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Research Article

Efficacy of Vision Therapy Software (CureSee) in Amblyopia

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Abstract

A developmental disorder of spatial vision, Amblyopia is defined clinically as a decrease in visual acuity (VA) in one, or more often in both eyes, in the absence of a clear disorder or ocular disease Amblyopia is the most common cause of monocular vision loss in children [1]. Affected individuals exhibit stereo acuity impairment and abnormal binocular summation [2]. Binocular therapies designed to improve amblyopia by binocular stimulation are highly differentiated into perceptual learning and differential training.

Objective:

- To determine the efficacy of Vision Therapy software (CureSee) in Amblyopia.
- To compare Stereopsis findings before and after VT
- To compare Visual Acuity before and after VT
- To compare Vergence amplitude before and after VT.

Methodology: 68 Amblyopic Subjects who are visiting Ahooja Eye & Dental Institute, Gurugram for eye examination and Amblyopia management were taken. Patients diagnosed with Amblyopia were included as well as Patients with Ocular surgery done within 2 months and Patients with any Ocular pathology were excluded. Verbal Consent was taken and selected patients were enrolled into CureSee Vision Therapy Software management for Amblyopia. Data is collected prior and post the use of CureSee Vision Therapy Software by patients and the collected data were decoded and tabulated using the Ms. Excel 2010 computer program and IBM Statistical Package for Social Sciences (SPSS) statistics version 23.0 was used for analysis of data.

Result and Conclusion: Visual Acuity improved significantly by 0.14 LogMar to the Median Values of Right Eye and by 0.60 LogMar to the Median Values of Left Eye. Stereopsis improved from 800 ± 520 sec of arc to 60 ± 60 sec of arc with P≤0.001. PFV and NFV also improved significantly after the use of Vision Therapy Software. Results conclude that Vision Therapy software is effective in improving Stereopsis, Visual Acuity and Vergence values in Amblyopic patients.

Keywords: Vision Therapy Software; CureSee; Amblyopia

Abbreviations: Logarithm of Minimum Angle of Resolution (LogMAR); Negative Fusional Vergence (NFV); Positive Fusional Vergence (PFV); Visual acuity (VA); Vison Therapy (VT)

Introduction

A developmental disorder of spatial vision, Amblyopia is defined clinically as a decrease in visual acuity (VA) in one, or more often in both eyes, in the absence of a clear disorder or ocular disease Amblyopia is the most common cause of monocular vision loss in children [1]. Affected individuals exhibit stereo acuity impairment and abnormal binocular summation2. Binocular therapies designed to improve amblyopia by binocular stimulation are highly differentiated into perceptual learning and differential training.

Types of Amblyopia[3]:

1. Deprivation amblyopia
2. Anisometropic amblyopia
3. Strabismic amblyopia
4. Mixed amblyopia

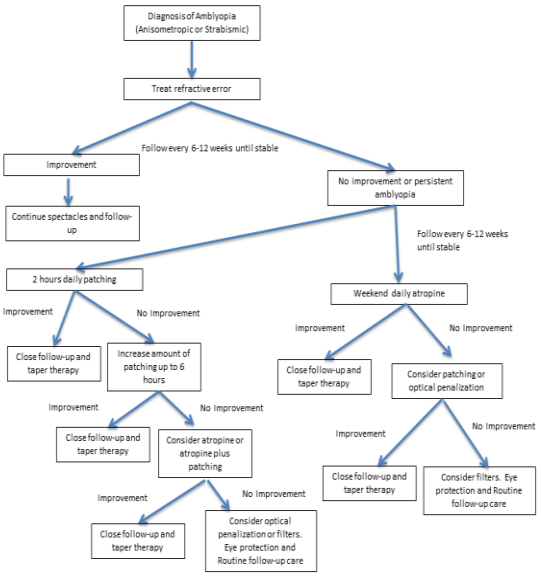
Prevalence of Amblyopia [4]:

- Global value, 1.75% (95% CI: 1.62-1.88),
- Highest rate in the European Regional Office (3.67%, 95% CI: 2.89-4.45) and
- Lowest in the African Regional Office (0.51%, 95% CI: 0.24-0.78).

Prevalence of Amblyopia in India:

Name of study	Year	Prevalence rate
V Kalikiyavi, et al. [5]	1997	1.10%
GV Murthy, et al. [6]	2002	4.40%
K Ajaneyulu, et al. [7]	2015	6.60%

Management of Amblyopia [8]:



Need of Study: The depth of amblyopia is positively correlated with the degree of binocular imbalance [9]. Affected individuals exhibit stereo acuity impairment and abnormal binocular summation. However, evidence suggests that binocular cortical communication continues in subjects with amblyopia [10]. These findings form the basis of the hypothesis that the development of these continuous binocular neural circuits can be exploited to 'awaken' the amblyopic eye. Binocular therapies designed to improve amblyopia through binocular stimulation are highly differentiated into perceptual learning and dichoptic training.

Aim and Objectives

Aim: To Find out the efficacy of Vision Therapy Software (CureSee) in Amblyopia.

Objectives:

- To compare Stereopsis findings before and after VT.

- To compare Visual Acuity before and after VT.

- To compare Vergence amplitude before and after VT.

Literature Review

In 2015, PEDIG conducted the first largely randomized controlled trial by comparing one-hour / day performance, 7 days/week of binocular gaming to 2 hours/day wrap-up for children <13 as a non-discriminatory study. There have been high-level studies examining the same type in children aged 13 to 17 years. The results of a sub-study in the small group showed improvement in 1-day/iPad game play and 2-hour/day teams with no significant differences between teams at 16-weeks. There were no side effects of treatment, especially diplopia, reduced VA of the eye or new tropia. The disappointing findings of this study were the full complement to the binocular game group. The results for the 13- to 17-year-old group were similar; the amblyopic VA eye would have been better with the iPad play, and it could have been much worse. Compliance was similarly poor, and 13% completing >75% of prescribed medications [11].

Gao, et al. compared 1 hour home play, dichoptic falling blocks video game play with a placebo game. They included participants 7 years and older. The results failed to show a significant difference in the amblyopic eye 6-week VA, the main outcome of interest. They found no significant effect on age, type of amblyopia or the effect of prior occlusion treatment [12].

Treatment of children with amblyopia by perceptual learning: In this study they tested whether the latest cognitive learning process that improved visual acuity in adults could be used to improve children's perception after conventional patching treatment was unsuccessful. A prospective clinical pilot study was carried out in children who were non-compliant with patching or in whom patching had failed despite good compliance. Each child was thoroughly tested before and after treatment. The treatment was based on a perceptual learning based process similar to the adult study [13].

Preliminary work in adult patients showed improvement in VA with citicoline and the addition of patching that was not maintained after the end of treatment. Early studies in amblyopic children were promising, showing the effect of citicoline treatment both alone and in addition to patching. A randomized controlled trial of treatment-naive participants with the addition of citicoline after the run-off phase showed a significant treatment effect within 90 days of the additional citicoline group. However, failure to show improvement in the control group (2 hours per day of adjustment) was unexpected and therefore the results of this study should be interpreted with caution [14].

Development of a computer-based system of strabismus and amblyopia treatment: In the case of amblyopia or 'lazy-eye' syndrome, treatment is usually done in two ways: by wearing a patch over a non-amblyopic eye for several hours a day or blurring the vision with a fine eye or extra power on the glasses. The disadvantage of these types of treatments is the lack of binocular vision. The proposed method maintains a visual impression. The parameter associated with strabismus can be measured very quickly using a defined system. Another advantage is that the

treatment can take place at the user's home, without time consuming visit to clinic.

Methodology:

The Purpose of this study was to determine the efficacy of Vision Therapy software in Amblyopia.

The methodology is discussed under the following topics:

1. **Area of study:**The study was conducted on amblyopic patients of Gurugram who are visiting Ahooja Eye & Dental Institute, Gurugram for their eye examination and Amblyopia management.

2. **Sample size:**68 Amblyopic Subjects who are visiting Ahooja Eye & Dental Institute, Gurugram for eye examination and Amblyopia management were selected.

3. **Inclusion criteria:** Patients diagnosed with Amblyopia

4. **Exclusion criteria:**
- Patients with ocular surgery done within 2 months.
- Patients with any Ocular pathology other than Amblyopia.

5. **Methods:**Subject who came to Ahooja Eye & Dental Institute, Gurugram for eye examination and Amblyopia management were enrolled into CureSee Vision Therapy Software management for Amblyopia. Verbal Consent was taken and Data is collected prior and post the use of CureSee Vision Therapy Software by patients

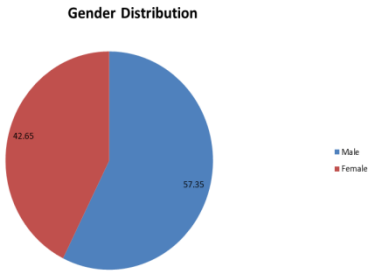
6. **Statistical analysis of data**: The collected data were decoded, tabulated and analyzed using the:

- MS- Excel 2010 computer program.
- IBM SPSS statistics version 23.0 was used for comparison of prevalence of colour vision defects in young students and working population analysis
- A critical p=0.05 was adopted.

Result and discussion: Total No. of Sample, N=68

Age and gender distribution: Median age of the subject was 20.00 ± 12.00 years

57.35% are male and 42.65% are female that have been enrolled in the study which is 39 male candidates and 29 female candidates.



Visual acuity:

- Pre Visual Acuity (OD) Median: 0.14 LogMar
- Post Visual Acuity (OD) Median: 0.00 LogMar
- 0.14 LogMar Improved
- Pre Visual Acuity (OS) Median: 0.60 LogMar
- Post Visual Acuity (OS) Median: 0.00 LogMar
- 0.60 LogMar Improved

	Pre (Median ± IQR)	**Post (Median ± IQR)**	**P**
Break	8.00 ± 2	7.00 ± 2	P=0.001
Recovery	5.00 ± 2	3.50 ± 2	P=0.002

Stereopsis:

	Pre (Median ± IQR)	**Post (Median ± IQR)**	**P**
Stereopsis	800 ± 520 sec of arc	60 ± 60 sec of arc	P≤0.001

Stereopsis improved from 800 ± 520 sec of arc to 60 ± 60 sec of arc with P≤0.001

Positive Fusional Vergence (PFV):

	Pre (median ± IQR)	**Post (median ± IQR)**	**P**
Blur	8.50 ± 6	7.00 ± 4	P≤0.001
Break	18.00 ± 9	17.00 ± 8	
Recovery	8.50 ± 9	8.00 ± 3	

Negative Fusional Vergence (NFV):

	Pre (median ± IQR)	**Post (median ± IQR)**	**P**
Break	8.00 ± 2	7.00 ± 2	P=0.001
Recovery	5.00 ± 2	3.50 ± 2	P=0.002

Discussion

Here we did study about the efficacy of Vision Therapy software in Amblyopia. Among 68 sample (N=68), Visual Acuity improved significantly by 0.14 LogMar to the median values of right rye and by 0.60 LogMar to the median values of left eye.

Stereopsis improved from 800 ± 520 sec of arc to 60 ± 60 sec of arc with P ≤ 0.001

PFV and NFV also improved significantly after the use of Vision Therapy Software.

Anaglyphic dichoptic exercises used in CureSee Vision Therapy software are effective in treatment of Amblyopia but are limited to two colors due to Anaglyphic Dichoptic principle. Thus, not much graphics can be introduced in exercises.

Conclusion

Results conclude that CureSee Vision Therapy software is effective in improving stereopsis, visual acuity and vergence values in Amblyopic patients.

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