

Efficacy of supplemental Occlu-pad therapy with partial occlusion in children with refractive anisometropic amblyopia

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Purpose: To study the efficacy of supplemental occlu-pad therapy with partial occlusion in children with refractive anisometropic amblyopia. **Methods:** Thirty-one children who did not improve after partial occlusion of 6 h for 6 months were supplemented with the use of occlu-pad for 1 h per day and three such sessions in a week. **Results:** The mean age was 6.8+/-1.4 years (range 5–9 years). A significant improvement of 3.2+/-1.3 lines in visual acuity was noticed at the end of 3 months of starting this supplemental therapy in children. Out of 31 children, 26 children improved at least 2 lines or more at the end of 3 months. All children ($n = 9$) having anisohyperopic amblyopia improved at the end of 3 months. **Conclusion:** Occlu-pad is useful in supplementing occlusion therapy in cases of refractive amblyopia and is more effective in anisohyperopic amblyopia.

Key words: Anisometropic amblyopia, occlu-tab, occlusion, refractive amblyopia

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Anisometropic amblyopia is a common cause of unilateral blindness in children. It results from unequal refractive error between two eyes that results in image blur which may lead to incomplete development of the visual system, and thereby, amblyopia. Patching or occlusion is the gold standard for the treatment of amblyopia. However, 15–40% of the patients may not achieve normal visual acuity despite the long course of the treatment. Most of the visual loss due to amblyopia is reversible if it is timely detected and appropriately managed.^[1-6]

Occlu-pad (Yaguchi Electric Co Ltd, Ishinomaki, Japan) is a new device which has been used to treat amblyopia and has shown promising results.^[7-10] It is basically a modified iPad created by removing the polarizing film layer from the LCD (liquid crystal display) screen. This makes the screen visible only by polarizing glasses without which the tablet display is not visible and turns into a plain white screen.^[7] We ask amblyopic children to play games or run apps on the occlu-pad using polarized glasses on amblyopic eye on top of the prescribed glasses. This will allow only the amblyopic eye to be capable of watching the app or playing the game.

We present our study of refractive amblyopia cases supplemented with patching and treated on occlu-pad and their results in 3 months.

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Methods

A total of 31 children with moderate anisometropic amblyopia who were on patching therapy for the last 6 months based on the Pediatric Eye Disease Investigator Group (PEDIG) study for moderate amblyopia were enrolled in the study done at the Baroda Children Eyecare and Squint Clinic, Vadodara.^[11,12] The study was approved by the Institutional Review Board and was cleared by the ethical committee. The patients were explained about the procedure and written consent was taken from the parents. All 31 children who were given the occlu-pad therapy were prescribed patching therapy for 6 months prior to starting the occlu-pad therapy. The children who were included in the study either did not have any improvement or had only a single line improvement over a period of 6 months despite regularly patching for 6 h per day.

Occlu-pad is a new device that will process images in such a way that only the eyes seeing through polarized glasses can see the images; this is achieved by peeling (removing) off the polarizing film layer in the display of the occlu-tab device. The patients are supposed to wear dedicated polarized glasses and play specially designed games on the occlu-tab.

The polarized glasses worn by the patients are made of the same material for both the right and left eyes. However, a polarizing film is applied on the lens of the amblyopic eye

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whereas the other eye has a light-shielding film through which only a plain white screen is seen by the fellow eye of the patient.^[7,8] So, there are two sets of glasses—one with a polarized film on the right side and one on the left side. We use the sets depending on which eye the patient has amblyopia, i.e., if the patient has amblyopia in the right eye, we use the set with the polarizing film on the right eye. As a result, the image of the games will be seen only to the amblyopic eye even if the patient is seeing through both eyes simultaneously. The specialized occlu-tab glasses were supposed to be worn on top of their full corrected prescribed glasses while playing the game on the device.^[7-10]

All the 31 children were trained for 1 h per session and there were three sessions per week at the clinic. They were advised to continue patching as they were doing before, that is, 6 h of patching of the better eye per day. The visual acuity was

measured at the end of every 1 month of therapy for 3 months and improvement of visual acuity was noted. Only the children who could do the three sessions per week and 1 h per session were included in the study. The visual acuity was again tested after 6 months to look for any recidivism after maintenance patching.

Results

A total of 31 children with mean age 6.8+/-1.4 years (range 5–9 years) in which there were 10 female and 21 male children were included in the study. The visual acuity of the patients before starting the therapy in the amblyopic eye was 0.5+/-0.2 lines, at the end of one month was 0.4+/-0.1 lines, at the end of 2 months was 0.3+/-0.2 lines, and at the end of 3rd month was 0.2+/-0.2 lines. This shows a significant improvement of 3.2+/-1.3 lines in visual acuity at the end of 3 months [Table 1]. A total

Table 1: Shows the age, sex, visual acuity, improvement in the all children on supplemental/additional occlu-tab therapy with occlusion

Age (in years)	Sex	Time				Improvement in lines
		Pretherapy	1 st month	2 nd month	3 rd month	
Visual Acuity Amblyopic Eye						
7	M	0.4	0.3	0.2	0.2	2
7	F	0.4	0.3	0.2	0.1	3
9	M	0.5	0.4	0.4	0.4	1
9	M	0.6	0.4	0.3	0.2	4
8	M	0.7	0.5	0.3	0.3	4
6	F	0.6	0.4	0.2	0.1	5
7	M	0.5	0.3	0.2	0	5
8	F	0.9	0.8	0.8	0.8	1
5	M	0.5	0.4	0.3	0	5
7	M	0.5	0.3	0.3	0.3	2
5	M	0.4	0.2	0.1	0.1	3
6	M	0.5	0.3	0.2	0.1	4
5	M	0.6	0.4	0.3	0.3	3
5	F	0.4	0.3	0.2	0	4
8	F	0.5	0.4	0.2	0.1	4
6	F	0.5	0.4	0.4	0.4	2
8	F	0.5	0.4	0.2p	0.1	4
9	F	0.4	0.3	0.2	0	4
7	F	0.5	0.3	0.2	0.1	4
8	M	0.4	0.2	0.1	0	4
5	M	0.4	0.3	0.2	0.1	3
8	M	0.8	0.5	0.5	0.5	3
9	M	0.6	0.5	0.5	0.5	1
6	M	0.5	0.3	0.2	0	5
8	M	0.5	0.4	0.4	0.4	1
6	F	0.9	0.8	0.6	0.6	3
5	M	0.4	0.3	0.2	0	4
6	M	0.3	0.1	0	0	3
5	M	0.6	0.5	0.4	0.4	2
6	M	0.5	0.3	0.1	0	5
8	M	0.4	0.3	0.3	0.3	1
Mean±SD	6.8±1.4 year	0.5±0.2	0.4±0.1	0.3±0.2	0.2±0.2	3.2±1.3
M	Male					
F	Female					

of five children showed only one line improvement over a period of 3 months. All five children were taken as suboptimal response and were anisomyopic children. These children were further evaluated and a detailed central macular thickness and multifocal Electroretinogram (ERG) was done. Three children had reduced central macular thickness and two were normal. Multifocal ERG was normal in all five children. However, one of the children had a subnormal pattern ERG.

The fact that anisomyopic children had poorer outcomes, prompted us to evaluate and compare the two groups. We found that 12 children (38.7%) were having anisohyperopic amblyopia. The mean age was 6.4+/- 1.5 years. The mean hyperopia in the amblyopic eye was 4.5+/- 2.5 diopters (D) with a mean spherical equivalent of 4+/- 2.8 D. The mean improvement in this smaller group of 12 children was 3.7+/- 0.9 lines over a period of 3 months.

The anisomyopic group had the remaining 19 children (61.3%). The mean age was 7.1+/- 1.3 years. The mean myopia in the amblyopic eye was -3.5+/- 2.9 D and a spherical equivalent of -4.4+/- 2.9 D. The mean improvement in this group was 2.9+/- 1.4 lines ($n = 19$), and if we remove the five children who showed only one line improvement, then it was 3.6+/- 1 lines, which is similar to the anisohyperopic group [Table 1].

In the group of five children who did not improve or improved only one line, the mean age was 8.4+/- 0.5 years. A mean spherical equivalent of -6.9+/- 1.1 D was seen with four children having large anisomyopia, one child had significant astigmatism. Incidentally, all of them improved only in the first month and did not show any improvement thereafter. A single line improvement does not constitute a positive response.

Discussion

Despite the best efforts, some children do not improve by occlusion therapy. One of the most common causes is compliance but multiple reasons have been suggested in the literature.^[2,3-6] We selected all the children who had already tried occlusion and either did not have any improvement or had only a single line improvement over a period of 6 months despite regularly patching for 6 h per day.^[12]

Although occlusion has been the gold standard of treating amblyopia, various options are now tried in children apart from occlusion.^[1,3,9,13] The occlu-tab uses white-screen technology to present the target images selectively to the amblyopic eye under binocular conditions through polarizing glasses.^[9] It has been successfully used in the treatment of amblyopia and has shown better adherence time than patching.^[8] However, it has not been tried in the refractive amblyopia cases not responding to patching. The improvement seen in our case series was probably due to a better adherence and active vision involvement secondary to the usage of games on the occlu-tab. The children continued the patching and were advised to add the occlu-tab in their protocol while patching as before.

Santhan Gopal *et al.* suggested that covert and overt attention increases the lateral occipital activity.^[3,14] When the child plays the games using the amblyopic eye, the overt attention mechanism is stimulated, and on doing the requisite task, the alternate covert mechanism is initiated.^[3,13,14] This would increase the top to down impulses from the posterior parietal cortex to the V1 area in the occipital cortex.^[3,13] Using

this device as a supplemental measure ensures better outcomes even in cases which are not responding to occlusion therapy in anisometropic amblyopia. We found it was more effective in the younger age and children with anisohyperopic amblyopia.

A sham treatment group would have helped in knowing the actual efficacy as these office sessions themselves may have improved the compliance.

Conclusion

Occlu-tab is a useful device to supplement occlusion in cases which do not respond to occlusion alone. It is more effective in children with anisometropia due to hyperopia than in children due to myopia.

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Conflicts of interest

There are no conflicts of interest.

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