Interactive Binocular Treatment (I-BiT™) For Amblyopia

Pilot Study with 3D Shutter Glasses

Nicola Herbison[1], Sue Cobb[2], Richard Gregson[1], Isabel Ash[1], Richard Eastgate[2], Jon Purdy[3], Trish Hepburn[2], Daisy MacKeith[1], Alexander Foss[1,2] & the I-BiT™ study group.
1. Nottingham University Hospitals NHS Trust. 2. The University of Nottingham. 3. The University of Bradford

Purpose

Conventional patching or penalisation treatment for amblyopia involves lengthy treatment times and can give disappointing results[1,2]. A computer-based interactive binocular treatment system (I-BiT™) for amblyopia has been developed. The purpose of this pilot study was to establish whether the latest I-BiT™ system prototype which utilises new 3D technology in the form of commercially available 'shutter glasses' is effective in improving visual acuity in children with amblyopia.

Figure 1: A: I-BiT™ kit including clinician and patient monitors B:Interactive video game. C: Shutter Glasses D:DVD footage as seen by left and right eye separately. Border images can be displayed to either eye.

Methods

Thirty minutes of I-BiT™ treatment was given once weekly for six weeks. Treatment consisted of playing a computer game and watching a DVD through the I-BiT™ system. Visual acuity (VA) was assessed at baseline, mid-treatment, at the end of treatment and four weeks post-treatment. This I-BiT™ system relies on the same principle as previous prototypes[3]. Images are presented to both eyes but parts of the image are presented only to the amblyopic eye to preferentially stimulate this eye.

Results

Ten patients were enrolled with strabismic, anisometropic or mixed amblyopia. The mean age was 65 months (5.4 years). Three patients had had previous amblyopia treatment. Nine patients completed the full course of I-BiT™ treatment. One younger patient was withdrawn from the study after three visits. The visual acuity for each patient is shown in Figure 2. All nine patients who completed treatment showed an improvement in VA. These improvements ranged from 0.025 to 0.45 LogMAR units with a mean of 0.18 (sd 0.143). At the end of the follow-up period, 6/9 patients (67%) who completed treatment showed a clinically significant improvement4 of 0.125 LogMAR units or more. The mean changes from baseline to weeks 3, 6 and follow-up with corresponding 95% Confidence Intervals are shown in Figure 3.

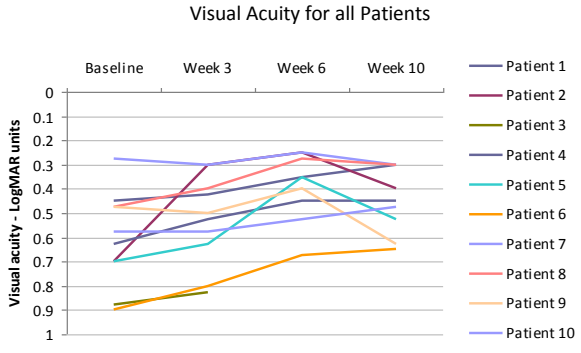

Figure 2: Visual acuity in LogMAR units for each patient pre-treatment (baseline) , mid-treatment (week 3), post-treatment (week 6) and at follow-up (week 10)

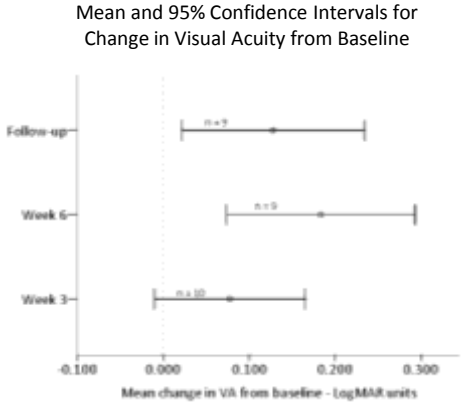

Figure 3: Mean and 95% confidence intervals for change in visual acuity (LogMAR) from baseline to mid-treatment (week 3), post-treatment (week 6) and follow-up (week 10).

Discussion

This small, uncontrolled study has shown extremely promising results. A mean improvement in VA of almost 2 logMAR lines was found with 3 hours of I-BiT™ treatment delivered over 6 weeks. Full compliance with treatment occurred in all but one patient (90%). Whilst it is recognised that this pilot study had significant limitations - it was unblinded, uncontrolled and too small to permit formal statistical analysis - these promising results suggest further investigation of I-BiT™ treatment is worthwhile.

Further Investigation

A multi-centre, parallel group, randomised controlled trial (RCT) is now underway (n=75) to further investigate the efficacy of I-BiT™ treatment. Computer software has been developed specifically for this study, and the I-BiT™ system has been granted a patent.

References

1. Woodruff G, Hiscox F, Thompson JR et al. Factors affecting the outcome of children treated for amblyopia. *Eye (Lond)* 1994 **8**, 627–31
2. Simons K, Stein L, Sener EC, Vitale S, Guyton DL. Full-time atropine, intermittent atropine, and optical penalization and binocular outcome in treatment of strabismic amblyopia. *Ophthalmology* 1997;104(12):2143-55
3. Eastgate RM, Griffiths GD, Waddingham PE, Moody AD, Butler TKH, Cobb SV, Comaish IF, Haworth SM, Gregson RM, Ash IM and Brown SM. Modified virtual reality technology for treatment of amblyopia. *Eye* 2006;20, 370–374
4. McGraw PV, Winn B, Gray LS and Elliott DB. Improving the reliability of visual acuity measures in young children. *Ophthal. Physiol. Opt*. 2000; 20;3:173-184

Acknowledgements

This study was funded by The Wellcome Trust (translational award ref: 090465). Thanks to Paul Jones (University of Hull) for programming the I-BiT™ software. Special thanks to Stephen Haworth for his part in the invention. Thanks to all members of the I-BiT™ steering group for their continued support of the project.

Conflict of interest statement: The University of Nottingham and Nottingham University Hospitals NHS Trust jointly hold the patent for the I-BiT™ system.