Glasgow Caledonian University
School of Health & Life Sciences
Study Protocol for Ethics Applications

The protocol must use these headings (if applicable) and contain the information requested. Additional headings can be added if necessary and it is expected all potential ethical issues are disclosed. The protocol should be approximately 2-3 sides of A4 for studies with no significant ethical concerns and approximately 4-5 sides of A4 for studies with significant ethical concerns. The protocol structure aligns with the research ethics toolkit (Li, et al. 2016), which is a framework for protocol writers to use when applying for research ethics.

Reference:
Li R., *et al.* 2016. Incorporating ethical principles into clinical research protocols: a tool for protocol writers and ethics committees. *Journal of Medical Ethics*, 42(4), pp. 229-234.

Study title: Light therapy as a novel treatment for myopia

Short title (optional):

Introduction:

- Background to the study and relevant literature.
- What is the scientific and/or theoretical justification for the study.

The World Health Organization (WHO) considers uncorrected refractive error due to myopia (short-sightedness) to be one of the major causes of visual impairment[1]. Over the past five decades, the prevalence of myopia in UK children has more than doubled from 10% to 23%[2]. Myopia primarily arises during childhood from excessive elongation of the eyeball which progresses for most until their late teenage years. The image is focussed in front of the retina, resulting in blurred distance vision requiring spectacles or contact lenses to correct vision. There is no 'safe level' of myopia with even low amounts increasing the risk of sight threatening pathologies such as retinal detachment[3] which leads to visual impairment. Visual impairment is associated with depression[4], reduced emotional wellbeing[5] and vison related quality of life[5]. Myopia can have major lifelong implications and, in children, poor vision and uncorrected refractive error negatively affects academic performance, attention[6] and reading performance[7]. This increase in prevalence of myopia in children will contribute to an increase in prevalence of severe eye pathology requiring specialist care in adulthood. This then places greater pressure on already stretched NHS services.

The increase in myopia in the UK has occurred too quickly to simply be due to genetics[2]. Rather, changes in lifestyle have contributed to this increase. Spending less time outdoors is a significant cause of myopia [8] which is likely due to reduced exposure to greater light intensity and subsequent impaired entrainment of the body clock (Circadian rhythm)[9]. Melatonin, the sleep hormone, is important in helping regulating

circadian rhythm. Its concentrations are greatest during the night and lowest during the day. Research reports that myopes have higher morning melatonin concentrations[10-11] demonstrating evidence that perhaps circadian rhythm, or at least melatonin concentrations, may differ in myopic children.

In the UK, the climate varies considerably by season and region[12]. These climatic challenges are likely to influence how often a child can spend outdoors. In particular, more northern parts of the UK, such as Scotland, experiences a wetter climate and has fewer hours of sunshine (Annual hours of sunshine: Scotland=1238.9hrs, England=1675.4hrs)[12]. This makes spending more time outdoors difficult and increases the risk of myopia for children living in Scotland.

Applying preventative individualised treatment strategies to reduce myopia progression in childhood can reduce the amount of myopia reached by adulthood thereby decreasing the risk of pathology and the associated effects on the individual, the community and the NHS. Consequentially, specialised myopia management contact lenses[13] and spectacle lenses[13] are available in the UK. Whilst treatments exhibit a similar efficacy on average, there is variability in treatment success[13-14]. Myopia management treatments are costly and are privately paid for by parents until myopia stabilises in late teenage years. Light therapy may provide a more affordable, non-invasive alternative to these expensive treatments and provide an alternative to spending time outdoors with the wetter climate and during the darker months of winter in Scotland. For example, over 10 years, the cost for light therapy using a SAD lamp including replacing bulbs and energy costs is approx. £240[15]. The cost for myopia management spectacles or contact lenses is approx. £3,000 and £6,000 respectively.

Light therapies (using SAD lamps) are a natural, non-invasive type of therapy. These lamps are typically used for 20-30minutes in the morning and are placed 20cm-arm's length[16]. Light boxes contain UV filters meaning there is no risk of UV damage to the eyes or skin[17]. Phototherapies are already used in the treatment of various paediatric disorders including jaundice[18], eczema[19] and seasonal affective disorder[20]. Furthermore, commercially available SAD lamps are safe to use in children over 7 years[16]. However, research exploring the potential for light therapy in myopia in humans is limited to one study in adults which found bright light therapy for 1 week promotes choroidal thickening[21] which may help combat the excessive axial elongation. Further studies exploring the potential benefits of light therapy in reducing myopia progression in children is required.

1. World Health Organisation: World Report on Vision https://www.who.int/publications/i/item/9789241516570. Accessed 22/3
2. McCullough, S.J., O'Donoghue, L. & Saunders, K.J. Six Year Refractive Change among White Children and Young Adults: Evidence for Significant Increase in Myopia among White UK Children. PLoS One 2016;11(1):1.
3. Flitcroft DI. The complex interactions of retinal, optical and environmental factors in myopia aetiology. Prog Ret Eye Res 2012;31(6):622-660.
4. Tolman J, Hill RD, Kleinschmidt JJ, Gregg CH. Psychosocial adaptation to visual impairment and its relationship to depressive affect in older adults with age-related macular degeneration. Gerontologist. 2005;45(6):747–53.
5. Finger RP, Fenwick E, Marella M, et al. The impact of vision impairment on vision-specifc quality of life in Germany. Invest Ophthalmol Vis Sci. 2011;52(6):3613–9.
6. Dudovitz RN, Izadpanah N, Chung PJ, Slusser W. Parent, teacher, and student perspectives on how corrective lenses improve child wellbeing and school function. Matern Child Health J. 2016; 20(5): 974–983.
7. Chung STL, Jarvis SH, Cheung SH. The effect of dioptric blur on reading performance. Vision Res. 2007; 47(12): 1584–1594.
8. Németh, J., Tapasztó, B., Aclimandos, W.A. et al Update and guidance on management of myopia. European Society of Ophthalmology in cooperation with International Myopia Institute. Eur J Ophthalmol 2021;31(3):853-883.

9. Lingham, G., Mackey, D.A., Lucas,R.& Yazar, S. How does spending time outdoors protect against myopia? A review. Br J Ophthalmol 2020;104(5):593-599.
10. Flanagan SC, Cobice D, Richardson PA, Sittlington JS, Saunders KJ; Elevated Melatonin Levels Found in Young Myopic Adults Are Not Attributable to a Shift in Circadian Phase. *Invest. Ophthalmol. Vis. Sci.* 2020;61(8):45. doi: https://doi.org/10.1167/iovs.61.8.45.
11. Kearney S, O'Donoghue L, Pourshahidi LK, Cobice D and Saunders KJ. Myopes have significantly higher serum melatonin concentrations than non-myopes. Ophthalmic Physiol Opt. 2017;37:557-567.
12. Met Office. Climate: UK and Regional series. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-and-regional-series. Accessed 10/30, 2021.
13. Wildsoet CF, Audrey C, Cho P et al. IMI – Interventions for Controlling Myopia Onset and Progression Report. Invest Ophthalmol Vis Sci 2019;60(3):106-131.
14. Kearney S, Seidel D & Day M. Evaluating treatment effectiveness in a case series of myopia patients. Kearney S, Seidel D & Day M. (2022) Optometry and Contact Lenses https://doi.org/10.54352/dozv.QXRF8309
15. Make Light Matter https://www.makelightmatter.co.uk/bright-light-therapy-guide/#:~:text=Energy%2Dwise%2C%20even%20the%20most,over%20one%20pence%20per%20treatment. Accessed 16/11/2022
16. Lumie®: https://lumie.fra1.digitaloceanspaces.com/4r1m3wbwookjg0jndnsxbwo6f4og Accessed 15/11/2022
17. NHS 2021: Treatment-Seasonal Affective Disorder: https://www.nhs.uk/mental-health/conditions/seasonal-affective-disorder-sad/treatment/. Accessed 05/2022
18. NICE 2016 Jaundice in Newborn babies under 28days https://www.nice.org.uk/guidance/cg98 Accessed 05/2022
19. NICE 2021 Atopic eczema in under 12s: diagnosis and management https://www.nice.org.uk/guidance/cg57/chapter/1-guidance. Accessed 05/2022
20. Swedo SE, Allen AJ, Glod CA, Clark CH, Teicher MH, Richter D, Hoffman C, Hamburger SD, Dow S, Brown C, Rosenthal NE. A controlled trial of light therapy for the treatment of pediatric seasonal affective disorder. J Am Acad Child Adolesc Psychiatry. 1997 Jun;36(6):816-21. doi: 10.1097/00004583-199706000-00019. PMID: 9183137.
21. Read SA, Pieterse EC, Alonso-Caneiro D et al. Daily morning light therapy is associated with an increase in choroidal thickness in healthy young adults. Scientific reports 2018;8(1):8200.

Study aim(s):

- Specify the study question(s) or hypothesis(es).
- The question(s) or hypothesis(es) should link to the scientific and theoretical justification provided in the introduction.

This study aims to investigate the potential benefits of morning light therapy in reducing myopia progression in children living in Scotland.

Study design and methods:

- Name the study design being used (e.g. RCT, single-case design, grounded theory).
- State the location where study will take place (e.g. online, GCU campus, or NHS).
- Describe any intervention(s) and/or study procedure(s) (e.g. motivational interviewing, exercise bike).
- Explain how data will be collected (e.g. online survey, interviews).
- Attach copies of any data collection tools being used (e.g. PHQ9, MMSE).
- Specify the length of time participants will be involved in the study (e.g. two half hour appointments in July 2019).

This is a prospective randomised controlled trial with 1:1 allocation of intervention and control (light therapy vs no light therapy). There is no placebo group, rather, there will be a group of children not

provided with the intervention and these children will be observed. Participants will be invited to attend the Vision Centre at Glasgow Caledonian University for two visits over a 6 month period. Visits will last between one and two hours including time for rest between measures if needed.

The intervention group will receive one SAD lamp per child to use once daily in the morning for 30minutes at 20cm (https://www.lumie.com/products/vitamin-l) for 3 months.

Following parent consultation and discussion, the following method was determined to result in optimum compliance:

The lamp will be used during the first lesson at school and brought home at weekends. The lamp can be set beside the child whilst they continue on with their school work. The lamp is slim, lightweight and portable. SAD lamps are simple to use and do not require training. However, there will be a contact point available at all times for parents and teachers to address any questions. The researcher will regularly contact parents and teachers to confirm correct set up of the lamp including pictures of the correct set up and to remind them to bring the SAD lamp to school after weekends.

Light therapy is considered safe in otherwise healthy eyes[1]. Any children with ocular pathology will be excluded. Mild side effects in healthy young people reported can include some eye strain[2]. This will be included in the risk assessment and an adverse event reporting system will be put in place to record any side effects or issues with tolerability.

Timepoints
The child and parent will attend the Vision Centre GCU both prior to and after the intervention period for a face to face appointment (Visit 1 and 3). Additionally, half way through the intervention period, questionnaire data will again be collected. This will be completed remotely with guidance from the researcher with the parent and child either by phone or online (Visit 2).

Primary outcomes measured at baseline and post intervention (Visit 1 and 3)

The applicant will supervise the work of a postgraduate researcher (Eleanor Leech) who will be a General Optical Council (GOC) registered optometrist. This will include overview of training, data collection, analysis and dissemination of results.

Ocular measures

The following information on ocular health will be measured to ensure suitability. These tests are routinely carried out in optometric practice during a routine child's eye examination.

Distance and near visual acuity
Slit lamp and fundus exam
Cover test
Accommodation measurement

Non-invasive measures of ocular biometry and refractive error (as detailed below) will be measured to monitor myopia progression. Cyclopentolate eye drops (1%) will be used. These are widely considered safe to use and are used routinely by community optometry as part of the paediatric NHS eye exam to ensure reliable results. All equipment (Zeiss IOL Master, Shin Nippon autorefractor) is based in the Vision Centre and free to use.

Salivary melatonin concentrations:

Saliva sampling is a safe, non-invasive, quick and painless method.
Participants will be asked to rinse their mouth with water 10minutes prior to salvia sampling and to avoid eating high sugar or acidic food prior to sampling.
Samples will be collected using the 'passive drool' method whereby the participant is asked to tilt their head forward slightly and let saliva pool in the floor of their mouths before drooling the sample through a saliva collection aid into a 1ml polypropylene vial. Samples will be stored at -80°C prior to analysis.

Samples will be analysed using a commercially available salivary melatonin ELISA kit. The storage of samples and analysis will be conducted by an experienced biological scientist, Dr John Butcher

All samples will be stored and disposed of in accordance with the Human Tissue Act.

Biometry:

Pupil size
Central axial length
Peripheral axial length at 20 degrees
Choroidal thickness
Anterior chamber depth
Vitreous chamber depth
Corneal curvature
Body weight
Body height

Refraction:

Cycloplegic central refraction
Peripheral refraction at 20 degrees

Questionnaires

The following data will be collected using questionnaires. The questionnaires will be completed by the researcher with the parent and child present during the appointment

Questionnaires:

Questionnaire 1:
Tolerability of the SAD lamp

Questionnaire 2:
DOB, gender, ethnicity
General health
Parental myopia
Current spectacle prescription
Time spent outdoors
Time spent reading
Reading distance and frequency of breaks from reading

Questionnaire 3:

Tayside Sleep questionnaire[3]

Midpoint of intervention (Visit 2)

Additionally, during the midpoint of the intervention period, Questionnaires 1, 2 (general health, spectacle prescription, time outdoors and reading questions only) and 3 will be used to collect data.

Timeline: Months 0-2 (June-July): Recruitment and advertising
Months 3-5 (August-October): Baseline data collection
Months 6-9 (November to January): implementation of SAD lamps, tolerability data collected
Months 10-11 (February-April): Data collection post intervention
Month 11-12: (April-May) Data analysis and write up

1. Brouwer, A., H-T Nguyen, Snoek, F.J., van Raalte, ,D.H., Beekman, A.T.F., Moll, A.C. & Bremmer, M.A. 2017, "Light therapy: is it safe for the eyes?", *Acta Psychiatrica Scandinavica,* vol. 136, no. 6, pp. 534-548.
2. Botanov, Y. & Ilardi, S.S. 2013, "The acute side effects of bright light therapy: a placebo-controlled investigation", *PloS one,* vol. 8, no. 9, pp. 1.
3. McGreavey JA, Donnan PT, Pagliari HC, Sullivan FM. The Tayside children's sleep questionnaire: a simple tool to evaluate sleep problems in young children. . Child Care Health Dev 2005;31(5):593-544.

Data management:

- Will the study collect data (or personal data)?
- What data (or personal data) will be collected (e.g. names, matric number)?
- Who will collect data (or personal data)?
- Who will have access to data (or personal data)?
- How will data (or personal data) be used?
- Where and how will data (or personal data) be stored (e.g. on a password protected GCU computer drive)?
- When and by whom will anonymisation occur?
- When and how will data (or personal data) be destroyed (e.g. confidentially after five years)?
- Will the study adhere with GCU data security and data protection/GDPR legislation?

Children will be randomly selected for light therapy.
In order to maintain confidentiality, all study reports and communication regarding the study will identify the participants by their study ID number. Participant confidentiality will be maintained at every stage and will not be made publicly available to the extent permitted by the applicable laws and regulations. Computers where information will be stored will be password protected.

All essential documentation will be stored securely and access will be restricted to authorised personnel. All study documentation and data will be archived as per regulatory requirements

Choice of control group and standard care (if applicable):

- Will the study use a control group?
- What will participants in the control group receive (e.g. usual care)?

The control group will be matched by age, ethnicity, refraction and parental myopia to the intervention group. The control group will continue to wear their normal refractive correction (spectacles) and will be monitored. Children in both the light therapy and control group will be asked to refrain from

commercially available myopia management contact lenses and spectacles for the 6 months of the study to ensure that any change in myopia progression can be attributed to the light therapy.

Delaying myopia management by 6 months is unlikely to significantly affect the child's overall myopia progression, as the treatment effects observed with current available myopia management spectacles/ contact lenses over the course of 12 months (longer than the current light therapy study) are clinically small:

Lam et al. (2020)[1] found that the myopia progression of subjects who wore their normal refractive correction was only 0.25D greater per year than subjects wearing myopia management spectacles spectacles.

For context, 0.25D is the smallest detectable change in refractive error and is within the limits of normal variation or 'noise' during refractive measurements. Indeed, according to Smith (2006)[2], the standard uncertainties with 95% confidence for subjective and objective refraction are 0.42D and 0.76D respectively, which are almost 2 and 3 times greater than the expected 0.25D difference between the control and treatment groups. Variation in refractive error and visual acuity measures can occur for several reasons, including (but not limited to) physiological factors (pupil size, accommodation), psychological factors (e.g. a patient may experience hesitancy or worry over answering incorrectly), differences in chart type, background illumination, refractive technique and instrument errors[2].

All individuals with myopia are at risk of potentially sight-threatening ocular conditions, such as glaucoma, retinal detachment and myopic macular degeneration[3,4,5]. However, the likelihood of developing myopia-related diseases increases substantially with 1D or more of myopia progression (an estimated 67% increase in prevalence of myopic macular degeneration with every 1D increase in myopia[3] and is much greater for those with high myopia (SER ≤ -6.00D)[5]. Therefore, the minor changes in refractive error that are expected by delaying myopia management treatment by 6 months are unlikely to have a significant impact on the individual's risk of developing myopia-related pathology in later life.

Before participating in the study, the parent or guardian will be made aware that they must refrain from optical myopia management options for the 6 month study duration. This information will be clearly detailed within the Parent Information Sheet and will be discussed with the parents and child before commencing the study. In addition, it will be made clear that parents and children can withdraw from the study at any time, without giving a reason, and their ongoing eyecare will not be affected.

References:

1. Lam, C.S.Y., Tang, W.C., Tse, D.Y., Lee, R.P.K., Chun, R.K.M., Hasegawa, K., Qi, H., Hatanaka, T. and To, C.H. (2020) 'Defocus Incorporated Multiple Segments (DIMS) spectacle lenses slow myopia progression: a 2-year randomised clinical trial', *British Journal of Ophthalmology,* 104(3), pp. 363-368. doi: 10.1136/bjophthalmol-2018-313739.
2. Smith, G. (2006) 'Refraction and visual acuity measurements: what are their measurement uncertainties?', *Clinical and Experimental Optometry,* 89(2), pp. 66-72. doi: 10.1111/j.1444-0938.2006.00022.x.
3. Bullimore, M.A. and Brennan, N.A. (2019) 'Myopia Control: Why Each Diopter Matters', *Optometry and Vision Science,* 96(6), pp. 463-465. doi: 10.1097/OPX.0000000000001367.
4. Flitcroft, D.I. (2012) 'The complex interactions of retinal, optical and environmental factors in myopia aetiology', *Progress in Retinal and Eye Research,* 31(6), pp. 622-660. doi: 10.1016/j.preteyeres.2012.06.004.
5. Haarman, A.E.G., Enthoven, C.A., Tideman, J.W.L., Tedja, M.S., Verhoeven, V.J.M. and Klaver, C.C.W. (2020) 'The Complications of Myopia: A Review and Meta-Analysis', *Investigative Ophthalmology & Visual Science,* 61(4), pp. 1-19. doi: 10.1167/iovs.61.4.49.

Inclusion and exclusions criteria:

- List inclusion criteria (e.g. adult, student, living with long-term condition).
- List exclusions criteria (e.g. child, pregnant, currently on sick leave from work).

Inclusion criteria:

- Children aged over 7 years and younger than 13 years.
- Minimum amount of -0.50D spherical equivalent refraction (SER) of myopia.
- Best corrected distance visual acuity of at least 0.3 logMAR in each eye.

Exclusion criteria:

- Myopia level of -10D or greater in either eye.
- Astigmatism of 4D or greater in either eye.
- Presence of significant ocular co-morbidities.
- Amblyopia in either eye.
- Previous use of myopia management treatments.
- Allergy to cyclopentolate eye drops.
- Use of atropine eye drops in the previous year
- Taking melatonin supplements
- Travelled across more than one time zone in the past month

Recruitment of participants:

- Anticipated sample size (e.g. 5 participants).
- Sampling method (e.g. convenience).
- Recruitment methods and copies of any advertisements/emails (e.g. social media, posters).
- Who will make first contact with potential participants (e.g. the gatekeeper)?
- How will the first approach to potential participant be made (e.g. email sent by gatekeeper)?
- Will potential participants be asked more than once to participate (e.g. a reminder email will be sent after four week)?

It is predicted that the light therapy will result in a similar reduction in progression as myopia management spectacle and contact lenses. Based on this, sample size calculations indicate that 50 myopes will be required: 25 in treatment group and 25 in control group (significance of 0.05, power 90%, detect a difference of 0.31D between groups), accounting for drop out of at least 20%. Previous research by the applicant indicates that in the Greater Glasgow area alone, over 9,000 children accessed NHS spectacles for myopia in the year 2018[1] indicating that the sample size is likely to be met within the local area.

The study will be advertised using email, social media and it will be advertised to children currently on the waiting list for the Myopia Management clinic at GCU. ~~Additionally, a stratified random sample of schools will be selected within the local area. Contact will be made with the relevant school head and if agreed, participant information sheets provided to children to take home to parents containing the researcher contact details if parents have any questions or if they wish to participate.~~
Local Optometrists and Optometric practices will be contacted with details of the study and asked to pass information onto the parents or carers of any potentially suitable children they see. Additionally, the R-Cade children's gaming club will be asked to pass information onto parents and carers.

Parents will be invited to email the researcher if they are interested in participating. For children recruited, parent email addresses will be stored securely on a password protected document on a GCU laptop.

Only healthy normal children with myopia will be invited to participate in both the control and intervention group. The light therapy group will be matched by age, ethnicity, parental myopia and refractive error to the control group. Potential participants be asked more than once to participate whereby a reminder email will be sent after 2 weeks. Children on the waiting list for the Myopia Management clinic at GCU will be offered to take part.

Data will be collected at baseline (before light therapy) and after three months of light therapy after the winter months (post light therapy)

1. Kearney S, Strang NC, J Lewsey, A Azuara-Blanco, S Jonuscheit. Socio-economic differences in accessing NHS spectacles amongst children with differing refractive errors living in Scotland. Eye https://doi.org/10.1038/s41433-021-01536-8

Consent:

- When and how will potential participants learn about the study?
- When and how will potential participants receive the participant information sheet?
- When and how will potential participants be able to ask questions?
- Will written consent be used?
- When and how will consent be secured?
- Who will be responsible for securing informed consent prior to starting the study?
- Will participants be told they can withdraw from the study?

Participant information sheets will be issued by email before attending the GCU Vision Centre. A physical copy will also be issued on arrival for their appointment. Participants and their parents are encouraged to ask questions at any point during the study, either by email or in person when attending for their appointment.

Informed consent from the parents and informed assent from the subject will be obtained before conducting the study. This will be secured when the participant and their parent arrive for their appointment. The researcher will confirm that the parents and child have read the information sheet and understand the nature of the study. The researcher will provide the opportunity for any questions before the consent form is discussed and signed by the parent. Participants are informed that they can choose to withdraw from the study at any time without it affecting their child's eyecare.

Possible harms:

- What possible harms does the study pose for participants and/or the study team?

Light therapies (also known as phototherapies) are a natural, non-invasive type of therapy. Light boxes contain UV filters to prevent harm from UV light meaning there is no risk of UV damage to the eyes or skin[1]. Phototherapies are used in the treatment of various paediatric disorders including paediatric

jaundice[2] and eczema[3]. Light therapy has been previously used in children to aid with paediatric seasonal affective disorder[4]. The lamps will be used in alignment with guidelines by the manufacturer.

Light therapy is considered safe in otherwise healthy eyes[5,6]. Any children with pre-existing ocular pathology will be excluded. Mild side effects in healthy young people reported can include some eye strain. This will be included in the risk assessment and an adverse event reporting system will be put in place to record any side effects or issues with tolerability.

The subject may experience side effects from the cyclopentolate 1% eye drops. Side effects from cyclopentolate 1% are generally minor and can include photophobia, blurred vision and temporary burning/stinging sensation on instillation. Systemic side effects are rare but could include headache, behavioural changes, gastrointestinal issues and facial flushing.

As the study involves the use of personal data, there is the potential for a breach of GDPR.
Data collection and subject participation could be affected by future COVID-19 restrictions.

As the study involves the collection of saliva, there is the potential for breach of GDPR through inappropriate storage or disposal of samples. However, samples will be stored and analysed by an experienced biological scientist Dr John Butcher and the researcher will undertake Human Tissue Act training

1. NHS 2021: Treatment-Seasonal Affective Disorder: https://www.nhs.uk/mental-health/conditions/seasonal-affective-disorder-sad/treatment/. Accessed 05/2022

2. NICE 2016 Jaundice in Newborn babies under 28days https://www.nice.org.uk/guidance/cg98 Accessed 05/2022

3. NICE 2021 Atopic eczema in under 12s: diagnosis and management https://www.nice.org.uk/guidance/cg57/chapter/1-guidance. Accessed 05/2022

4. Swedo SE, Allen AJ, Glod CA, Clark CH, Teicher MH, Richter D, Hoffman C, Hamburger SD, Dow S, Brown C, Rosenthal NE. A controlled trial of light therapy for the treatment of pediatric seasonal affective disorder. J Am Acad Child Adolesc Psychiatry. 1997 Jun;36(6):816-21. doi: 10.1097/00004583-199706000-00019. PMID: 9183137.

5. Brouwer, A., H-T Nguyen, Snoek, F.J., van Raalte, ,D.H., Beekman, A.T.F., Moll, A.C. & Bremmer, M.A. 2017, "Light therapy: is it safe for the eyes?", *Acta Psychiatrica Scandinavica,* vol. 136, no. 6, pp. 534-548.

6. Botanov, Y. & Ilardi, S.S. 2013, "The acute side effects of bright light therapy: a placebo-controlled investigation", *PloS one,* vol. 8, no. 9, pp. 1.

Steps taken to mitigate possible harms:

- How are the possible harms being mitigated by the study team?
- Is debriefing being offered to participants and/or the study team?
- Are safety procedures in places to support participants and/or the study team?

The Principal Investigator has up to date Good Clinical Practice training. The data protection act and GDPR will strictly be followed by using best security practices. The researcher will be trained in Information Security and Data Management. A certificate of completion will be required prior to their commencement in the project.

All children with allergy to cyclopentolate will be excluded. Eye drop information sheet from College of Optometrists will be provided. Parents will be advised of any potential side effects and what action (if any) is required. The researcher will be a GOC registered optometrist

SAD lamps are reported to be safe to use in adults and children. Any children with pre-existing ocular pathology will be excluded. An adverse event reporting system will be put in place to record any side effects or issues with tolerability

Data collection could be affected by future COVID-19 restrictions. The study team have experience working in a clinical environment during the COVID-19 pandemic and are familiar with various infection control protocols (eg. enhanced cleaning procedures and PPE). Adaptions to the study design, such as the virtual collection of information via phone or email, can be made if it becomes unfeasible to perform in-person examinations.

Saliva sampling is safe and non-invasive. The researcher will undergo Human Tissue Act training and sample storage and analysis will be conducted by an experienced Biological Scientist, Dr John Butcher

Possible benefits:

- What are the possible benefits associated with participating in the study?

A potential benefit of participating in the study is that the child's myopia progression may be slowed by a small amount if receiving the intervention.

On a local level, the project will be used to inform patient management decisions and support local CPD provision. The applicant has developed and is leading on a new Myopia Management CPD Module. This project and award will further evidence the speciality and expertise of the Myopia Clinic at GCU and data will be used to inform teaching to healthcare practitioners from across the UK. Nationally, the project can be used to inform guidance to health care practitioners on myopia management.

Community engagement (if applicable):

- Does the study include any patient and/or public engagement (e.g. yes/no)?
- How will patient and/or the public be involved in the study (e.g. dissemination of findings)?

PPI consultation: Patients and carers provided their views on the study design and provided insight into usefulness of the research question, study design and feasibility and dissemination of results. For example, study visits may take up to 1.5hours, PPI feedback indicated that the frequency and duration of visits were acceptable and not too intensive.

Return of results and incidental findings (if applicable):

- Will the study team notify participants of any important health related findings (e.g. high blood pressure)?
- Will the study team signpost the participants to their General Practitioner, if they find any concerning health related information?
- What steps will the study team take if a participant discloses professional misconduct and/or poor practice during the study?
- Will participants be able to access the findings from the study they were involved with?
- How will participants be able to access the findings from the study after it is completed?

Children will be receiving routine care from their community optometrist so any ocular or health related findings should already be addressed. The date of most recent eye examination will be confirmed with each subject before they participate in the study. However, if the study team identify any further health concerns then they will notify the participant and manage the findings as appropriate and according to local health guidelines. The GP will be informed if necessary. The research assistant completing the study will be a GOC registered optometrist.

Any professional misconduct or poor practice from the study team will be thoroughly investigated and addressed.

Participants will be able to access the results from the study when completed. A weblink to the published paper will be emailed to participants along with a brief explanation of the results written in lay terms.

Post-trial access (if applicable):

- Will participants be able to continue using any intervention they received during the study after it is completed?

Participants in the intervention group are permitted to keep the SAD lamps provided

Payment and/or reimbursement:

- Will participants receive any payment or reimbursement for their participation?
- How and when will participants receive payment/reimbursement?
- How much payment/reimbursement will participants receive?

There is no payment or reimbursement

Study related injury or difficulties:

- How and when will study related difficulties be reported?
- Will study related difficulties be reported to chief investigator/sponsor?
- Will study related difficulties be documented in the final report/dissemination?

Participants will be issued with a contact email address for the study team and are advised to contact the team should any issues arise. They will also be provided with an email address for someone out with the research team

A monthly 'check-in' email/text will be sent to subjects recruited to allow any study related complications to be addressed. Any difficulties which arise during the study will be documented in the final report.

Other ethical concerns:

- What other ethical issues need to be considered?

Participants will be asked to refrain from myopia management treatment during the study duration. Participants in both the intervention and control groups will still have access to normal spectacles and optometric care, which is what they would normally receive in optometry practices in the UK. This is also

part of the standard operating procedure at the Myopia Management clinic GCU whereby children are observed for a period of up to 12 months to determine rate of progression before starting treatment.

A control group is necessary to provide information on the effectiveness of light therapy in children living in the UK, and allows a direct comparison with other studies of myopia management options such as myopia management spectacles[1-5]. As myopia progression generally declines with increasing age, a control group is required to differentiate any treatment effect from a natural reduction in progression[6]. A historical control group would be inappropriate as several factors (such as age, ethnicity, parental myopia, time spent outdoors and time spent doing near work) can influence myopia progression, thus subjects need to be matched accordingly to determine the true treatment effect[6]. A stepped wedge study design was considered[7]; however, as the treatment effects of myopia management are small, it is expected that a minimum 'step length' of 12 months would be required to produce a clinically significant difference in refractive error (0.25D). A smaller step length between the crossovers from control to intervention would not produce clinically meaningful data. As the minimum expected step length of 12 months is greater than the proposed monitoring period of the control group in the current RCT study design, a stepped wedge design was discounted.

It is expected that the difference in mean myopic SER will be 0.25D less in the treatment group compared to the control group in alignment with similar myopia management strategies such as greater time spent outdoors as an intervention[8.] It is also important to note that the risk of developing myopia-related pathology increases substantially for individuals who experience large increases in their myopia (of 1D or more) or for those with high myopia (SER ≤-6.00D). Therefore, the small differences in refractive error between the control and treatment group (expected to be around 0.25D) is unlikely to significantly increase the risk of myopia-related pathology in later life for individuals within the control group. This information will be detailed within the participant information sheet and will be discussed with the parent or guardian before they give consent for their child to participate in the study.

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The Department of Vision Sciences at GCU are currently looking to recruit children with myopia (short-sightedness) as part of a study to investigate the use of light therapy to help slow myopia progression.

The aim of this study is to determine how effective Seasonal Affective Disorder (SAD) lamps are at slowing the progression (worsening) of myopia. The study team are looking to recruit healthy children with myopia aged over 7 years but younger than 13 years.

If you are interested in taking part or would like more information, please contact:xxxx

Questionnaire 1: Tolerability of SAD Lamp

1. How many hours a day do you wear your glasses?

Monday to Friday:
Saturday and Sunday:

2. Can you see clearly with your glasses? (both when looking far away and reading?) If no, please provide details

3. Do you experience eye strain when you are using the lamp? If yes, please provide details

4. Do you experience headaches when you are using the lamp? If yes, please provide details

5. Do you experience dizziness or nausea (feeling sick or unwell) when you are using the lamp? If yes, please provide details

6. Do you notice double vision when you are using the lamp? If yes, please provide details

Questionnaire 2: Lifestyle risk factors and demography

1. What is your child's date of birth?

2. What is your child's gender assigned at birth?

3. Does your child have any health conditions?

4. Does your child take any medications?

5. Does your child have any eye problems (other than requiring glasses)?

6. What is your child's ethnicity?

- White
- Mixed/multiple ethnic groups
- Black/African/Caribbean/Black British
- Asian/Asian British (excluding Chinese)
- Chinese

7. What age did your child start wearing glasses?

8. Do any of the child's parents have myopia? (have more difficulty seeing objects far away without glasses on (for example: watching TV and driving)

    - Mother has myopia
    - Father has myopic
    - Both parents are myopic
    - Neither parent is myopic

9. How myopic is the mother and/or father? (for example right eye: -2.00D left eye: -3.00D)"

10. How many hours per day on a school day does your child spend outside (sport, playing in the garden or in the park, walking to/from school)?

11. How many hours per day on a weekend day does your child spend outside (sport, playing in the garden or in the park, walking to/from school)?

12. How many hours per day on a school day does your child spend doing near activities (homework, reading, tablet, phone)?

13. How many hours per day on a weekend day does your child spend doing near activities (homework, reading, tablet, phone)?

14. At approximately what distance does your child hold books/devices away from their eyes when they are performing a concentrated task such as reading/writing or playing a game?

15. How often does your child take a break when doing near work (reading, writing, using a tablet or phone)?

Questionnaire 3: Tayside Children's sleep questionnaire

Parents are asked about their children's sleep habits over the previous 3 months – answers are collected using a five-point, Likert-type scale that ranges from 0 (indicating that the behaviour never occurs) to 4 (meaning it happens every night).

1. How long after going to bed does your child usually fall asleep?

    - ≤ 15mins
    - 15-30mins
    - 30-45mins
    - 45-60mins
    - ≥60mins

2. Which one of the following options regarding the statement: 'The child goes to bed reluctantly' most closely applies to your child?

a) This sleep behaviour never occurs

b) This problem occurs once or twice a month
c) This problem occurs one or two times a week
d) This problem occurs between three and five nights a week
e) This problem happens every night

3. Which one of the following options regarding the statement: 'The child has difficulty getting to sleep at night (and may require a parent to be present)' most closely applies to your child?

a) This sleep behaviour never occurs
b) This problem occurs once or twice a month
c) This problem occurs one or two times a week
d) This problem occurs between three and five nights a week
e) This problem happens every night

4. Which one of the following options regarding the statement: 'The child does not fall asleep in his or her own bed' most closely applies to your child?

a) This sleep behaviour never occurs
b) This problem occurs once or twice a month
c) This problem occurs one or two times a week
d) This problem occurs between three and five nights a week
e) This problem happens every night

5. Which one of the following options regarding the statement: 'The child wakes up two or more times in the night' most closely applies to your child?

a) This sleep behaviour never occurs
b) This problem occurs once or twice a month
c) This problem occurs one or two times a week
d) This problem occurs between three and five nights a week
e) This problem happens every night

6. Which one of the following options regarding the statement: 'After waking up in the night the child has difficulty falling asleep again by himself or herself' most closely applies to your child?

a) This sleep behaviour never occurs
b) This problem occurs once or twice a month
c) This problem occurs one or two times a week
d) This problem occurs between three and five nights a week
e) This problem happens every night

7. Which one of the following options regarding the statement: 'The child sleeps in the parent's bed at some time during the night' most closely applies to your child?

a) This sleep behaviour never occurs
b) This problem occurs once or twice a month
c) This problem occurs one or two times a week
d) This problem occurs between three and five nights a week
e) This problem happens every night

8. Which one of the following options regarding the statement: 'If the child wakes, he or she uses a comforter (e.g. Dummy) and requires a parent to replace it' most closely applies to your child?

a) This sleep behaviour never occurs
b) This problem occurs once or twice a month
c) This problem occurs one or two times a week
d) This problem occurs between three and five nights a week
e) This problem happens every night

9. Which one of the following options regarding the statement: 'The child wants a drink during the night' most closely applies to your child?

a) This sleep behaviour never occurs
b) This problem occurs once or twice a month
c) This problem occurs one or two times a week
d) This problem occurs between three and five nights a week
e) This problem happens every night