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Heterophoria, fusional amplitudes and stereoacuity in school aged children

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There is no actual or potential conflict of interest in relation to this presentation.

Introduction

- The stability of binocular vision depends on good fusional amplitudes and its measurements provide information about the patient's ability to cope with a deviation *(Hainey, Cleary, and Bed 1999; Narbheram and Firth 1997)*.

- However, weak correlations between fusional amplitudes and angle of deviation have been reported in the literature *(Liebermann et al. 2012; Radakovic et al. 2012).*

- There are no **uniform normative values** of fusional amplitudes, even though standards for vergence have been established since 1940s *(Radakovic et al. 2012).*

- **Aims: (1)** Determine the prevalence of heterephoria; (2) Determine the relationship between heterophoria, fusional amplitudes and stereoacuity in children.

Methods and materials

- A cross-sectional study was carried out on a sample of 630 school-aged children (7.67±1.19 years).

- Children received an orthoptic assessment of visual acuity, ocular alignment, fusional amplitudes (step vergence test), stereoacuity, ocular movements and non-cycloplegic autorefraction.

- **Exclusion criteria** included children with manifest strabismus, microtropia and visual acuity <0.5 (0.3 LogMAR) or different between the two eyes (two lines of visual acuity).

Phorias were measured before vergence amplitudes to avoid the shift in the lateral phoria towards the direction of the prism duction (Cooper 1992).

Negative fusional vergence was measured first to avoid affecting the value of vergence recovery (Fray 2013; Rosenfield et al. 1995; Von-Noorden and Campos 2002).

Results and discussion

- **Orthophoria** at both near and distance fixation was noted in the majority of the children (59.5% at near and 94.9% at distance). Both exophoria and esophoria were more common at near fixation than at distance.

- This result is similar to other studies revealing that ortophoria at distance fixation is commonly present in children with reported values in the literature between 70.5% and 93.4% (Aring et al. 2005; Radakovic et al. 2012).

- There was no significant relationship between age and gender in the distribution of phoria measurements.

- Published studies agree in finding a lack of relationship between phoria measurements, age and gender in the infant years (Chen et al. 2000; Jiménez et al. 2004; Letourneau and Giroux 1991; Radakovic et al. 2012).

Results and discussion

- Mean **fusional ranges** with prism bar found in the present study and those reported by other publications

Mean difference range <2.00Δ; Normal range of 8.00±2.00.

Fusional amplitudes variation increase with prism bar - unequal step sizes, raging from 1Δ to 5Δ.

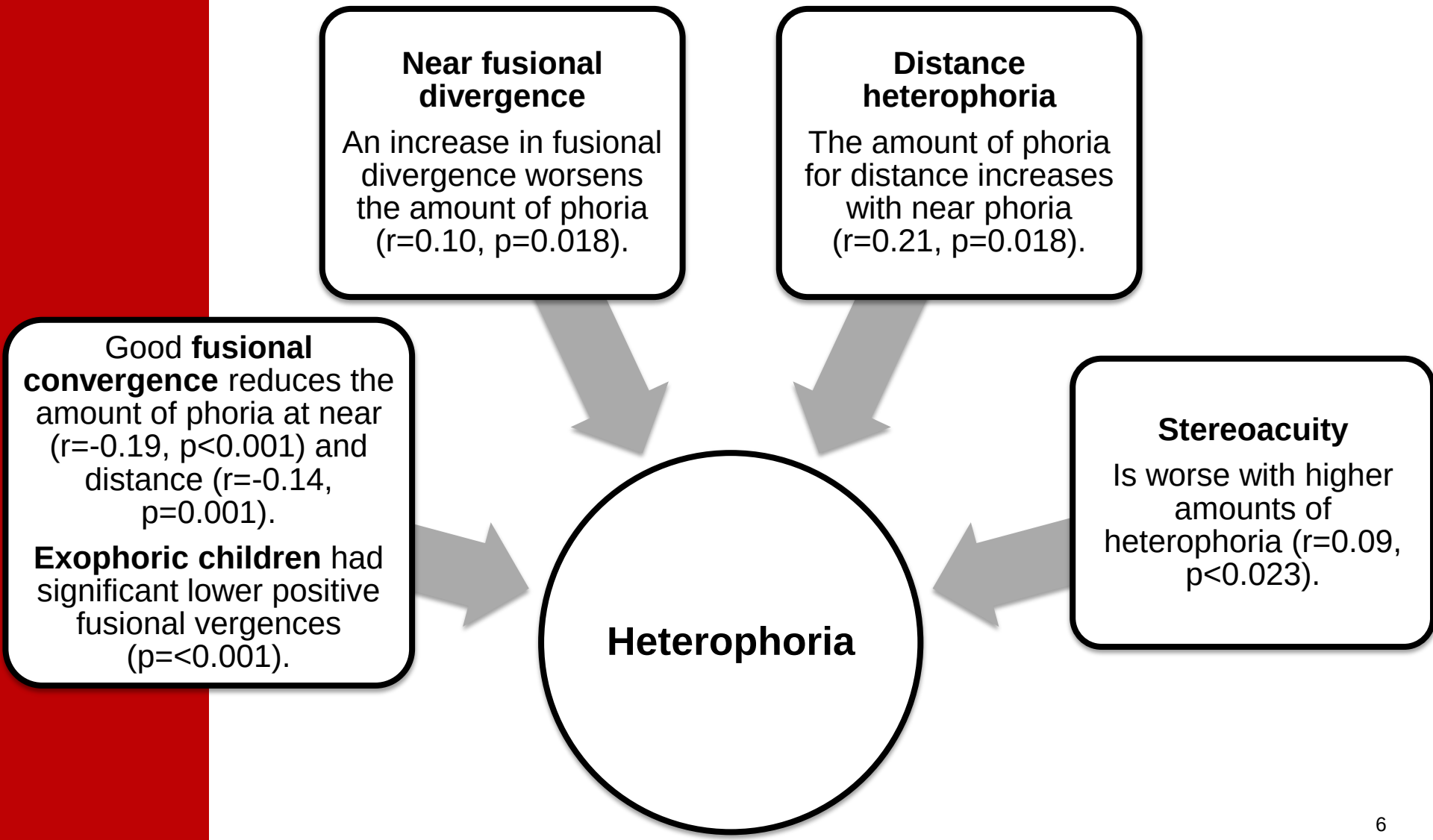
Studies	n	age	Mean±Std. Deviation	Median	Difference range with the present study
Distance fusional divergence					
Jiménez et al. (2004)	1015	6-12	6.00±2.00	---	1.02±0.20
Radakovic et al. (2012)	152	6-7	7.30±2.10	---	0.28±0.30
Liebermann et al. (2012)	38	4-13	9.00±2.00	---	1.98±0.20
Present study	630	6-14	7.02±1.80	8.00	---
Distance fusional convergence					
Jiménez et al. (2004)	1015	6-12	17.00±7.00	---	4.01±3.87
Radakovic et al. (2012)	152	6-7	13.70±4.40	---	0.71±1.27
Present study	630	6-14	12.99±3.13	12.00	---
Near fusional divergence					
Jiménez et al. (2004)	1015	6-12	11.00±3.00	---	1.30±1.04
Radakovic et al. (2012)	152	6-7	16.20±4.10	---	6.50±2.14
Liebermann et al. (2012)	38	4-13	15.00±3.00	---	5.30±1.04
Present study	630	6-14	9.70±1.96	10.00	---
Near fusional convergence					
Chen and Abidin (2002)	60	7-12	19.40±9.38	---	0.57±4.3
Jiménez et al. (2004)	1015	6-12	18.00±8.00	---	1.97±2.92
Radakovic et al. (2012)	152	6-7	29.60±6.60	---	**9.63±1.52**
Present study	630	6-14	19.97±5.08	20.00	---

Report median values allowing the use of a 5Δ measurement error for near fusional convergence (**20.00±5.00**) and 2Δ for distance fusional convergence (**12.00±2.00**) and near fusional divergence (10.00 ±2.00).

Results and discussion

Spearman's rho correlation

Relationship between phoria, fusional amplitudes and stereoacuity



Discussion and Conclusion

- Although correlations were very weak (<0.41) it indicates relationships between fusional amplitudes, heterophoria and stereoacuity.

- The prism fusion range tested in this study was the fast fusional range (phasic) controlled by a fast neural integrator.

- In the present study as we measured the **fast vergence system** it is not possible to identify if the esophoric children had a more robust vergence adaptation that uses the slow fusional vergence system to eliminate the constant demand on the fast fusional vergence system.

- The **role of convergence** in the control of intermittent exodeviations is also currently unclear. It is not possible yet to assure if the presence of an intermittent exotropia signals a deficit in the **slow vergence system**.

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