Parental Predictors of Poor Visual Outcome with Occlusion Treatment for Unilateral Amblyopia

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ABSTRACT

Aim: Visual acuity outcome of amblyopia treatment depends on the compliance. This study aimed to determine parental predictors of poor visual outcome with occlusion treatment in unilateral amblyopia and identify the relationship between occlusion recommendations and the patient's actual dose of occlusion reported by the parents.

Methods: This study comprised three phases: refractive adaptation for a period of 18 weeks after spectacle correction; occlusion of 3 to 6 hours per day during a period of 6 months; questionnaire administration and completion by parents. Visual acuity as assessed using the Sheridan-Gardiner singles or Snellen acuity chart was used as a measure of visual outcome. Correlation analysis was used to describe the strength and direction of two variables: prescribed occlusion reported by the doctor and actual dose reported by parents. A logistic binary model was adjusted using the following variables: severity, vulnerability, self-efficacy, behaviour intentions, perceived efficacy and treatment barriers, parents' and childrens' age, and parents' level of education.

Results: The study included 100 parents (mean age 38.9 years, SD ±9.2) of 100 children (mean age 6.3 years, SD ±2.4) with amblyopia. Twenty-eight percent of children had no improvement in visual acuity. The results showed a positive mild correlation (kappa = 0.54) between the prescribed occlusion and actual dose reported by parents. Three predictors for poor visual outcome with occlusion were identified: parents' level of education (OR = 9.28; 95%CI 1.32-65.41); treatment barriers (OR = 2.75; 95%CI 1.22-6.20); interaction between severity and vulnerability (OR = 3.64; 95%CI 1.21-10.93). Severity (OR = 0.07; 95%CI 0.00-0.72) and vulnerability (OR = 0.06; 95%CI 0.05-0.74) when considered in isolation were identified as protective factors.

Conclusions: Parents frequently do not use the correct dosage of occlusion as recommended. Parents' educational level and awareness of treatment barriers were predictors of poor visual outcome. Lower levels of education represented a 9-times higher risk of having a poor visual outcome with occlusion treatment.

Keywords: amblyopia, visual outcome, parental predictors, educational level, treatment barriers

INTRODUCTION

Amblyopia has a prevalence of approximately 2% to 4% in the population and is a form of cerebral visual impairment caused by a deprivation of vision or abnormal binocular interaction.[1] This condition is characterised by abnormal neuronal numbers and connections in the visual pathway and cortex caused by a disturbance of vision during a sensitive period of development.[2] Amblyopia is not always effectively treated by wearing spectacles and is unrelated to any structural abnormality.

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The management of amblyopia is a challenge for clinicians and continues to be the subject of clinical research. Early treatment of amblyopia, during the critical period, leads to a better outcome than later treatment.[3,4] Mainstream treatment for unilateral amblyopia involves refractive correction with spectacles and/or occlusion by patching or penalisation of the fellow eye.[5]

Whilst effectiveness of occlusion therapy for amblyopia is a research priority,[5,6] there is a lack of research into the risk factors associated with poor visual outcomes. Several studies have suggested that one of the factors influencing outcome with amblyopia treatment is the level of compliance with occlusion therapy.[7-11] However, risk factors associated with poor compliance and parental predictors of compliance with amblyopia treatment continue to remain unknown, particularly given that the

approach to treatment is not standardised and is different for each patient.[12]

It is well known that occlusion of the dominant eye can be problematic due to the forced use of the degraded vision of the non-dominant eye. Also skin irritations can be caused by adhesive patches. Children who wear glasses and use a patch are also more likely to be victims of physical or verbal bullying[13] which potentially affects their willingness to participate in treatment. Parents' difficulties in patching their children are also common and can cause great distress within the family.[14,15] Parents report having difficulties with occlusion therapy regardless of the child's age, with fewer parents reporting difficulties when the child is treated with glasses alone.[15] Recent investigations associate poor compliance with parental fluency, country of origin, educational level and initial visual acuity of the child.[16]

This study aimed to investigate parental predictors of poor visual outcome with occlusion treatment in unilateral amblyopia and to identify the relationship between occlusion recommendations and the patient's actual dose of occlusion as reported by the parents. This investigation contributes to the understanding of the relationship between health advice and parents' behaviour and quantifies the effect of various parental predictors (risk factors) of poor visual outcome with occlusion treatment for unilateral amblyopia.

METHOD AND STUDY DESIGN

Ethics approval for this study was obtained from the local ethics committee. Informed consent was obtained from the parents of the children after the nature of the study was explained.

This prospective study comprised three phases: (i) spectacles and refractive adaptation for a period of 18 weeks, (ii) occlusion of 3 to 6 hours per day for a period of 6 months and (iii) questionnaire administration to parents of amblyopic children with strabismic and/or anisometropic amblyopia. A convenience sample was used to recruit participants.

Each child underwent an ophthalmic evaluation consisting of an assessment of visual acuity, cycloplegic retinoscopy, fundoscopy, fixation behavior and binocular function. After this evaluation, spectacles were prescribed where appropriate. Given that there is evidence to suggest that amblyopia improvement with optical correction alone occurs in one-quarter of patients[6] and by 18 weeks of spectacle wear,[17] spectacles were prescribed full-time and participants were reviewed at 6-week intervals for 18 weeks prior to any occlusion treatment being prescribed.

Children were eligible for inclusion in the study if they (i) were under 8 years of age, (ii) were diagnosed with moderate unilateral strabismic and/or anisometropic amblyopia, defined as 6/12 to 6/30, or had three lines difference between the visual acuity of both eyes and with vision in the sound eye better than 6/12[6] and (iii) had been prescribed 2 to 6 hours of occlusion therapy per day for a minimum of 6 months. Children with ocular pathology or developmental delay were excluded.

Occlusion was prescribed according to a standardised treatment protocol of 2 to 6 hours of occlusion therapy per day for a minimum of 6 months. Occlusion was not objectively monitored. The orthoptists carrying out the vision tests had no knowledge of the factors determining participation in the study.

Visual acuity was used as the measure of visual outcome, classified as a categorical variable, improvement or no improvement, based on visual acuity results after 6 months of treatment. Improvement was considered to have occurred in cases where the visual acuity improved at least one line after 6 months of occlusion. Visual acuity was recorded using age-appropriate methods of assessment. Children were tested with their optical correction at 6 metres with either the Sheridan-Gardiner singles test or Snellen acuity chart. The same test was used for each child during the study period, even if they were able to progress to another test.

Parents were asked to participate by filling out a self-administered questionnaire. For this study, "parent" was defined as the full-time guardian or the person who administered the occlusion treatment. The questionnaire consisting of 51 items was based on the main components of Roger's Protection Motivation Theory (PMT). This theory brings together three cognitive appraisal processes, which are commonly considered in fear-arousing situations.[18] These involve: a perception of the severity of a potentially harmful situation; a perceived vulnerability or susceptibility to harm; and a perception of how likely a particular course of action was to reduce or prevent the threat, labelled response efficacy. A fourth cognitive mediator was added to the model; the expectancy that one can perform particular actions, labelled self-efficacy.[19] This fourth model was adopted in this study because it takes into account the decision to make specific protective health behaviours or, alternatively, produce a maladaptive response; the threat appraisal process and the coping appraisal process. Protective health behaviours are those which reduce risk or threat. In this study protective health behaviour relates to the parents' full involvement in their child's occlusion rehabilitation program.

The questionnaire was translated from Searle et al[20] into Portuguese. It contained six sections divided into two parts. The first part included questions relating to demographics and socioeconomic status, including information about occlusion. Parents were also requested to provide details on the health care provider's recommendations for patching their child and how many hours, on average, they were presently achieving. The second part included questions

relating to the study variables regarding parents' experiences with occlusion therapy in the last 6 months. Responses to individual items were measured on a 5-point Likert scale: 1 - totally agree; 2 - agree; 3 - meaningless; 4 - disagree; 5 - totally disagree (Table 1).

Table 1. Questionnaire administered to parents

Psychosocial variables		**Examples**
Severity		I am worried about visual problems of my child.
Self-efficacy		The visual acuity of my child is going to get better if she patches every day.
Treatment barriers	Stress perception	Patching my child is stressful.
	Limitations	When my child is patching she can't play.
	Stigma	The appearance of my child with the patch bothers me.
Percieved efficacy		I patch my child easily.
Behaviour intentions		I am going to patch my child like my health care provider recommends.
Vulnerability		If left untreated my child is going to have problems at school.

To determine the questionnaire's internal consistency, a pre-test was undertaken using a sample of 30 respondents. Cronbach's alpha was used to evaluate internal consistency for each variable. The internal consistency estimate of reliability for each variable was as follows: severity (α = 0.63); self-efficacy (α = 0.77); treatment barriers (α = 0.82); perceived efficacy (α = 0.88); behaviour intentions (α = 0.87) and vulnerability (α = 0.88)

After collecting the data, the association between visual outcome (no-improvement and improvement) and a number of factors was assessed. These included childrens' age, parents' age, and parents' educational level, either 'basic' (secondary education or less) or 'higher' education. Associations between visual outcome and the various components of the psychosocial variables of Roger's Protection Motivation Theory (Table 1); and interactions between perceived efficacy and self-efficacy, severity and vulnerability, and limitations and stigma were also assessed.

After initial descriptive analysis, correlational analysis was used to describe the strength and direction of two occlusion variables: prescribed occlusion reported by the health care provider and actual dose reported by parents. A logistic binary regression technique was used to estimate the odds ratio (OR) for each factor. The parameters' significance was tested with the Wald test at a 5% significance level.[21,22]

This analysis allowed the investigation of questions of interest including: (i) What is the relationship/ correspondence between occlusion recommendations from the health care provider and the patient's actual dose reported by the parents? (ii) What is the relationship between non-improvement after 6 months of treatment and parents' psychosocial variables? and (iii) What are the parents' predictors for non-improvement of visual acuity after 6 months of occlusion?

RESULTS

All 100 study participants who were approached agreed to participate in this study. The mean age of the 100 parents included in the study was 38.9 years (SD ±9.2). The mother was the most frequent participant (71%). In relation to educational level, 63% of parents had a basic education compared with 37% who had a higher education. The 100 children had a mean age of 6.3 years (SD ±2.4, range 2-8), 51% were male. Prescribed occlusion as reported by the health care providers was 3 hours in 57% of the children, between 4 and 6 hours in 31%, and 6 hours in 12%. Seventy-two percent of children demonstrated improved visual acuity after 6 months of therapy, compared with 28% who showed no improvement.

To determine if the parents were applying the recommended regime of occlusion we assessed the correspondence between recommendations from the health care provider and the patient's actual dose reported by the parents. The results show that there is a positive mild correlation between the prescribed occlusion and the actual dose (kappa = 0.54). The results illustrate discrepancies between the number of hours recommended and parental dosage. From 50 parents who had to patch their child 3 hours, only 43 (86%) complied and 7 parents (14%) were using other dosages. It is curious that some parents reported patching above the recommended dosage with six parents patching between 4 and 6 hours, and one parent patching more than 6 hours. On the other hand, from 38 parents who had to patch between 4 and 6 hours, only 22 (58%) complied. Thirteen parents (34%) reported that their child was patching 3 hours and three parents (8%) reported that their child was patching more than 6 hours.

Binary logistic regression was performed to assess the impact of 14 factors on the likelihood that respondents would have a problem with improvement of visual acuity. The full model containing all predictors was statistically significant, indicating that the model was able to distinguish between respondents whose children's visual acuity improved and those who did not. At a 5% significance level, three risk factors or predictors for no improvement after occlusion, were identified: parents' education (OR = 9.28; 95%CI 1.32-65.41, p = 0.025), treatment barriers (OR = 2.75; 95%CI 1.22-6.20, p = 0.015) and the interaction between severity and vulnerability (OR = 3.64; 95%CI 1.21-10.94, p = 0.022) (Table 2).

Severity (OR = 0.07; 95%CI 0.00-0.72, p = 0.036) and vulnerability (OR = 0.06; 95%CI 0.05-0.74, p = 0.028), when considered in isolation were identified as protective factors that promote compliance with treatment.

Table 2. Reasons for referral

Variable	Odds Ratio (95.0% Confidence interval)
Severity	0.07 (0 - 0.72)
Vulnerability	0.06 (0.05 - 0.74)
Perceived efficacy	0.15 (0.04 - 6.17)
Treatment barriers	**2.75 (1.22 - 6.20)**
Limitations	5.08 (0.29 - 89.71)
Stigma	1.62 (0.44 - 5.96)
Self-efficacy	0.45 (0.04 - 4.60)
Behaviour intentions	1.80 (0.20 - 15.98)
Parents' age	0.97 (0.91 - 1.05)
Childens' age	1.03 (0.83 - 1.29)
Parents' education	
Parents' basic education (1)	**9.28 (1.32 - 65.41)**
Parents' higher education (2)	1.45 (0.41 - 4.98)
Interactions between variables	
Perceived efficacy and Self efficacy	2.30 (0.44 - 12.07)
Severity and Vulnerability	**3.64 (1.21 - 10.93)**
Limitations and Stigma	0.60 (0.25 - 1.43)

Parents with a basic education were found to be a predictor for poor visual outcome with occlusion treatment. To better analyse this finding, Table 3 provides data for educational level and visual acuity improvement. This table shows that most of the children who did not show an improvement in visual acuity after occlusion treatment had parents with a basic education.

Table 3. Parents educational level and visual acuity improvement

Level of education	Improvement (N=72) N (% of improvement)	No Improvement (N=28) N (% of no improvement)
Basic education	44 (61.1%)	20 (71.4%)
Higher education	28 (38.9%)	8 (28.6)

Treatment barriers, such as parents who believed that patching reduced their child's activities like playing and reading, were also found to be negatively associated with visual improvement. Furthermore, the outcome in visual acuity was poorer when parents believed that their child's visual impairment was severe (severity) and associated with future implications (vulnerability). However, when severity and vulnerability were considered in isolation, they were statistically significant as variables that promote compliance.

DISCUSSION

In this study, we examined factors that may influence visual outcome after treatment with occlusion. The optimum outcome of amblyopia treatment is binocular vision, which is best promoted by an equal visual input from each eye.[5] Methodological studies to investigate the effectiveness of occlusion treatment have shown that spectacles alone are a powerful treatment for amblyopia, but that patching is superior to spectacles alone.[23]

The results of this study suggest that parents' level of education could play an essential role in the visual outcome of occlusion treatment. After 6 months of occlusion it was found that 28% of children did not demonstrate an improvement in visual acuity. It was also found that parents very often do not apply the correct dosage of occlusion recommended by the health care providers. The present study suggested that parents with lower levels of education have more difficulties in treatment implementation, resulting in a higher proportion of children with no improvement in visual acuity after 6 months of therapy. Other studies have also found this association.[9,16] In this study we found that these parents represented a risk factor 9 times higher compared with parents with a higher level of education.

The influence of parents' educational level may be related to the interaction or communication between the health care provider and the parent. Parental understanding of technical terms and psychological processes is likely to be limited and may initially be hindered by the emotional arousal engendered in the communication of the diagnosis and treatment plan. The health professional must encourage parents to verbalise doubts and contribute to their child's management to decrease anxiety, increase communication and decrease the time of treatment. Increasing a parent's understanding and thereby compliance to treatment will help lead to positive results in the child's visual rehabilitation. Instructions about treatment objectives can be useful for increasing compliance.[24] Health professionals must also involve parents in finding resolutions to problems related to patching. Parents should be encouraged to repeat instructions about their child's treatment as given by their health care provider, in order to ensure all information is correctly understood. It is essential to allow some time for any clarification of doubts the parents my have about their child's treatment.

This study also found that parents with an awareness of treatment barriers (beliefs regarding prohibition of children's activities or limitations, perceived emotional

distress and stigma) have a risk factor 2 times higher than other parents, consistent with previous published scientific work.[20] Perceived prohibition, or limitations, of the childrens' activities has been found to be negatively associated with compliance because parents have the perception that patching is preventing their children from playing, socialising and reading.

Interaction between severity and vulnerability was also identified as a risk factor for no-improvement in parents with high distress levels associated with treatment implementation, with a risk 3 times higher than other parents. Hence low compliance was influenced by vulnerability, treatment barriers and self-efficacy components associated with parents having high levels of distress.[12] On the other hand, parents with high levels of severity (parents who believe that amblyopia is a serious disease when left untreated) and vulnerability (parents who believe that their children could have amblyopia in the future) are less likely to have compliance problems.

One of the main limitations of logistic regression is that the explanatory variables must not be highly correlated with one another as this could cause problems of estimation. To understand if this could explain the difference in findings between the two psychosocial variables, severity and vulnerability, when analysed in isolation versus in interaction we assessed the correlation between variables. The correlation analysis showed a null correlation with a Pearson correlation of -0.053. These results are important because it demonstrates to health care providers the need to analyse parents' behaviour and their coping strategies in treatment implementation. The current results will help to contribute to the understanding and promotion of compliance interventions.

A further limitation of this study is related to the mechanisms by which the visual acuity improvement was assessed. We cannot exclude the learning effect from repeated testing and the use of Snellen and Sheridan-Gardiner visual acuity tests may have affected outcomes. The advantages of logMAR acuity data over the Snellen fraction are well known, and yet existing logMAR charts have not been adopted into routine ophthalmic clinical use in Portugal.

In conclusion, parents frequently do not use the correct dosage of occlusion as recommended, and parents' educational level and awareness of treatment barriers may be predictors of poor visual outcome. Future studies should be conducted to further investigate these findings and explore additional relationships between visual acuity improvement and other variables. It is also important to analyse compliance variables in children, for example their experiences of distress and anxiety during occlusion treatment and to determine whether cost-effective compliance-promoting strategies can be designed and implemented.

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