

CORRELATION BETWEEN VISUAL FUNCTION AND PERFORMANCE OUTCOME IN PREMIER LEAGUE SOCCER[‡]

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SUMMARY

With the increase in sports vision research in recent years, certain aspects of vision have been included in the medical assessment of athletes. Sports vision research has concentrated on certain aspects of visual ability, peripheral vision for instance; or combinations of functions, such as dynamic visual acuity. An analysis of the importance of specific visual functions to elite soccer performance has not been assessed. A full range of visual assessments were performed on all professional players at the English Premier League Club Manchester United. Six visual functions were identified as being most relevant to elite soccer players, namely binocular vision, stereoscopic vision, contrast sensitivity, peripheral visual sensitivity, peripheral contrast sensitivity, and visual reaction time. An individual vision score of the players were compared to the final scores of 38 games during a season. The only function which revealed a clear correlation ($p < 0.001$) with the outcome of the game was the binocular vision score. The findings support Manchester United's current visual training strategy.

Key words: Visual function, binocular vision, peripheral vision, soccer, exercise

ÖZET

PREMIER LEAGUE FUTBOLDA VİZÜEL FONKSİYON İLE PERFORMANS ARASINDAKİ KORRELASYON

Son yıllarda sporda görme üzerine araştırmaların artışıyla birlikte bazı görme parametreleri sporcuların sağlık değerlendirmelerine eklendi. Sporda görme çalışmaları vizüel yetilerden periferik görme veya dinamik vizüel keskinlik gibi bileşik işlevler üzerinde yoğunlaşmıştır. Belirli vizüel işlevlerin elit futbol performansına etkisi şimdiye dek incelenmemiştir.

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İngiliz Premier Lig Kulübü Manchester United'da tüm profesyonel oyuncuların vizüel değerlendirmeleri yapılmaktadır. Futbola ilişkin en anlamlı parametreler binoküler görme, stereoskopik görme, kontrast duyarlılık, periferik vizüel duyarlılık, periferik kontrast duyarlılık ve vizüel reaksiyon zamanı olarak öne çıkmaktadır. Burada bir sezondaki 38 maç boyunca bireysel vizüel skorlar maç skorlarıyla kıyaslanmaktadır. Maç sonucu ile en ileri düzeyde korrelasyon ($p<0.001$) saptanan parametre binoküler vizüel skor oldu. Bu bulgular Manchester United'ın güncel vizüel antrenman stratejisini desteklemektedir.

Anahtar sözcükler: *Vizüel fonksiyon, binoküler görme, periferik görme, futbol, egzersiz*

INTRODUCTION

The comprehensive assessment of physiological functions is accepted as highly relevant to the selection and development of athletes in most competitive sports. A thorough assessment of visual function has been one of the exceptions to this approach, but with the increase in sports vision research in recent years, certain aspects of vision have been included in the medical assessment of athletes. Because of the wide variations both in the visual assessment methods, and in the professionals performing the assessments, comparisons between research findings have proven to be difficult. Sports vision research has concentrated on certain aspects of visual ability, peripheral vision for instance; or combinations of functions, such as dynamic visual acuity (a combination of eye movements, motion detection, binocular vision and acuity). An analysis of the importance of specific visual functions to elite soccer performance has not been assessed.

Over a nine year period, a full range of visual assessments have been performed on all professional players at the English Premier League Club Manchester United. Six visual functions were identified as being most relevant to elite soccer players (Table 1).

Table 1. Visual functions assessed and their significance

Binocular vision	Strength of binocular control
Stereoscopic vision	Depth perception
Contrast sensitivity	The reaction of the visual system to stimuli varying in shade and hue
Peripheral visual sensitivity	The reaction of the visual system to stimuli in the peripheral field
Peripheral contrast sensitivity	The reaction of the visual system to stimuli in the peripheral field which vary in shade and hue
Visual reaction time	Response to visual stimuli

Over the past six years all players have had an individual vision score awarded based on a weighted score, dependant on their ability in each of the relevant visual functions. This information forms the basis of the club's vision training strategy, which is aimed at improving the relevant visual function as necessary. The aim of this study was to assess the results during a season of 38 domestic games, evaluating the average total vision score of the players involved in each individual game and comparing it to the final result.

MATERIAL AND METHODS

During the 2003-04 English Football Season, the following data was collected for each of 38 games:

- Goal difference;
- Average total vision score of the players involved for Manchester United Football Club;
- Average score for each individual visual function of the players involved for Manchester United Football Club.

The visual scores for each player (i.e., the average of the sum of the individual vision scores of all players involved) in each match were calculated. The outcome of a soccer game defined as the number of goals scored, a positive figure denoting a victory for the club and a negative number denoting a defeat.

RESULTS

When analysing the results, it was acknowledged that there were several variables which were impossible to completely account for; for example, the visual ability of the opposing team which remains unknown, the ability of the opposition, and the selection of players in different positions. It can be assumed that the variation in soccer ability of the opposing teams would be compensated for over the whole season. It was also acknowledged that tactical selection by the coaching staff would be varying, for example the use of weaker players at the end of a game in which a team has a significant lead.

Using the Pearson's Correlation Coefficient, the hypothesis of a linear correlation between the outcome of a soccer game and the visual ability of the players involved was analysed.

A moderately significant correlation was found between the Vision Scores and the Goal Difference ($p=0.04$), however no linear relationship between the two variables was obtained upon regression analysis.

When the scores for the individual visual functions were considered, the only function which revealed a clear correlation with the outcome of the game was the binocular vision score. There was a significant correlation between the Binocular Scores and the Goal Difference ($p=0.0001$), and a positive linear relationship existed between the two variables (Fig. 1).

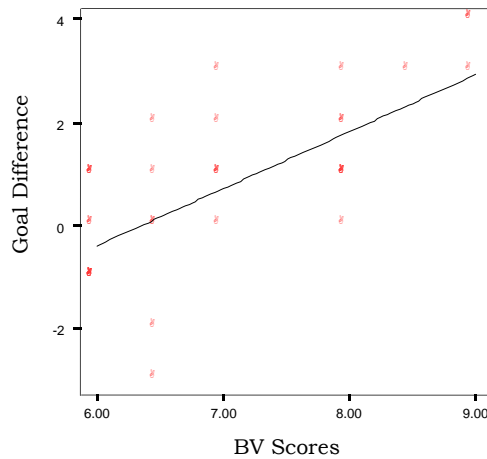


Figure 1. Goal difference versus binocular vision score ($r^2=0.50$, $GD = -7.06+1.12*BVS$)

To investigate this correlation further; the binocular vision scores for defenders, midfield players and strikers were considered separately and analysed for a correlation with the match outcome. There was no correlation when strikers and defenders were considered, however when the binocular vision scores for the midfield players were considered, the outcome was significant ($p=0.0001$), and there was a positive linear relationship between the two variables (Fig. 2).

To assess the relevance of binocular vision further, the correlation between the binocular vision scores and the goals scored in the last 20 minutes were analysed. In this sample of 38 matches, the players in question scored in only 15 of the 38 games. A significant correlation ($p=0.0001$) existed, however there was no linear relationship between goals scored in the final 20 min and the binocular vision scores.

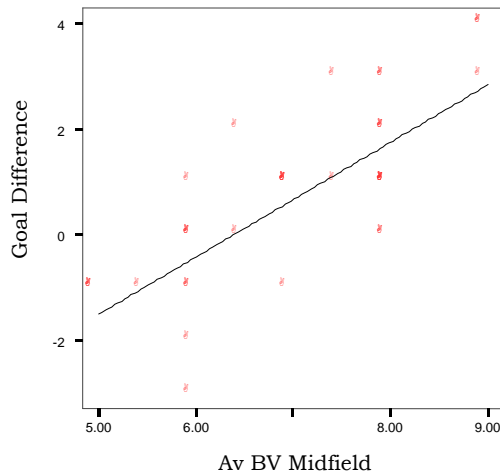


Figure 2. Goal difference versus binocular vision score of midfield players ($r^2=0.59$, $GD = -6.91+1.08*BVS$)

DISCUSSION

Previous research concerning sports vision has tended to analyse combinations of visual functions, such as dynamic visual acuity. This requires the individual to consider visual functions of motion detection, smooth pursuit eye movements, binocular vision, and visual acuity. The assessment of each of these functions on an individual basis provides more relevant information, and allows for the improvement of any potential weaknesses. In previous and ongoing research, and in this study individual visual functions have been assessed using standard clinical methods.

The results obtained support the hypothesis that players' visual ability can affect the outcome of a soccer game, and it appears that the strength of binocular vision of the involved players is an important part of elite performance. In an earlier project at Manchester United by the same investigator, the pass completion rates of 10 players were recorded for the first and last 20 minutes of a series of 10 competitive matches, and the rate compared to their binocular vision scores. Players with weaker binocular vision score displayed a 20 to 70% reduction in pass completion rates.

Binocular vision is the only aspect of visual ability which fatigues. This is due to the role of the extra-ocular muscles in ensuring balance

of the two eyes, which ensures binocular stimulation and summation of information from the visual environment. It would therefore not be an unexpected finding that players with weaker control would demonstrate fatigue of binocular ability, which would affect their judgement of depth and distance, and therefore the ability to accurately pass the ball. The results of this current study add to the evidence of the importance of binocular vision to soccer.

CONCLUSIONS

This study has evaluated whether the level of the visual function of individual elite soccer players affects the outcome of competitive games. The limits of this study lie with the small sample size, and the small range of nominal values in some of the variables considered. However, the finding of significance in correlation analysis of the vision data and match outcome, have led to the start of a further study to compare the match outcomes to players' visual ability. Five seasons will be considered to increase the range of data analysed.

The aspects of visual ability assessed in this study can be improved in all subjects with normally developed visual systems, and with an absence of ocular and cerebral pathology. The potential for improvement applies particularly to binocular vision, and exercises to improve this aspect of visual function have been successfully used in routine clinical orthoptics for over 50 years. The findings about the importance of high levels of visual ability, especially binocular vision confirms Manchester United's current visual training strategy.

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