one pile and then narrow the choice down to 1 by asking if it is better with one or two eliminating one tint at a time. If all tints are chosen there is no strong preference and advice on antiglare strategy can be given from known optical principles if required.

If there is no colour preference it does not mean that there is no need for normal protection outside from non-ionising radiation.

Record
Colour preference and dislike for completeness

Normative data

Reference No.	Colour	Frequency chosen by: Net Ball Umpires Best	Net Ball Umpires Worst	Rifle Best
1	Green	9	1	2
2	Yellow	2	18	9
3	Blue	8	2	2
4	Orange	2	9	2
5	Grey	3	2	5
6	Pink	5	1	4
7	Violet	3	2	

Reference: Griffiths G.W.2001. Colour preference – a comparative study Optometry Today Vol 41: 20 p33 - 36

STATISTICAL ANALYSIS

Mean and Standard Deviation

For the first few screenings the most useful ways of describing the data are the average or mean and the standard deviation.

$$\text{AVERAGE} = \frac{\Sigma X}{N} = \bar{X}$$

STANDARD DEVIATION

$$= \sqrt{\left(\frac{\Sigma (X - \bar{X})^2}{N - 1} \right)}$$

SYMBOL	MEANING
X	The individual score
$\bar{X}$	The mean of the scores (average)
N	The number of scores used
Σ	The sum of (pronounced sigma)

Reference: Frances Clegg 1993 "Simple Statistics" Published Cambridge University Press

Vision Profile

Using the figures for average and standard deviation it is now possible to build up a profile of the group that has been tested, where:

- **Average is + or - one standard deviation of the mean.**

- **Above or below average is + or - two standard deviation from the mean.**
- **Needing attention or excellent are + or - three standard deviations from the mean.**

With the profile of the group to refer to the individual profiles can be drawn up.

TEST		**RESULTS**					
		May Need Attention	**Below Av**	**Av**	**Above Av**	**Excellent**	**SD**
Vision							
90%	R						
	L						
10%	R						
	L						
Stereopsis							
Minutes of Arc							
Time (Secs)							
Vernier Acuity							
Vergence (Cycls / Min)							
Focus (Cycls / Min)							
Dynamic Fixation (Secs)							
Glare Recovery							
With Visor							
without Visor							

	May Need Attention	**Average**	**May Need Attention**	**SD**
Muscle Balance				
Distance				
near				

Individual Results

Name **SPORTING, A. HERO**

Date 1.1.2000

Visual Correction (estimate)	
R +0.50	L +0.50

SCALE	VISUAL ABILITIES												
	Vision High		Vision Low		Stere	Vernier	Phoria		Verge	Focus	Dyn Fix	Glare Recovery	
	R	L	R	L			Dist	Near				Visor	No Visor
Excellent		-0.3							39		11.34	2	
Above Average	-0.2		0	0	30	6				25			10
Average							0	-2					
Below Average													
Needs Attention													

Score 54 (count the squares)

Rank 1 (compare with the rest of the group)

RECOMMENDATIONS

Alistair has an outstanding all round visual performance.

SPORTS VISION ASSOCIATION

SPORTS VISION DIRECTORY

October 1996

SPORTS VISION SKILLS

INTRODUCTION

These visual skills are routinely tested by trained teams from the SVA. Advice may then be given and action recommended to minimise injury and maximise performance.

1. Accommodation

This is the ability to focus from one point in space to another.

Deficits in this ability can force the athlete to use excess effort in the convergence /divergence systems (see below, vergence), which makes it difficult to follow and see incoming or outgoing objects.

2. Confrontation

This is a test for the limits of the visual field and the speed of response to peripheral objects.

3. Contrast Sensitivity.

This is the ability to see an object against its background, which is more difficult when the brightness and colours are similar.

Deficits in the ability make it difficult to see and follow objects.

4. Colour Vision

This is the ability to tell different colours apart which often needs to be done quickly in sport.

Colour deficiency is usually inherited and 8% of males are affected (0.1 % of females). It can make it difficult for athletes to recognise other players and follow moving objects.

5. Dynamic Fixation

Is the ability to move the eyes rapidly from one position of gaze to another. Deficits can affect concentration and relaxation. Its speed and accuracy can vary from one sport to another.

6. Eye Dominance

The dominant eye is the reference eye, usually the stronger eye, which is used to align or target an object.

7. Eye / Hand - Body Co-ordination.

This is the co-ordination of the eyes hands and body as a unit. Deficits can affect levels of performance in eye led sports like football, boxing and tennis.

8. Glare

Is where comfort and visual performance is reduced by a relatively bright light source in the visual field.

9. Fusion Flexibility (Binocularity)

Is the ability to fuse the two images from the athletes eyes into one. Deficits in this skill can cause double vision or make it difficult to follow objects and people. Directions and distances can be misjudged during competition and performance reduced.

10. Muscle Balance

Is the control of the six muscles in each eye and the control of the two eyes together.

11. Peripheral Awareness.

Is the ability to be aware of peripheral objects whilst maintaining central vision.

Deficits can cause athletes to lose objects to the sides of where they are looking or be distracted by movement and objects in the peripheral field of vision.

12. Proaction.

Is an action initiated by a player such as kicking, hitting and throwing a ball or other object.

13. Reaction

This is the time to respond to a visual stimulus. This involves the ability of the athlete to use sound to assist any visual stimulation. Deficits will slow overall response times.

14. Retinoscopy

Is a means of estimating if a person is short or long sighted, by shining the light from a Retinoscope into the subjects eyes.

15. Stereopsis (Depth Perception)

The ability to rapidly and accurately judge distances during sporting activities. Poor depth perception can cause athletes to misjudge where they are on the field of play and the distance of balls, pucks and opponents.

16. Vergence

Is the turning in or out of the eyes to follow a moving object such as a ball.
Convergence is a movement of the eyes towards each other
Divergence is a movement of the eyes away from each other.

17. Visual Acuity (Static)

This is the basic measure of vision. While not extremely important in isolation, athletes should have at least 6/6 (20/20 in America) to 6/5 acuity for most sports. Acuity with both eyes together should be better than each eye tested separately. Deficits can make it difficult to see small objects or subtle facial expressions.

18. Visual Acuity (Dynamic)

This is the ability to see clearly when either the athlete or the object or both are moving. Deficits can affect timing, distance judgement and the detailed view of the object (which way the ball is spinning for example).

20. Visual Field

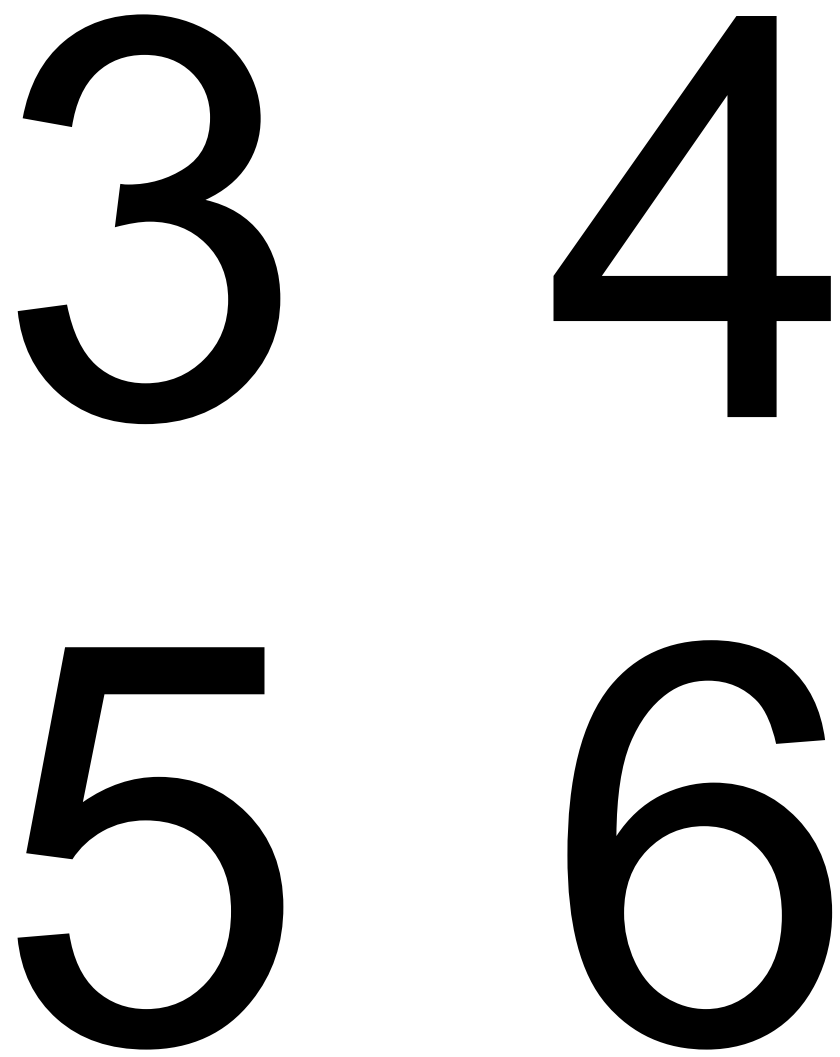
Is the limit of peripheral vision, which is normally 200° horizontally and 130° vertically.

21. Visualisation.

This is the ability to imagine and mentally rehearses sporting actions and responses. Deficits can hinder the best response in the game situation and make it difficult for the athlete to learn form mistakes.

STATION NUMBERS

1 2


3 4
5 6

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11 12

www.sportvisionservices.co.uk

FURTHER INFORMATION

SPORTS VISION ASSOCIATION:
01302 782514
nasmith@freeuk.com

Alan Smith
20 Vallent Gardens
Sprotborough
DN5 7RU

SPORTS VISION EQUIPMENT:
01509 817700
gprescott@lafayetteinstrument.com

Greg Prescott
Lafayette Instrument Co. (Europe)
Park Rd., Sileby
Loughborough
LE12 7TJ
United Kingdom