
Comparison of Different Binocular I Pad Games with Patching for Treatment of Amblyopia in Children: Pilot Study

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Abstract: Purpose- The aim of the study is to compare visual functions of children with uncorrected amblyopia treated with different binocular I Pad games and/or patching. Methods- Children with untreated amblyopia were enrolled in this pilot study. Children were divided into three groups: children treated with patching only, children attributed to play binocular snake I Pad game with patching, children attributed to play binocular blocks I Pad game with patching. Visual acuity VA, refraction, stereo acuity test, and ocular alignment tests were performed for all participants in the first visit and 4 weeks after starting treatment. Visual functions were compared between both visits. Results- A total of 18 children with untreated amblyopia participated in this study. Children were divided into three groups: Group 1= 8 children treated with patching only, Group 2= 5 children attributed to play binocular snake I Pad game with patching, and Group 3= 5 children attributed to play binocular blocks I Pad game with patching. There was no significant difference ($P > 0.05$) in gender and age between the three groups. Children showed good compliance to all patching treatment and I pad games groups. After 4 weeks, Visual acuity was improved in all amblyopic children in the form of one line improvement in patching group, two lines with binocular snake I Pad game and three lines with binocular blocks I Pad game. Moreover, stereoacuity was improved in all groups with greatest advance in blocks games group followed by snake group then patching group. Conclusion- This study demonstrated great effectiveness of both snake, and blocks binocular I Pad games on visual functions improvement for treatment of amblyopia. These games can contribute with patching in achieving better VA and stereoacuity enhancement in a shorter duration than patching alone.

Keywords: Amblyopia, I Pad Games, Patching, Stereoacuity, Visual Acuity

1. Introduction

Amblyopia (Lazy eye) was defined as “decreased vision in one or both eyes as a result of insufficient stimulation of the development of the visual system” [1]. It is clinically a change in the visual acuity between the two eyes that is equal or more to 0.2 log MAR.

The prevalence of amblyopia is varying worldwide. For

example, in Saudi Arabia, the prevalence of amblyopia is ranged between 1.3 to 3.3%. The highest prevalence of amblyopia is in Canada (4.7%), while the lowest prevalence of amblyopia was in Singapore (1.19%) [2-6]. This variation of prevalence among different countries could be due to different vision screening programs used for pre-school children, which plays a major role in detecting different visual problems. Hence, early treatment of the condition and preventing visual complications [2].

The conventional treatment of Amblyopia is patching the good eye or penalization. Although patching treatment has a significant role in improving the visual acuity in amblyopic patients, it has some disadvantages including recurrence of amblyopia, lack of commitment and the visual acuity in the amblyopic eye may not reach to normal visual standard (i.e. 6/6 in some cases) [7].

Binocular treatment is a new approach that is recommended to treat amblyopia such as playing binocular I Pad games with wearing red-blue goggles to preserve eye binocularity. Previous studies provided evidence about the efficacy of binocular I Pad treatment in improving the visual functions in amblyopic eye than patching [7, 8]. However, no one compares its outcome. Thus, the purpose of this study was to differentiate between two different binocular I Pad games in improving visual functions of amblyopic eyes in preschool children.

2. Method

2.1. Participants Recruitment

This study was approved by the ethics committee of deanship of scientific research at King Saud University. The protocol of the study was explained to each participant at the time of recruitment and informed consent was obtained according to the Declaration of Helsinki.

Children with untreated amblyopia of both genders aged from 5 to 9 years were enrolled in this pilot study. Amblyopia was defined as “best-corrected visual acuity ≥ 0.2 log MAR and an intraocular difference of ≥ 0.2 log MAR associated with the presence or history of strabismus, anisometropia, or both in an otherwise healthy child” [9].

Children with amblyopia were recruited from Pediatric ophthalmology clinic of a tertiary care hospital and were divided into three groups based on treatment: Group 1= 8 children treated with patching only, Group 2= 5 children attributed to play binocular snake I Pad game with patching, and Group 3= 5 children attributed to play binocular blocks I Pad game with patching. Children were classified based on the type and severity of amblyopia i.e. strabismic, anisometropic or combined.

2.2. Procedure

Visual acuity VA, refraction, stereoacuity, and ocular alignment tests were performed for all participants in the first visit and 4 weeks after starting the treatment. Visual Acuity was measured using Lea symbol chart, Stereo acuity was tested using titmus fly test and Refraction was tested by cyclo retinoscopy. Ocular alignment test was measured in primary position at near fixation using cover uncover and alternative cover test. Visual functions were compared between both visits.

2.3. Binocular I Pad Games

Two games were selected in this study: snake game (figure 1) and blocks game (figure 2). Although these two games

have similar mechanism in the treatment of amblyopia, they differ in the playing criteria. Snake game is a pursuit game, while blocks game is building game. The child was asked to wear red-blue goggles added to his optical correction for half an hour while playing the binocular I Pad games. These goggles present the high-contrast images to the amblyopic eye, while the low-contrast image was presented to the normal fellow eye. The blue filter placed over the amblyopic eye to provide the amblyopic eye with contrast of 100%, while the red filter placed over the fellow eye to provide contrast of 20% [9, 10]. Compliance form was designed including the time and duration of patching and playing I pad game. This form was given to parents to record treatment compliance.

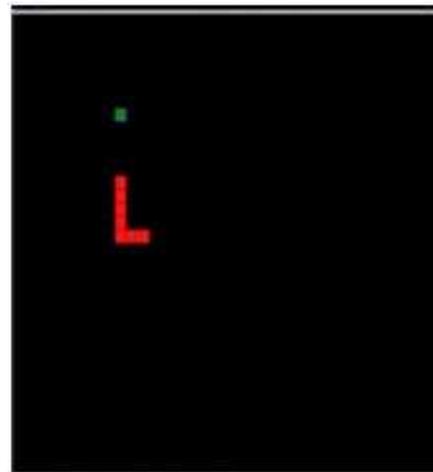


Figure 1. Binocular snake I Pad game.



Figure 2. Binocular blocks game.

2.4. Statistical Analysis

Statistical analysis was performed using SPSS version 22.0. All variables were expressed as Mean \pm Standard deviation. The paired T-test was used to evaluate the difference between measurements of each group. The confidence interval was set at 95% and probability values of $P < 0.05$ were considered statistically significant.

3. Result

A total of 18 children of both genders aged from 5 to 9 years with untreated amblyopia were enrolled in this pilot

study. There was no significant difference in gender (P value=0.7), and age (P value= 0.3) between the three groups. The characteristics of studied groups are shown in table 1.

Table 1. The characteristics of studied groups.

	Patching only N=8	Snake game +patching N=5	Blocks game +patching N=5
Age (mean±SD)	4.8±1.72	6.4±2.4	6.4±8.1
Gender M (%)	5 (62%)	2 (40%)	2 (50%)
Type of amblyopia N (%)			
Anisometropic	4 (50%)	1 (20%)	2 (50%)
Strabismic	2 (25%)	3 (60%)	-
Combined	2 (25%)	1 (20%)	2 (50%)
VA in amblyopic eye (mean±SD)	0.48±0.25	0.4±0.9	0.6±0.11
VA in normal eye (mean±SD)	0.19±0.22	0.12±0.07	0.3±0.16
Degree of amblyopia N (%)			
Mild	4 (50%)	2 (40%)	-
Moderate	3 (37.5%)	3 (60%)	5 (100%)
Severe	1 (12.5%)	-	-
Stereopsis (mean±SD)	3552±0	3552±0	3552±0

Follow up visit

After four weeks, ten children with amblyopia visited the clinic for follow up (n=4 Amblyopic children who underwent patching treatment only, n=2 children played binocular snake

game in addition to patching, n=3 children played blocks I Pad game in addition to patching). Table 2 demonstrates the visual functions of participants.

Table 2. The visual functions of children attending their follow up visit after 4 weeks.

	Patching only N=4		P value	Snake game+patching N=2		P value	Patching only N=4		P value
	1 st Visit	2 nd Visit		1 st Visit	2 nd Visit		1 st Visit	2 nd Visit	
VA	0.48±0.25	0.31±0.2	0.2	0.4±0.9	0.18±0.5	0.07	0.6±0.11	0.18±0	0.01
Stereoacuity	3552±0	1967±181	0.1	3552±0	175±106	0.005	3552±0	53±41	0.000

P value for VA <0.01

P value for stereoacuity <0.05

Visual acuity was improved in all amblyopic children in the form of one line improvement in patching group, two lines with binocular snake I Pad game and three lines with binocular blocks I Pad game. Moreover, stereoacuity was enhanced in all groups with greatest advance in blocks games group followed by snake group then patching group. The VA and stereoacuity of children who played blocks game was better than the VA of amblyopic children who played snake game (p= 0.01 & 0.000 respectively). Children showed good compliance to the specific treatment given including both patching treatment and I pad games except one child who is excluded from the study.

4. Discussion

This current study compared the visual functions (i.e. visual acuity and stereoacuity) in three groups of children with amblyopia who were treated with patching only and two different binocular I Pad games (snake and blocks games). Our data attested that binocular I Pad games augment the visual function of amblyopic eye. Previous studies confirmed that VA and stereopsis were improved in school age amblyopic children who played blocks I Pad game [8, 13] and snake game [11]. On the other hand, other studies showed no improvement [1, 7]. This is explained by the fact

that school aged amblyopic children in these studies were asked to play blocks games only without patching. This suggests that patching the sound eye is a necessity in amblyopia treatment and binocular games are the reason behind the variation in visual functions between these studies.

The present findings proclaimed a greater improvement in stereo acuity, in blocks game than in snake game. Some studies support the present results [8, 13]. However others reported no improvement for most subjects [1, 7]. This can be assigned to differences in stereo acuity tests used. Binocular games improve the visual functions of amblyopic eye and fasten the treatment of amblyopia as it reduces suppression and increase binocularity.

Children playing snake I Pad game reported that they lost their interest in continuing playing the game after three days of starting the treatment. While children who played blocks game did not have any complaints. This could be due to the different pattern of the two games as in snake game, the child was asked to keep the eye on following different located dotes in attempt to grab them, while in blocks game, the child was asked to fall blocks in order to build over them and create different forms of buildings, which could be more diverse and interesting for children in this age. This could interpret the reason of better

improvement in VA and stereo acuity in blocks groups relative to snake group.

5. Conclusion

In conclusion, this study demonstrated great effectiveness of both blocks, and snake binocular I Pad games on visual functions enhancement for treatment of amblyopia. Furthermore, these games can contribute with patching in achieving more VA and stereo acuity improvement in a shorter duration than patching alone. Although we had a small sample size and treatment remained only 4 weeks, binocular I pad games showed a good potential for treating amblyopia.

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Author Contributions

Kholoud Ahmed Bokhary: Main investigator
 Latifah Saud Aldohayan: Ophthalmic examination and data collection
 Fahmy Rania Medhat: Writing and scientific revision of the manuscript
 Abdullah Ghazi Alotaibi: Ophthalmic examination

Author Disclosure Statement

The authors declare no potential conflicts of interest with respect to the authorship, and/or publication of this article

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