FUSIONAL STAMINA – A BETTER WAY OF DESCRIBING BINOCULAR VISION

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Objective

Previous research has shown that the ability to compensate for a phoria (latent strabismus) is more important than the size of the phoria itself (e.g. Percival 1928, Sheard 1930). Sheard postulated that the relative vergence in the opposite direction should be at least twice as large as the fusional demand, i.e. the phoria. Later studies have indeed provided legitimacy for this criterion, particularly for exophorias (Sheedy & Saladin 1978, Evans 2007). Nevertheless, differences in time or before and after treatment might be very small, but span both sides of the criterion. The purpose of this study is to provide a reliable continuous alternative measure to the dichotomous Sheard's criterion in children.

Methods

Phorias and positive fusional vergence (PFV) were measured by cover test and a prism bar at distance (6m) and near (40cm) in a selection of 87 typical children aged 5-10 years of same socio-economical background. Five children were removed from the study due to manifest or intermittent strabismus. Fusional stamina was then derived from these measures. This value is calculated by dividing the respective fusional vergence by two and then subtracting the measured phoria.

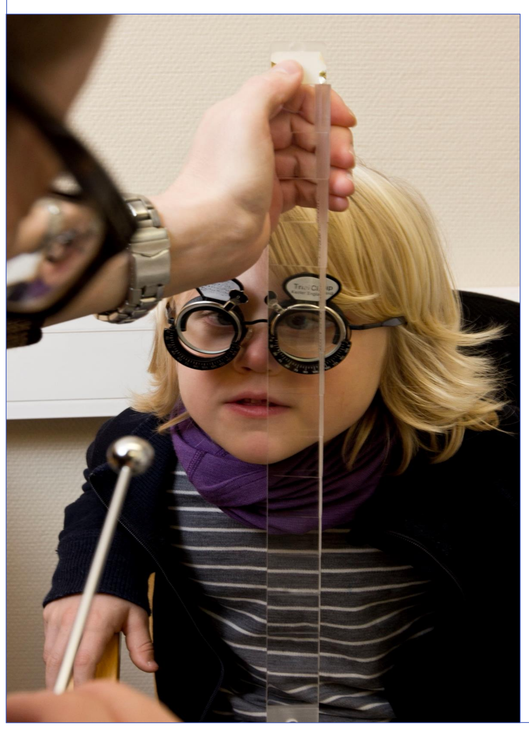
Repeatability at near was checked after one year for a subgroup of 40 children believed to be more at risk for binocular vision deficits on the basis of near point of convergence that was high for their age.

Results

There were no significant differences in any of the binocular measures between different age groups, nor between the two testing times.

Mean values (SD) in prism dioptres. N= 82	
Phoria (exo) at 6m	0.3 (2.8)
Phoria (exo) at 40cm	2.5 (3.9)
PFV (break) at 6m	18.5 (11.11)
PFV (recovery) at 6m	11.3 (9.5)
PFV (break) at 40cm	33.4 (14.5)
PFV (recovery) at 40cm	24.7 (13.6)
Fusional Stamina at 6m	**8.9 (6.6)**
Fusional Stamina at 40cm	**14.1 (9.2)**

When the four (4.9%) children in the group above who did not pass Sheard's criterion at distance or near are excluded, mean Fusional Stamina is 9.2 (6.4) at 6m and 15.0 (8.5) at 40cm.



Repeatability

Correlations between two testing times @ 40cm, N= 40		*p*-value
PFV break	0.38	.02
PFV recovery	0.50	.01
Fusional Stamina	**0.62**	**<.001**

Mean Fusional Stamina (SD) based on passing or failing Sheard's criterion @ 40cm		
Participants, N= 40	**FS Time 1**	**FS Time 2**
Pass both times, n= 32	12.9 (7.6)	12.2 (5.0)
Fail both times, n= 3	-5.0 (2.7)	-9.3 (4.7)
Pass-fail, n= 1	3.0	-2.0
Fail-pass, n= 4	-5.0 (1.8)	3.5 (4.2)

Discussion & Conclusion

Fusional stamina is a more reliable measure than Sheard's criterion for classification of binocular vision because it provides a continuous measure that determines the degree of disruption to binocular vision. It is easy to calculate, and the value will be positive whenever the criterion is passed. Interestingly, five (12.5%) of the children in the second part of this study did not pass Sheard's criterion in one of the two trials: either the first or the second trial. Mean Fusional Stamina for the trial these children did pass was 3.4 (SD 3.6), i.e. more than one standard deviation below the mean at 40cm according to the upper table in the results section. This implies that binocular vision problems might be missed when using Sheard's criterion alone. A low level of Fusional Stamina does therefore appear to be a more reliable measure of binocular vision problems.

It is beyond the scope of this study to state when or how binocular vision deficiencies should be treated. We do, however, acknowledge that when 1.5x the standard deviation is subtracted from mean Fusional Stamina, the result is approximately zero – corresponding to Sheard's criterion. In other domains, e.g. psychology, scores calculated this way are often regarded as low.

According to Sheard, the "blur-point" should be used as a value for PFV, whereas we for practical reasons have used the (often somewhat higher) "break-point". Nonetheless, the data above provides normative values for a typical population of children between the ages 5 to 10 years, and evidence for repeatability after one year, which is higher than for PFV alone. This is important information for researchers as well as clinicians who treat children with symptoms/avoidance, especially related to school work at close distances.

References

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