Original Research Article

Patching with video gaming versus patching with mobile phone use in treatment of adult amblyopia: an experimental study

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ABSTRACT

Background: Adults with amblyopia are currently offered no treatment in clinical practice. Recently, it has been demonstrated that patching one eye of a binocularly normal subject with a diffuser strengthens that eye's contribution to the binocular percept when the diffuser is removed. So, this study assesses effectiveness and difference of occlusion therapy while using mobile phones and while playing video games in adult patients with amblyopia.

Methods: Subjects with refractive, anisometropic, sensory and strabismic amblyopia in 18 to 40 age year old included in the study. It's a 6 months' observational study with 2 follow-up after first visit. 66 patients were observed. The first group (n=29) give occlusion therapy while using mobile phone and second group (n=37) done occlusion therapy while playing video games. Student t-test is used to analyse vision and contrast sensitivity and analysed using statistical software SPSS (version 20.0).

Results: Out of 29 patients in first group, 18 (62%) were females, and 11 (38%) were males. Out of 37 patients in second group, 20 (54.1%) were females, and 17 (45.9%) were males. First group (patching with reading in mobile phone) had more improvement than second group (patching with video gaming) in vision and contrast.

Conclusion: Males are more adult amblyopes comparing to females (in both the groups). In case of comparing the improvement of visual acuity and contrast sensitivity. Better improvement is obtained more in contrast sensitivity during follow-up.

Keywords: Amblyopia, Contrast sensitivity, Mobile phone, Occlusion therapy

INTRODUCTION

Amblyopia is diminished vision that results from inadequate visual experience during the first years of life. Typically, amblyopia is clinically defined as reduced visual acuity accompanied by one or more known amblyogenic factors, such as strabismus, anisometropia, high refractive error, and cataract. Amblyogenic factors interfere with normal development of the visual pathways during a critical period of maturation. The result is structural and functional impairment of the visual cortex, and impaired form vision. The critical period is seen as the period of time during which abnormal visual inputs can result in amblyopia, but it is also the time during which amblyopia can be reversed by eliminating the abnormal visual inputs and, usually, occluding the normal eye for some periods of time.

However, there are now reasons to believe that these critical periods for development and treatment of amblyopia cannot be rigidly defined. Firstly, it is clear that visual acuity of the amblyopic eye is not always firmly established even after amblyopia therapy has been terminated, because the age of the patient is beyond what is generally considered to be the critical period.1

Scott and Dickey reported a short term follow up study of amblyopic patients. After patching therapy was stopped...
seventeen per cent of patients lost a line of visual acuity and 8% lost two lines or more. In a study of patients 10 years after amblyopia therapy was stopped, Gregersen and Rindziunski reported that 14% of patients lost all of the previously improved visual acuity in the amblyopic eyes, 67% of patients lost at least one line of visual acuity in the amblyopic eye.

Treatment options for adults with amblyopia isn’t magic. It is real and based on science. For decades there has been a belief among eye doctors that if a patient had amblyopia it can be only treated before 8 to 10 years only. More and more studies are there regarding adult amblyopia therapy by using the occlusion and various another method.

Video gaming has been shown to improve certain visual functions in the normal visual system. Li, Ngo proposed the use of video games to induce plasticity and improve visual function in adult amblyopia. They showed that playing either action (Medal of Honor) or no action (SimCity) video games with the fellow eye patched improved visual and stereo acuity in amblyopia. They suggested that video games induce essentially the same changes as perceptual learning- a reduction of noise and an increase in sampling efficiency. Since then, two additional studies have examined the effect of video games on amblyopia, with both binocular and monocular tasks.

Now a day’s usage of mobile phone is increasing in day by day in our life especially in young generation. Majority of the adult population is engaged in their scheduled lifestyle and most of the people like to use their mobile phones. So, we selected two groups of adult amblyopic population (age18-40 years). One group selected for occlusion while using mobile phone and second one was occlusion while doing video game. We had assessed the improvement of visual acuity and contrast sensitivity in both group and trying to identify which group was better treatment. There are so many studies going on topic related to adult amblyopia if we have any further treatment options for adult amblyopia it might be another update.

METHODS

A total of 66 subjects were recruited in the study. Written consent was obtained from all subjects after an explanation of the study details. The protocol was approved by the Ethical Committee of Little Flower Hospital of medical science and Research Centre, Angamaly. Adult amblyopia of age between 18-40 years attending to pediatric Ophthalmology unit of Little Flower eye hospital Angamaly for 1 year will be participated in the study (September 2018 to August 2019). Subjects with refractive, anisometropic amblyopia/ sensory and strabismic amblyopia in 18 to 40 age year old are to be included in the study and patients with poor compliance, follow up less than 6 months, organic amblyopic patients were excluded.

66 patients were recruited based on inclusion and exclusion criteria. After selection a detailed clinical history including age of onset, family history, birth history, developmental milestones, maternal obstetric history, systemic history, noted and recorded in all available cases. Informed consent obtained from the subjects.

The initial ocular examination- visual acuity using log MAR chart, contrast sensitivity using Pelli Robson chart, near stereopsis using TNO/Lang stereo acuity test, cover test, retinoscopic examination (dry/dilated), subjective refraction, slit lamp examination (anterior segment), fundus examination (90 D or indirect ophthalmoscope) and patients with refractive and anisometropic- amblyopia without any other ocular manifestaion selected from other types of amblyopia such as strabismic amblyopia and vision deprivation related amblyopia.

Counselling given to the patient for using mobile with occlusion. Patient should never use earphones in mobile phones while occlusion. Hand and eye coordination should be maintained during the occlusion period. It is to stimulate the near activity. Likewise, occlusion therapy during video games given to other unit. Video games given according to patient’s interest, but we have 5 different types of games patient has to choose any of from these. They are shooter games, fighting games, color contrast games (candy crush, bubble shooter, etc). Lazy eye is occluded. Occlusion time given according to the patient’s visual acuity. (according to PEDIG classification). Visual acuity, contrast sensitivity, were the parameters we assessed. Improvement of visual acuity and contrast sensitivity in 2 months regular follow up in 2 visits. Change in visual acuity is to be checked with log MAR and contrast sensitivity with Pelli-Robson.

Statistical method

Data collected was entered in MS excel and analyzed using statistical package for the social sciences SPSS (Version 20.0). Descriptive analysis was done with measures of proportion, mean, standard deviation etc. Student t-test is used to analyze vision and contrast sensitivity.
RESULTS

Out of 29 patients in first group, 18 (62%) were males, and 11 (38%) were females (Figure 1). From the paired samples test of vision, it infer that there is significant difference between first and third visit because the p-value is less than the level of significant p<0.05 and also highly correlated between these variables (Table 1).

So visual acuity is increased in the follow up visit. From independent samples test table (Table 2), it infers that there is significant difference in contrast sensitivity between first and second visit (p=0) and first and third visit (p=0.003) follow up because the p-value is less than the level of significant (p<0.05) i.e., contrast sensitivity was improved.

Table 1: Paired t-test for accessing the significance of visual acuity in pre and post intervention of first group.

| Pair   | First visit - second visit | Mean    | SD      | Std. error mean | 95% confidence interval of the difference | t-test  | df  | Sig. (2-tailed) |
|--------|---------------------------|---------|---------|-----------------|------------------------------------------|---------|-----|----------------|
| Pair 1 |                           | 0.01957 | 0.03612 | 0.00753         | 0.00395 - 0.03518                        | 2.598   | 22  | 0.016         |
| Pair 2 |                           | 0.02895 | 0.03843 | 0.00882         | 0.01043 - 0.04747                        | 3.284   | 18  | 0.004         |

Table 2: Paired t-test for accessing the significance of contrast sensitivity in pre and post intervention of first group.

| Pair   | First visit - second visit | Mean    | SD      | Std. error mean | 95% confidence interval of the difference | t-test  | df  | Sig. (2-tailed) |
|--------|---------------------------|---------|---------|-----------------|------------------------------------------|---------|-----|----------------|
| Pair 1 |                           | -0.08478| 0.09936 | 0.02072         | -0.12775 - -0.04182                      | -4.092  | 22  | 0.000         |
| Pair 2 |                           | -0.07105| 0.09177 | .02105          | -.11528 - -0.02682                       | -3.375  | 18  | 0.003         |

Table 3: Paired t-test for accessing the significance of visual acuity in pre and post intervention of second group.

| Pair   | First visit - second visit | Mean    | SD      | Std. error mean | 95% confidence interval of the difference | t-test  | df  | Sig. (2-tailed) |
|--------|---------------------------|---------|---------|-----------------|------------------------------------------|---------|-----|----------------|
| Pair 1 |                           | 0.05192 | 0.15651 | 0.03069         | -0.01129 - 0.11514                       | 1.692   | 25  | 0.0103        |
| Pair 2 |                           | 0.09000 | 0.21374 | 0.04779         | -0.01003 - 0.19003                       | 1.883   | 19  | 0.041         |

Table 4: Paired t-test for accessing the significance of contrast sensitivity in pre and post intervention of second group.

| Pair   | First visit - second visit | Mean    | SD      | Std. error mean | 95% confidence interval of the difference | t-test  | df  | Sig. (2-tailed) |
|--------|---------------------------|---------|---------|-----------------|------------------------------------------|---------|-----|----------------|
| Pair 1 |                           | -0.06346| 0.12850 | 0.02520         | -0.11536 - -0.01156                      | -2.518  | 25  | 0.019         |
| Pair 2 |                           | -0.12000| 0.22618 | 0.05058         | -0.22586 - -0.01414                      | -2.373  | 19  | 0.028         |

In second group out of 37 patients in first group, 20 (54.1%) were males, and 17 (45.9%) were females (Figure 3). From the paired samples test it infer that there is no significant difference between first and second visit and first and third visit have significant because the p value is less than the level of significant p<0.05 and also highly correlated between these variables (Table 3). From the above independent samples test table (Table 4) of contrast sensitivity it infer that there is significant difference between first and second (p=0.019) and first and third (p=0.028) follow up because the p value is less than the
level of significant. Significant improvement in vision and contrast sensitivity can be observed in the second group too.

In another similar study conducted by Lirw et al and they found playing video games (both action and non-action games) for a short period of time using the amblyopic eye results in a substantial improvement in a wide range of fundamental visual functions including visual acuity (33%), positional acuity (16%). So from comparing from the study video games either it is an action game or any other type of game along with patching of amblyopic eye can give a better results in fundamental visual functions.

In case of comparing the improvement of visual acuity and contrast sensitivity. Better improvement is obtained more in contrast sensitivity. Some patient had improvement only in contrast sensitivity not in visual acuity. In a similar study conducted by Zhou et al they try to access a new form of rapid binocular plasticity in adults with amblyopia (8 subjects). They evaluated improvement in monocular contrast sensitivity and significant improvement was observed in their study.

Most of the adult amblyopes might be facing problems in their day to day life due to their decreased visual functions. Theoretically no treatments are opted for people in this particular age. But there are more studies going on to this topic adult amblyopia. All those studies are not only based on the improvement of visual functions but also, they were using video games, prosthetic contact lens, virtual reality oculars light head moulded display for making interest on the amblyopic subjects. These all are different methods used for treating adult amblyopic patients. In all studies improvements is there. From this study we can connive one more thing that reading using mobile phone give more attention and result to the amblyopic eye rather than doing video games.

**Future scope of the study**

The treatment modalities that have chosen in this study may become a good way for treating adult amblyopia.

**CONCLUSION**

Significant improvement in visual acuity and contrast sensitivity observed in both the groups patching while reading in mobile phone and patching when playing video games. First group (patching with reading in mobile phone) had more improvement than second group (patching with video gaming). Males are more adult amblyopes comparing to females (in both the groups).

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