Quality of life and mental health in amblyopic children treated with and without occlusion therapy

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PURPOSE	To assess the long-term (≥1 year) psychosocial effects of occlusion therapy in children with refractive amblyopia and their caregivers.
METHODS	Multiple self-reported questionnaires were used to investigate HRQoL, anxiety, depression, and stress in a cross-sectional study of children with refractive amblyopia and their caregivers. Children were divided into two subgroups: those treated with glasses only and those treated with both glasses and occlusion therapy who had stopped wearing a patch at least 1 year earlier.
RESULTS	A total of 79 children were included: 32 in the refraction-only group and 47 in the glasses + occlusion group. Median age of subjects was 12 years (IQR = 3.0). Mean age of the 79 caregivers was 41.9 ± 5.0 years. No significant differences were found for any of the psychosocial outcomes analyzed between children treated with glasses and patching and those treated with glasses only. The differences remained insignificant between children according to age of first occlusion (<6 vs ≥6 years). The only significant (but not clinically relevant) difference observed for caregivers was a higher score in the depression dimension of the Hospital Anxiety and Depression Scale for caregivers of children treated with glasses only ($P = 0.036$; *effect size* = 0.23).
CONCLUSIONS	In our study cohort, patching was not associated with long-term negative psychosocial outcomes in children with refractive amblyopia treated with occlusion therapy. (J AAPOS 2019;23:339.e1-5)

The cost-effectiveness of screening for amblyopia is determined more by long-term negative effects of unilateral vision loss[1] than by the positive effects of amblyopia treatment.[2] The psychosocial effect of amblyopia treatment on quality of life has gained attention in recent years,[3-5] and it is increasingly clear that more evidence is needed on the intermediate- and long-term psychological effects of amblyopia and amblyopia treatment on patients and their families.[4] The literature suggests that health-related quality of life (HRQoL) impairments in this setting are more closely related to treatment than to the condition itself.[4] Studies have shown that patching for amblyopia may result in lower self-perceived social acceptance in children,[6] greater stress and anxiety levels among caregivers,[4] and worse caregiver-child relationships.[4] In addition, significant differences have been found for the psychosocial effects of treatment depending on whether the children were treated with occlusion therapy (patching) or refractive therapy (glasses).[5]

Most studies of the effects of amblyopia or amblyopia treatment on HRQoL in children have focused on the perspective of adults, whether through questionnaires completed by the children's parents or guardians[4] or by adults who had been treated for amblyopia as children.[7] In addition, many studies may actually be detecting effects caused by strabismus rather than amblyopia,[4] because large-angle strabismus can negatively effect HRQoL.[8] The purpose of the present study was to assess the psychosocial effects of patching on caregivers and their children who had completed treatment at least 1 year earlier. The study focused on long-term effects, because most studies to date have emphasized the children's response during the treatment period.[4,6] Accordingly, we analyzed HRQoL, anxiety, stress, and depression on caregivers and their children with refractive amblyopia but not strabismus.

Subjects and Methods

Children 8-17 years of age (born between 1999-2007) with refractive amblyopia treated with refractive therapy alone or with refractive plus occlusion therapy at the Ophthalmology Department of Braga Hospital in 2014 were included. Occlusion therapy had to

have been completed at least 1 year previously. Children with mixed amblyopia (refractive and strabismic), organic amblyopia, or cognitive impairment were excluded. The study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Health Science Ethics Committee of Braga Hospital. All participants provided informed consent.

Eligible children and their parents or guardians (caregivers) were invited to participate in the study. Those who agreed were asked to complete questionnaires to evaluate anxiety, depression, stress, and HRQoL. The patients' electronic medical records (in the Global Intelligence Technologies database-Glintt) were reviewed for information on age, type of treatment, best-corrected visual acuity (converted to logMAR), age at first patching, and date when occlusion therapy was completed.

All the questionnaires had been previously adapted and validated for use in Portuguese.[9-15] Children completed two child-specific questionnaires: (1) the KIDSCREEN-52 (K52) instrument,[9] a 52-item instrument for children and adolescents aged 8-18 years that measures HRQoL in 10 individually scored dimensions, where higher scores indicate higher HRQoL; and (2) the EADS-C,[10] a set of three self-reported scales (21 items in total) that measure anxiety, depression, and stress symptoms according to four levels and where higher scores indicate a more negative emotional state. Caregivers competed the following four adult-specific questionnaires: (1) the Beck Anxiety Inventory,[11] a self-reported 21-item scale that measures symptoms of anxiety during the past week, where higher scores indicate greater anxiety; (2) the Hospital Anxiety and Depression Scale (HADS),[12] which measures symptoms of anxiety and depression using two 7-item scales, where scores are interpreted as normal (0-7), mild (8-10), moderate (11-14), and severe (15-21); (3) the abbreviated World Health Organization Quality of Life instrument (WHO-QOL-BREF),[13] a 26-item questionnaire with 4 domains (physical health, psychological, social relationships, and environment), where higher scores for each domain represent higher levels of quality of life; and (4) the NEO Five-Factor Inventory (NEO-FFI),[14] a 60-item scale that captures the personality traits neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness, and where higher scores indicate a stronger presence of a given trait. In addition, both children and caregivers completed the 10-item Perceived Stress Scale (PSS-10),[15] which assesses perceptions of stress during the last month, with higher scores indicating worse perceived stress. The scores were calculated following the instructions of the authors of the original scales.[8,16-20]

Data analysis was performed using SPSS Statistics for Windows version 24 (Armonk, NY: IBM Corp). Two-sided *P* values of <0.05 (95% confidence interval) were considered statistically significant. Normality was assessed with the Shapiro-Wilk test. The reliability of all the instruments and their dimensions was assessed using Cronbach's α, with a value of $\geq$0.70 indicating good internal consistency.[21] Effect size was calculated using Cohen's *d* for the *t* test (0.2, small effect; 0.5, medium effect; 0.8, large effect) and Cohen's suggestion ($r = Z/\sqrt{n}$) for the Mann-Whitney test (0.1-0.3, small effect; 0.3-0.5, medium effect; >0.5, large effect).[22]

Results

Of the 106 children/caregivers approached, 79 agreed to participate; 47 had been treated with glasses and patching, and 32 with glasses only. The questionnaire response rates were 100% for children and 75% for caregivers.

The median age of children was 12 years (IQR = 3.00); the mean age of parents was 42 ± 5 years (standard deviation). The age of the children did not vary significantly between the glasses + patching group and the glasses-only group (*P* = 0.12; *ES[r]* = 0.18). Median best-corrected visual acuity was 0.22 logMAR (IQR = 0.25) in the worse-seeing eye (WE) and 0.05 (IQR = 0.15) in the better-seeing eye (Table 1). Reliability scores for all instruments and their dimensions were close to or above 0.70.[21] Values for Cronbach's α were compared to those reported in the Portuguese instrument adaptation and validation studies.[9-15] The inter-item correlation scores were above 0.30 in all cases (eSupplement 1, available at jaapos.org),[21] indicating good internal consistency and conferring a sense of robustness to this study.

No significant differences or large effect sizes were found on comparing anxiety, depression, stress, and HRQoL between children who had worn a patch and those who had not (Table 2).

In the children treated with glasses and patching, we compared questionnaire scores between those who had started patching before 6 years of age and those who had started later (Table 2). No significant differences or large effect sizes were found. A similar approach was taken to compare the results of the anxiety, depression, stress, and HRQoL questionnaires completed by the caregivers (Table 3). Significantly higher scores (greater impairment) were observed in the depression domain of the HADS among caregivers of children treated with glasses only compared with caregivers of children treated with glasses and patching (*Z* = 2.03; *P* = 0.04; *ES* = 0.23).

Discussion

To our knowledge, this is the first study to compare the long-term effects ($\geq$1 year) of patching on anxiety, stress, depression, and HRQoL in children with refractive amblyopia. Our main objective was to determine whether psychosocial effects reported for occlusion therapy in children persist beyond the treatment period. By excluding children with strabismic amblyopia, either alone or combined with refractive amblyopia, we controlled for the psychosocial effects of strabismus.[19,23] Another novel aspect of this study is that we assessed anxiety, stress, depression, and HRQoL among caregivers to rule out their influence on the children's results.

Most studies on the effects of amblyopia or amblyopia treatment have reported findings from the perspective of adults,[22-25] but, as stated by Carlton and Kaltenhaler[4] in their systematic review of amblyopia and QoL, "It is not possible to state that the impact of amblyopia treatment

Table 1. Characteristics of children and caregivers

				Sex, no. (%)		BCVA, logMAR, median (IQR)		Age, years, at patching initiation, no. (%)	
Group	Subgroup	No. (%)	Age[a]	M	F	Worse eye	Better eye	<6	≥6
Children	Glasses + patching	47 (59.5)	12 (3)	21 (44.7)	26 (55.3)	0.30 (0.18)	0.00 (0.10)	22 (46.8)	25 (53.2)
	Glasses only	32 (40.5)	11 (6)	17 (53.1)	15 (46.9)	0.22 (0.24)	0.10 (0.22)		
Caregivers	Glasses + patching	47 (59.5)	42.3 ± 5.1	9 (19.1)	38 (80.9)				
	Glasses only	32 (40.5)	41.3 ± 4.9	16 (50.0)	16 (50.0)				

BCVA, best-corrected visual acuity; *IQR*, interquartile range.
[a]Age presented as median (IQR) for children and mean with standard deviation for caregivers.

Table 2. Comparison of psychosocial tests for children according to treatment and age at patching initiation occlusion onset

	Treatment[a]			Age at patching, years[a]		
Psychosocial test	Glasses + occlusion (n = 47)	Glasses only (n = 32)	P value	<6 (n = 22)	≥6 y (n = 25)	P value
KIDSCREEN-52_Health	17.3 ± 3.1	16.6 ± 3.3	0.33[b]	17.4 ± 3.4	17.3 ± 2.9	0.96[b]
KIDSCREEN-52_Feelings	25.7 (3.6)	25.4 (4.4)	0.98[c]	25.8 ± 3.1	25.5 ± 4.0	0.92[b]
KIDSCREEN-52_Humor	29 (4.6)	28.3 (5.6)	0.94[c]	28 ± 4.7	29.8 ± 4.4	0.19[b]
KIDSCREEN-52_Self-perception	20.1 (3.0)	19.4 (4.4)	0.90[c]	19.7 ± 2.6	20.5 ± 3.4	0.37[b]
KIDSCREEN-52_Autonomy	20.7 (3.0)	20 (3.6)	0.54[c]	20.4 ± 3.0	21 ± 3.0	0.44[b]
KIDSCREEN-52_Family	25.9 (3.6)	25.3 (4.4)	0.73[c]	26.1 (3.1)	25.8 (4.1)	0.81[c]
KIDSCREEN-52_Economics	12.3 (2.9)	12.6 (2.5)	0.85[c]	12.5 (2.9)	12.2 (2.9)	0.81[c]
KIDSCREEN-52_Friends	24.6 (4.6)	24.9 (3.9)	0.93[c]	24.5 (3.5)	24.7 (5.4)	0.32[c]
KIDSCREEN-52_School	24.1 ± 3.7	24.0 ± 4.0	0.95[b]	24.6 (3.7)	23.7 (3.7)	0.37[c]
KIDSCREEN-52_Bullying	13.1 (2.3)	13.1 (2.3)	0.94[c]	13.2 (2.1)	13 (2.6)	0.88[c]
EADS-C_Stress	4 (3.6)	3.9 (3.5)	0.87[c]	4 (3.3)	4.1 (3.9)	0.91[c]
EADS-C_Anxiety	2.7 (2.5)	3.1 (3.1)	0.69[c]	2.8 (2.6)	2.6 (2.5)	0.83[c]
EADS-C_Depression	3 (3.2)	4.1 (4.8)	0.60[c]	3.5 (3.1)	2.5 (3.3)	0.17[c]
Perceived stress scale-10	11.5 ± 7.3	12.5 ± 7.4	0.56[b]	13.1 ± 7.7	10.1 ± 6.7	0.17[b]

ES, effect size.
[a]For statistical comparisons between subgroups, mean ± standard deviation and the *t* test were used for normally distributed data; median and interquartile range (in parentheses) and the Mann-Whitney test, for non-normally distributed data.
[b]*T* test.
[c]Mann-Whitney test.

felt by the child is the same as that perceived by the adult on what and how their child's experience was." In our study, we used three questionnaires suitable for children aged 8-17 years to analyze potential psychosocial effects of patching. The robustness of these questionnaires is supported by their good internal consistency in comparison with the validated Portuguese versions[9-15] and their high inter-item correlation. Although a new patient-derived Pediatric Eye Questionnaire (PedEyeQ) is now available for assessing eye-related quality of life and functional vision in children of any age with any eye condition,[26] it has not yet been validated for use in Portugal.

We found no significant differences in long-term anxiety, depression, stress, or HRQoL scores between amblyopic children treated with glasses and patching and those treated with glasses only. Although children who started to wear a patch before 6 years of age and their caregivers showed higher levels of perceived stress on the PSS-10 questionnaire than older children and their caregivers, the differences were not statistically significant and only had a small effect size (0.40 and 0.41, resp.).

Hrisos and colleagues[24] found that patching can cause short-term distress for both children and their families, and Weber and colleagues[3] detected a lower self-perception of social acceptance that was significantly correlated with patching in amblyopic children compared with age-matched controls. Chong and colleagues,[23] however, found no differences in stress levels between amblyopic children treated with and without patching. Patches are now available in a range of colors and styles and, like glasses, have become more popular and socially acceptable.[4]

Although significantly higher depression scores on the HADS were observed for caregivers of children who did not have to wear a patch compared with those of children who did, the levels were not high or clinically relevant (6.5 vs 8.3, with an effect size of 0.23; $P = 0.04$).

Our study has several strengths. First, we examined the psychosocial effects of occlusion therapy for amblyopia on children who had stopped wearing a patch at least 1 year ago, enabling us to investigate whether patching has a lasting effect on patient well-being. Second, we evaluated effects from the perspective of children and we did this using self-reported questionnaires rather than

Table 3. Comparison of caregivers' psychosocial dimensions between treatment regimens and age of occlusion onset

Psychosocial test[a]	Patching vs non-patching[b]			Age at beginning of patching, years[b]		
	Patching (n = 47)	Non-patching (n = 32)	P value	<6 (n = 22)	≥6 (n = 25)	P value
BAI Score	11.5 ± 7.6	12.2 ± 7.9	0.68[c]	11.4 (7.7)	11.6 (7.6)	0.98[d]
HADS Anxiety	7.8 ± 3.7	8.1 ± 2.6	0.63[c]	7.7 ± 3.5	7.8 ± 3.9	0.88[c]
HADS Depression	6.5 (3.7)	8.3 (3.5)	0.04[d]	7.1 (3.3)	6 (3.9)	0.40[d]
PSS-10	15.6 ± 6.2	15.7 ± 5.3	0.96[c]	17 ± 6.2	14.4 ± 6.1	0.17[c]
NEO-FFI Neuroticism	20.5 ± 7.2	22.2 ± 6.6	0.29[c]	21.3 ± 8	19.8 ± 6.5	0.49[c]
NEO-FFI Extraversion	29.8 ± 5.3	31.2 ± 4.8	0.26[c]	29.6 ± 4.9	30 ± 5.6	0.82[c]
NEO-FFI Openness	23.1 ± 4.8	22.1 ± 4.8	0.35[c]	23.2 ± 4.4	23 ± 5.2	0.90[c]
NEO-FFI Agreeableness	29.7 ± 5.8	27.7 ± 5.2	0.11[c]	28.7 ± 6.1	30.6 ± 5.5	0.27[c]
NEO-FFI Conscientiousness	34.8 ± 5.9	35 ± 5.2	0.89[c]	34.9 ± 5.4	34.7 ± 6.3	0.90[c]
WHOQOL Physical	76.5 ± 15	74.1 ± 15.1	0.51[c]	75.2 ± 14.8	77.7 ± 15.3	0.57[c]
WHOQOL Psychological	76.5 ± 14.1	73.7 ± 13.4	0.26[c]	73.9 (13.6)	78.8 (14.4)	0.08[d]
WHOQOL Social	74.1 ± 15.8	74 ± 15.4	0.93[c]	74.6 (17.7)	73.7 (14.2)	0.71[d]
WHOQOL Environmental	68.4 ± 14.5	68.1 ± 13.2	0.91[c]	67.3 ± 15.5	69.4 ± 13.8	0.63[c]

[a]The Beck Anxiety Inventory (BAI) is self-reported 21-item scale that measures symptoms of anxiety during the past week, where higher scores indicate greater anxiety. The Hospital Anxiety and Depression Scale (HADS) measures symptoms of anxiety and depression using two 7-item scales, where scores are interpreted as normal (0-7), mild (8-10), moderate (11-14), and severe (15-21). The abbreviated World Health Organization Quality of Life instrument (WHOQOL-BREF) is a 26-item questionnaire with four domains (physical health, psychological, social relationships, and environment). NEO Five-Factor Inventory (NEO-FFI) is a 60-item scale that captures the big five personality traits (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness) and where high scores indicate a stronger presence of a given trait. The 10-item Perceived Stress Scale (PSS-10) assesses perceptions of stress during the previous month, with higher scores indicating worse perceived stress.
[b]For statistical comparisons between subgroups, mean ± standard deviation and the *t* test were used for normally distributed data; median and interquartile range (in parentheses) and the Mann-Whitney test, for non-normally distributed data.
[c]Normal distribution and application of *t* test.
[d]Non-normal distribution and application of Mann-Whitney test.

interviews.[19] Finally, we controlled for the potential effects of strabismus, which is a bias present in many other studies.

Our study also has several limitations. First, because this was a cross-sectional study, it only assessed the characteristics of our population at a given time. Second, the generic questionnaires may not have been sensitive enough to capture small between-group differences or specific emotional aspects associated with eye conditions. Third, because we only assessed anxiety, depression, stress, and HRQoL, there may have been other differences that we did not measure or investigate. We were also unable to determine how long the children had worn a patch, because the answers were too vague or the respondents did not recall. We therefore decided to eliminate this variable because it was unreliable. Finally, the relatively small number of participants may have affected our results, but since the effect sizes were small, we suspect that our results would not have changed much with a larger sample.

Our findings show that children with refractive amblyopia treated with glasses and patching did not differ from those treated with glasses only in terms of anxiety, depression, stress, and HRQoL measured at least 1 year after completion of patching. We also found that the age at which patching was started (<6 vs ≥6 years) had no bearing on the psychosocial aspects analyzed. The depression dimension of the HADS questionnaire revealed significant differences between carers, but these were not clinically relevant, corroborating the results for the children. The lack of significant differences observed between children who underwent patching and those who did not suggests that negative experiences associated with amblyopia occlusion therapy do not persist into later life.

Literature Search

PubMed was searched, without date or language restriction, on various dates from December 2016 to January 2018, using the following MESH terms: *amblyopia*, *psychosocial impact*, *patching*, and *HRQOL*.

References

1. Carlton J, Karnon J, Czoski-Murray C, Smith KJ, Marr J. The clinical effectiveness and cost-effectiveness of screening programmes for amblyopia and strabismus in children up to the age of 4-5 years: a systematic review and economic evaluation. Health Technol Assess 2008;12: iii, xi-194.
2. Membreno JH, Brown MM, Brown GC, Sharma S, Beauchamp GR. A cost-utility analysis of therapy for amblyopia. Ophthalmology 2002;109:2265-71.
3. Webber AL, Wood JM, Gole GA, Brown B. Effect of amblyopia on self-esteem in children. Optom Vis Sci 2008;85:1074-81.
4. Carlton J, Kaltenthaler E. Amblyopia and quality of life: a systematic review. Eye (Lond) 2011;25:403-13.
5. Chen Y, Chen X, Chen J, Zheng J, Xu J, Yu X. Longitudinal impact on quality of life for school-aged children with amblyopia treatment: Perspective from children. Curr Eye Res 2016;41:208-14.
6. Webber AL, Wood J. Amblyopia: prevalence, natural history, functional effects and treatment. Clin Exp Optom 2005;88:365-75.

7. Satterfield D, Keltner JL, Morrison TL. Psychosocial aspects of strabismus study. Arch Ophthalmol 1993;111:1100-105.

8. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983;67:361-70.

9. Gaspar T, Matos MG, eds. Versão portuguesa dos instrumentos KIDSCREEN-52: Instrumentos de Qualidade de Vida para Crianças e Adolescentes. [Portuguese version of KIDSCREEN Instruments of Quality of Life in Children and Adolescents]. Lisbon, Portugal: Faculdade de Motricidade Humana/Universidade de Lisboa; 2008.

10. Leal IP, Antunes R, Passos T. Estudo da escala de depressão, ansiedade e stresse para crianças (EADS-C). Psicologia e Saúde Doenças 2009;10:277-84.

11. Quintão S, Delgado AR, Prieto G. Validity study of the Beck Anxiety Inventory (Portuguese version) by the Rasch rating scale model. Psicol Reflex Crit 2013;26:305-10.

12. Carona C, Canavarro MC, Pereira M, et al. Estudos psicométricos do instrumento de avaliação da qualidade de vida da organização mundial de saúde (WHOQOL-Bref) para português de Portugal. Psiquiatr Clínica 2006;27:41-9.

13. Pais-Ribeiro J, Silva I, Ferreira T, Martins A, Meneses R, Baltar M. Validation study of a Portuguese version of the Hospital Anxiety and Depression Scale. Psychol Health Med 2007;12:225-35; quiz 235-237.

14. Pedroso-Lima M, Magalhães E, Salgueira A, et al. A versão portuguesa do NEO-FFI: caracterização em função da idade, género e escolaridade. Psicologia 2014;28:1-10. Available at: http://www.scielo.mec.pt/scielo.php?script=sci_arttext&pid=S0874-20492014000200001.

15. Trigo M, Canudo N, Branco F, Silva D. Estudo das propriedades psicométricas da Perceived Stress Scale (PSS) na população portuguesa. Psychologica 2010;10:353-78.

16. Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. Psychol Med 1998;28:551-8.

17. Costa PT, McCrae RR. NEO PI-R Professional Manual. Odessa, FL: Psychological Assessment Resources; 1992.

18. Beck AT, Steer RA. Beck Anxiety Inventory Manual. San Antonio, TX: Psychological Corporation; 1993.

19. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav 1983;24:385-96.

20. Lovibond SH, Lovibond PF. Manual for the Depression Anxiety Stress Scales. 2nd ed. Sydney: Psychology Foundation of Australia; 1995.

21. Field A. Discovering Statistics Using SPSS. London: Sage Publications Ltd; 2009.

22. Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988.

23. Choong YF, Lukman H, Martin S, Laws DE. Childhood amblyopia treatment: psychosocial implications for patients and primary carers. Eye (Lond) 2004;18:369-75.

24. Hrisos S, Clarke MP, Wright CM. The emotional impact of amblyopia treatment in preschool children: randomized controlled trial. Ophthalmology 2004;111:1550-56.

25. Holmes JM, Strauber S, Quinn GE, Cole SR, Felius J, Kulp M. Pediatric Eye Disease Investigator Group. Further validation of the Amblyopia Treatment Index parental questionnaire. J AAPOS 2008;12:581-4.

26. Hatt SR, Leske DA, Castaneda YS, et al. Development of pediatric eye questionnaires for children with eye conditions. Am J Ophthalmol 2019;200:201-17.