Brief Communication

Comparison between Bagolini Striated Glasses and Worth Four Dot Test in Assessment of Fusion and Suppression in Patients with Strabismus

Sharmeen Shahid
The University of Lahore

ABSTRACT

This cross sectional study was conducted at the Mayo Hospital Lahore from January 2019 to April 2019 to find out difference and agreement between Bagolini Striated Glasses and Worth Four Dot Test in assessment of fusion and suppression in patients with strabismus. Fifty patients with strabismus, with visual acuity of ≥ 0.6 Log Mar and at least 4 years of age were included. Fusion and suppression were assessed with Bagolini Striated Glasses (BAG) and Worth Four Dot Test (W4DT) at 1/3 meter. Forty-one patients were able to perform W4DT and forty-five patients performed BAG. There were 9 patients who were unable to demonstrate results with W4DT. There were 5 patients who could not demonstrate BAG. Fisher exact test showed 0.570 Exact sig. (2 sided) that exhibited an insignificant difference in the results of the two techniques. Cohen's kappa test showed -0.180 which indicated poor agreement between the two tests.

Key Words: Binocular single vision, Strabismus, Fusion, Suppression, Worth Four Dot Test Bagolini Striated Glasses.

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Correspondence: Sharmeen Shahid
The University of Lahore
Email: Sharmeen.shahid@ahs.uol.edu.pk

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INTRODUCTION

Alignment and coordination between the two eyes are important factors for binocular fusion and stereopsis. Strabismus if not corrected in due time can lead to Amblyopia and compromised binocular functions.[1] Strabismus has adverse effects on quality of life, not only in childhood but throughout their life.[2-3] Conversely, failure in normal development of sensory or motor fusion led to strabismus in about 2 – 4% of all children making this disorder noteworthy community health issue.[4] There are multiple risk factors which are associated with strabismus, including maternal smoking in pregnancy, prematurity, family history of squint, retinopathy of prematurity and refractive errors.[5,6]

Strabismus leads to lack of fusion and suppression which ultimately compromises binocularity and depth of perception.[7,8] There are numerous methods to determine the fusion amplitude, e.g. by a prism bar, Synoptophore or loose prisms.[9] BAG is used for patients with strabismus to test suppression, normal or abnormal retinal correspondence, especially in cases of manifest strabismus.[10] BAG test is an optical procedure based on subjective response, using glasses without any dioptric power.[11] Like Bagolini Glasses, the W4DT is one of the simplest methods for investigating binocular status.[12]

Very little data is available from the local studies regarding agreement between the BAG and W4DT. This study was designed to find out differences between these two tests and to assess if one can be used instead of other test if the results are in agreement.

METHODS

A cross-sectional analytical study was carried out at

the Mayo Hospital Lahore from January 2019 to April 2019. Fifty strabismus patients were enrolled in this study. Sample size of 50 patients was estimated by using 5% level of significance, 90% power of test with expected percentage with Bagolini Glasses as 20.68% and Worth 4 Dot test as 2.29%.[13]

Approval was taken from the ethical review board of the university. Patients of both genders, with strabismus and at least 4 years of age were included. Individuals who had visual acuity of ≥ 0.6 LogMar in either eye were included. Patients with other ocular pathologies were excluded. History and ocular examination including orthoptic assessment was done. Status of fusion and suppression was assessed with both tests at 1/3 meter. Results of both tests were compared. Data was analyzed by using SPSS-21. To compare the results of both tests Fisher exact test was applied. Cohen's kappa test was used to evaluate agreement between the two tests. The cooperation level of patients was also observed with both tests. P-value equal to or less than 0.05 was taken as significant.

RESULTS

Fifty patients were included in the study. Age ranged between 4 and 21 years (10.02 ± 4.7 years). There were 28 (56.0%) males and 22 (44.0%) females. Minimum visual acuity was 0.0M and maximum visual acuity was 0.6M included in the study. Ten patients (20%) had right esotropia, 9 patients (18%) had left esotropia, 3 (6%) had right exotropia and 4 (8%) had left exotropia. Eight (16%) patients had alternating Esotropia and 12 (24%) Intermittent Exotropia. Twenty six patients (52%) had good stereopsis, 18 (36%) had fair and 6 (12%) had poor stereopsis.

There were 45 patients (90%) patients who were able to perform BAG and 41(82%) were able to perform W4DT. Forty-six patients were cooperative with BAG, 1 patient was uncooperative with BAG, 1 patient was unable to decide and 2 patients were highly uncooperative with BAG. There were 43 patients who were cooperative with W4DT, 4 patients who could not decide and there were 3 patients who were uncooperative with W 4 D T. Fisher's exact test was applied to compare the results obtained by two methods (Table 1). It showed a p value of 0.057 and indicated insignificant difference between both methods. Measurement of the agreement was determined by kappa. Its value was -.18 which showed very poor agreement between both methods (Table 2).

Table 1: *Fisher's Exact Test shows value of 0.057 which indicates insignificant difference between both methods.*

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.220[a]	1	.269		
Continuity Correction	.241	1	.624		
Likelihood Ratio	2.103	1	.147		
Fisher's Exact Test				.570	.354
N of Valid Cases	50				

Table 2: *Agreement between two methods.*

	Value	Asymp. Std. Error	Approx. T[b]	Approx. Sig.
Measure of Agreement	-.180	.077	-2.294	.022
No of Valid Cases	100			

DISCUSSION

Individuals with good stereoacuity are able to perform motor tasks more easily than those with poor or absent.[13] Reduced stereo acuity also affects the reading ability of children. For stereoacuity, binocular single vision (BSV) is the fundamental requirement. This study was carried out to compare the W4DT and BAG. There is an insignificant difference in results obtained by the two procedures. W4DT was easy to explain to patients objectively and it was readily understood by them. BAG procedure was difficult to explain particularly to young children. In another study the researchers tried to find out accuracy and applicability of W4DT and BAG to detect fusion. Their study had 87 patients. They found fusion in 52 patients with both tests. Eighteen patients demonstrated fusion only with

BAG and 2 patients with W4DT. They concluded that might be due to dissociative factor of red and green glasses in W4DT. They found a 69% correlation rate between W4DT and BAG.[14]

Bak et al, investigated the acceptability of W4DT in patients with Red green color vision defect and anomalous and normal BSV. A retrospective analysis of therapeutic records was accomplished on 30 patients. They could easily perform the W4DT.[15] This advantage of W4DT was also described by Basheer et a.[16]

CONCLUSION

There is an insignificant difference between BAG and W4DT. However, the procedure of BAG was difficult to understand by younger patients. They found it difficult in defining the pattern observed by BAG, particularly by preschool children. W4DT was easy perform and children found it user-friendly.

Conflict of Interest: Author declared no conflict of interest.

REFERENCES

1. **Zhu H, Pan C, Sun Q, Huang D, Fu Z, Wang J, et al.** Prevalence of amblyopia and strabismus in Hani school children in rural southwest China: a cross-sectional study. BMJ open. 2019; **9 (2):** bmjopen-2018-025441.
2. **Menon V, Saha J, Tandon R, Mehta M, Khokhar S.** Study of the psychosocial aspects of strabismus. J Pediatr Ophthalmol Strabismus, 2002; **39 (4):** 203-208. Doi: 10.3928/0191-3913-20020701-07.
3. **van de Graaf ES, Borsboom GJJM, van der Sterre GW, Felius J, Simonsz HJ, Kelderman H.** Differences in quality-of-life dimensions of Adult Strabismus Quality of Life and Amblyopia & Strabismus Questionnaires. Graefes Arch Clin Exp Ophthalmol. 2017; **255 (9):** 1851-1858. Doi: 10.1007/s00417-017-3694-x. Epub 2017 May 29.
4. **Das VE.** Strabismus and the Oculomotor System: Insights from Macaque Models. Annu Rev Vis Sci. 2016; **2:** 37-59. Doi: 10.1146/annurev-vision-111815-114335. Epub 2016 Jul 18.
5. **Cotter SA, Varma R, Tarczy-Hornoch K, McKean-Cowdin R, Lin J, Wen G, et al.** Joint Writing Committee for the Multi-Ethnic Pediatric Eye Disease Study and the Baltimore Pediatric Eye Disease Study Groups. Risk factors associated with childhood strabismus: the multi-ethnic pediatric eye disease and Baltimore pediatric eye disease studies. Ophthalmology, 2011; **118 (11):** 2251-2261. Doi: 10.1016/j.ophtha.2011.06.032. Epub 2011 Aug 19.
6. **Ziakas NG, Woodruff G, Smith LK, Thompson JR.** A study of heredity as a risk factor in strabismus. Eye (Lond). 2002; **16 (5):** 519-521. Doi: 10.1038/sj.eye.6700138.
7. **O'Connor AR, Stephenson TJ, Johnson A, Tobin MJ, Ratib S, Fielder AR.** Strabismus in children of birth weight less than 1701 g. Arch Ophthalmol. 2002; **120 (6):** 767-773. Doi: 10.1001/archopht.120.6.767.
8. **Bui Quoc E, Milleret C.** Origins of strabismus and loss of binocular vision. Front Integr Neurosci. 2014; **8:** 71. Doi: 10.3389/fnint.2014.00071.
9. **Pan CW, Chen X, Zhu H, Fu Z, Zhong H, Li J, et al.** School-based assessment of amblyopia and strabismus among multiethnic children in rural China. Sci Rep. 2017; **7:** 13410. Doi: 10.1038/s41598-017-13926-8
10. **Hatt S, Antonio-Santos A, Powell C, Vedula SS.** Interventions for stimulus deprivation amblyopia. Cochrane Database Syst Rev. 2006; **(3):** CD005136. Doi: 10.1002/14651858.CD005136.pub2. Update in: Cochrane Database Syst Rev. 2014; **2:** CD005136.
11. **Hirai T, Arai M, Ito Y, Sato M.** Modified Bagolini striated glass test: clinical applications of starlight test in binocular visual field screening. Br J Ophthalmol. 1998; **82 (11):** 1288-1293. Doi: 10.1136/bjo.82.11.1288.
12. **Morya AK, Solanki, K, Bhandari S, Naidu A.** Binocular Functions. In: Mravicic, I. , editor. Eye Motility [Internet]. London: Intech Open; 2019. Doi: 10.5772/intechopen.84162
13. **Webber AL, Mandall TR, Molloy DT, Lister LJ, Birch EE.** Worth 4 Dot App for Determining Size and Depth of Suppression. Transl Vis Sci Technol. 2020; **9 (4):** 9. Doi: 10.1167/tvst.9.4.9. Erratum in: Transl Vis Sci Technol. 2022 Jan 3; **11 (1):** 20.
14. **Arthur BW, Cake S.** Bagolini lenses vs the Polarized Four-Dot test. J Pediatr Ophthalmol Strabismus. 1996; **33 (2):** 98-103. Doi: 10.3928/0191-3913-19960301-08.
15. **O'Connor AR, Birch EE, Anderson S, Draper H.** FSOS Research Group. The functional significance of stereopsis. Invest Ophthalmol Vis Sci. 2010; **51 (4):** 2019-2023. Doi: 10.1167/iovs.09-4434. Epub 2009 Nov. 20.
16. **Bak E, Yang HK, Hwang JM.** Validity of the Worth 4 Dot Test in Patients with Red-Green Color Vision Defect. Optom Vis Sci. 2017; **94 (5):** 626-629. Doi: 10.1097/OPX.0000000000001058.
17. **Schultinga L, Burggraaf F, Polling JR, Gutter M.** Bagolini glasses: do they affect the horizontal prism fusion amplitude? Strabismus, 2013; **21 (2):** 127-130. Doi: 10.3109/09273972.2013.787632.
18. **Basheer S, Sarwar MS.** Applicability of Worth four dot test in patients with red green color vision defect visiting Mayo Hospital Lahore. Ophthalmol.Pak. 2018; **8 (01):** 22-25.

Author's Designation and Contribution

Sharmeen Shahid; Optometrist: *Concepts, Design, Literature search, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript review.*