COPYRIGHT AND CITATION CONSIDERATIONS FOR THIS THESIS/ DISSERTATION

Creative Commons

- Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

- NonCommercial — You may not use the material for commercial purposes.

- ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.

How to cite this thesis

The effect of a homoeopathic complex eye drop solution on the symptoms of computer-induced asthenopia

A research dissertation presented to the
Faculty of Health Sciences, University of Johannesburg.
as partial fulfillment for the
Master's Degree in Technology: Homoeopathy

By:

Glory Makwale
(Student number: 2011005581)

Supervisor: _______________  Date: 26/10/2016
Dr J. Pellow
M.Tech Hom (TWR)

Co-supervisor: _______________  Date: 26/10/2016
Ms S.M. Richter
B. Optom (RAU); M. Phil (RAU); M. Cont (UJ); CAS (NECO); FDO (SA); FAAO
ABSTRACT

Computer-induced asthenopia (eyestrain) is defined as fatigue of the ciliary and extraocular muscles from prolonged near vision work on a visual display unit (Tiwari et al., 2011). Common symptoms associated with asthenopia include: ocular discomfort; dry, red, itchy or irritated eyes; eye fatigue; intermittent diplopia at near fixation; blurred vision; and frontal headache (Sheedy et al., 2003). About 70% of computer user’s worldwide experience eye discomfort and there are an increasing number of people affected by it (Barthakar, 2013). Current conventional treatment for asthenopia involves ergonomic measures, eye drops to help with eye moisture, occupational glasses, correction of refractive errors and punctal occlusion (Garin, 2014). The homoeopathic complex eye drop solution is a commercially available eye drop solution indicated for the relief of computer-induced asthenopia symptoms and contains *Conium maculatum* 6X, *Natrum chloratum* 6X, *Ruta graveolens* 6X and *Senega officinalis* 6X. No research to date could be found on the effect of this complex on the symptoms of computer-induced asthenopia.

The aim of the study was to determine the effect of a homoeopathic complex eye drop solution on the symptoms of computer-induced asthenopia using a Symptom Index Questionnaire.

This was a randomised, double-blind, placebo-controlled, one day study. The study took place at the University of Johannesburg (UJ) Doornfontein campus. Fifty participants between the ages of 18-35 years were recruited by means of purposive sampling. The sample group was shared with another researcher focusing on rating ocular discomfort using a visual analogue scale and assessing tear break-up time (TBUT). Participants were recruited by means of advertisements placed at the UJ Doornfontein campus with permission given. An initial consultation took place at the UJ Optometry Clinic; all potential participants were requested to read and sign the Participant Information and Consent Form and complete the Participant Selection Questionnaire. The participants who met the criteria were screened for any refractive errors using an autorefractor by a qualified optometrist. The participants who had significant refractive errors were excluded from the study. Participants proceeded to the computer lab at UJ to play a computer game for a two hour period, after which they then completed the Symptom Index Questionnaire (SIQ), evaluating the symptoms of asthenopia. Participants then returned to the computer lab and were divided into two groups: one group received the homoeopathic complex eye drop solution (treatment group) and the other group distilled water.
(placebo group). Participants placed two drops into each eye. They then played for an extra 30 minutes, and again completed the SIQ.

Data was analyzed using the following non-parametric methods: inter-group analysis was conducted with the Mann-Whitney U-test; intra-group analysis was done using the Wilcoxon-Signed Ranks test (Kuhudzai, 2015).

Intra-group analysis revealed that the placebo group showed a significant improvement over time of all symptoms evaluated, while the treatment group only improved in 8 of the 11 symptoms. Inter-group analysis indicated that there was a statistically significant difference in three symptoms (tearing eyes, frontal headache and difficulty focusing) of computer-induced asthenopia between the two groups in favour of the placebo group. Therefore it can be concluded that the homoeopathic complex eye drop solution was not more effective than the placebo in decreasing the symptoms of computer-induced asthenopia, over a short time period. Future studies could make use of a larger sample size and longer duration, and individualised homoeopathic treatment could also be investigated.
This dissertation is dedicated to my caring parents

for all their encouragement and support
Acknowledgments

I wish to thank the following:

My parents, brothers, Lindiwe, and Tshepo, for all your love; encouragement and support throughout my long years of studying.

My supervisor Dr. Pellow, for all your assistance and guidance in making this dissertation presentable.

My co-supervisor Ms S.M. Richter, for providing me with the necessary information to make this dissertation possible and conducting eye-screen tests on the participants.

Dorothy, for providing me with the necessary information regarding the medication.

The individuals who participated in this study, your time and effort were greatly appreciated. Without you this dissertation would not have been possible.

Anesu Kuhudzai for analysing the results of this study.

Mogashoa’s family for the love, warmth and support throughout the years of my upbringing.

My friends, for the long lasting friendships and support.
Table of Content

DECLARATION................................................................................................................................. i
ABSTRACT ........................................................................................................................................ ii
DEDICATION ................................................................................................................................... iv
ACKNOWLEDGEMENTS ............................................................................................................... v
APPENDICES..................................................................................................................................... x
LIST OF TABLES ............................................................................................................................. xi
LIST OF FIGURES .......................................................................................................................... xii

CHAPTER 1 - INTRODUCTION
1.1 Introduction and epidemiology............................................................................................ 1
1.2 Aim of the study .................................................................................................................... 1
1.3 Benefits of the study .............................................................................................................. 2
1.4 Hypothesis .............................................................................................................................. 2
1.5 Null hypothesis ...................................................................................................................... 2

CHAPTER 2 - LITERATURE REVIEW
2.1 Anatomy of the eye ................................................................................................................ 3
2.2 Extra-ocular muscles of the orbit ........................................................................................ 4
2.3 Refraction and accommodation of the eye .......................................................................... 5
2.4 Visual pathway ...................................................................................................................... 6
2.5 Visual acuity .......................................................................................................................... 7
2.6 Refractive errors ................................................................................................................... 7
   2.6.1 Astigmatism .................................................................................................................. 8
   2.6.2 Hyperopia .................................................................................................................... 8
   2.6.3 Myopia ....................................................................................................................... 9
   2.6.4 Presbyopia .................................................................................................................. 9
2.7 Treatment of refractive errors ........................................................................................... 10
   2.7.1 Contact lenses .........................................................................................................10
   2.7.2 Spectacles ................................................................................................................10
   2.7.3 Refractive surgery .................................................................................................11
2.8 Asthenopia ................................................................. 12
  2.8.1 Computer-induced asthenopia ........................................... 13
  2.8.2 Factors associated with the onset of computer-induced asthenopia .......... 14
    2.8.2.1 Computer/ VDU screen ............................................... 15
    2.8.2.2 Dry eyes ............................................................... 15
  2.8.3 Symptoms of computer-induced asthenopia .................................. 16
2.9 Treatment and prevention of computer-induced asthenopia ...................... 16
  2.9.1 Ergonomic measures .................................................... 16
  2.9.2 Conventional treatment options ......................................... 17
  2.9.3 Occupational glasses .................................................... 18
2.10 Homoeopathy .................................................................. 18
  2.10.1 History of homoeopathy .................................................. 18
  2.10.2 Principles of homoeopathy ............................................... 18
    2.10.2.1 Law of Similars ....................................................... 18
    2.10.2.2 Hering's Law of Cure .............................................. 19
    2.10.2.3 The Law of Proving ................................................. 19
    2.10.2.4 The Law of Minimum Dose and Dynamisation .................... 19
    2.10.2.5 Potency and frequency prescribing guidelines ....................... 20
  2.10.3 The vital force ........................................................... 20
  2.10.4 Classical prescribing .................................................... 20
  2.10.5 Complex prescribing .................................................... 21
  2.10.6 Homoeopathic complex eye drop solution ................................ 21
    2.10.6.1 Conium maculatum 6X ............................................ 21
    2.10.6.2 Natrum mariaticum 6X ............................................ 23
    2.10.6.3 Ruta graveolens 6X ............................................... 24
    2.10.6.4 Senega 6X ........................................................ 25
2.10 Related Research ................................................................ 26
CHAPTER 3- METHODOLOGY

3.1 Research sample.................................................................................................................. 27
3.2 Research design and procedure .......................................................................................... 28
3.3 Reliability and validity........................................................................................................ 28
3.4 Data collection and analysis .............................................................................................. 29
3.5 Ethical considerations......................................................................................................... 29

CHAPTER 4- RESULTS

4.1 Introduction.......................................................................................................................... 30
4.2 Tests...................................................................................................................................... 30
  4.2.1 Wilcoxon Signed-Ranks test.......................................................................................... 30
  4.2.2 Mann-Whitney test......................................................................................................... 30
4.3 Background variables .......................................................................................................... 31
  4.3.1 Age................................................................................................................................. 31
  4.3.2 Gender and race.............................................................................................................. 32
  4.3.3 Hours of computer use per day....................................................................................... 33
  4.3.4 Duration of symptoms.................................................................................................... 33
  4.3.5 Various asthenopic symptoms......................................................................................... 34
  4.3.6 Symptom Index Questionnaire (SIQ)........................................................................... 34
4.4 Individual symptom results................................................................................................ 37
  4.4.1 Tired eyes....................................................................................................................... 38
  4.4.2 Aching eyes..................................................................................................................... 38
  4.4.3 Itchy/irritated eyes.......................................................................................................... 39
  4.4.4 Tearing eyes................................................................................................................... 40
  4.4.5 Dry eyes........................................................................................................................ 41
  4.4.6 Burning eyes.................................................................................................................. 42
  4.4.7 Double vision................................................................................................................ 43
  4.4.8 Blurry vision.................................................................................................................... 44
4.4.9 Light sensitivity
4.4.10 Frontal headache
4.4.10 Difficulty focusing

4.5 Intra-group analysis
4.6 Inter-group analysis

CHAPTER 5 - DISCUSSION

5.1 Introduction
5.2 Distribution and frequencies: screening questionnaire
5.3 Symptom Index Questionnaire (SIQ)

5.4 Factors contributing to the results
5.4.1 Simplex Vs. complex prescribing
5.4.2 Potency selection
5.4.3 Sample size
5.4.4 Compliance
5.4.5 Duration of the study
5.4.6 The placebo effect

CHAPTER 6 - CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion
6.2 Recommendations

REFERENCES
APPENDICES

APPENDIX A: Advertisement……………………………………………………………………..71

APPENDIX B: Participant information form……………………………………………………72

APPENDIX C: Participant consent form…………………………………………………………74

APPENDIX D: Participant selection questionnaire………………………………………………75

APPENDIX E: Symptom Index Questionnaire…………………………………………………..78
List of Tables

TABLE

1. Gender distribution for the treatment and placebo groups……………………………………32
2. Race distribution for the treatment and placebo groups……………………………………32
3. Number of hours of computer use for the treatment and placebo groups per day………33
4. Duration of symptoms for the treatment and placebo groups…………………………..34
5. Occurrence of symptoms…………………………………………………………………34
6. Sum total of the severity of symptoms pre-treatment……………………………………36
7. Sum total of the severity of symptoms post-treatment………………………………….37
8. Wilcoxon Signed-Ranks test for each individual symptom……………………………..47
9. Mann-Whitney U test results……………………………………………………………..48
List of Figures

2.1. Anatomy of the eye…………………………………………………………..3
2.2. Accommodation of the eye…………………………………………………6
2.3. Visual pathway of the eye…………………………………………………7
2.4. Astigmatism………………………………………………………………..8
2.5. Hyperopia……………………………………………………………………8
2.6. Myopia……………………………………………………………………..9
2.7. Prebyopia……………………………………………………………………9
2.8. LASIK VS PRK……………………………………………………………11
2.9. VDT image……………………………………………………………………15
2.10. Corrected ergonomic postures…………………………………………….17
2.11. Conium maculatum………………………………………………………22
2.12. Natrum muriaticum………………………………………………………23
2.13. Ruta graveolens…………………………………………………………24
2.14. Senega officinalis…………………………………………………………25
4.1. Bar graph showing age distribution in the treatment and placebo groups……31
4.2. overall mean values for time 1 and 2 for the treatment and placebo groups…35
4.3. Mean values for tired eyes for the treatment and placebo groups……………38
4.4. Mean values for aching eyes for the treatment and placebo groups…………39
4.5. Mean values for itchy or irritated eyes for the treatment and placebo groups…39
4.6. Mean values for tearing eyes for the treatment and placebo groups…………40
4.7. Mean values for dry eyes for the treatment and placebo groups……………41
4.8. Mean values for burning eyes for the treatment and placebo groups............42

4.9. Mean values for double vision for the treatment and placebo groups.........43

4.10. Mean values for blurry vision for the treatment and placebo groups........43

4.11. Mean values for sensitive eyes for the treatment and placebo groups........44

4.12. Mean values for frontal headache for the treatment and placebo groups......45

4.13. Mean values for difficulty focusing for the treatment and placebo groups....46
CHAPTER ONE
INTRODUCTION

1.1 Introduction and epidemiology
Visual display units (VDU’s) such as laptops, tablets, smartphones, computers, game consoles and televisions have become an essential part of our modern life both in school and at work places (Izquierdo & Townsend, 2008). Up to 90% of computer users may experience visual symptoms at one time or another with the use of VDU’s (Barthakur, 2013).

Asthenopia (eyestrain) is typically associated with near-work and symptoms include dry eyes, eye fatigue and difficulty focusing. The major cause of computer-induced asthenopia is fatigue of the ciliary and extra-ocular muscles due to prolonged accommodation and vergence required by near-vision work (Tiwari et al., 2011). The severity of the symptoms is proportional to the time spent using a VDU device and symptoms are substantially reduced after discontinuing usage; even so, the symptoms can affect work productivity and quality of life (Barthakur, 2013).

Conventional treatment for asthenopia includes correction of refractive errors, use of occupational glasses, eye drops and punctal occlusion (Garin, 2014); ergonomic measures can also be helpful (Barthakur, 2013).

Homoeopathy is a holistic treatment modality based on the “Law of Similars” (Dekkers, 2009). Homoeopathic remedies enhance the body’s own curative abilities, enabling the body to heal itself (Ahmad, 2005). Homoeopathic remedies may provide a safe complementary treatment option for asthenopia. The homoeopathic complex eye drop solution used in this study consists of Conium maculatum 6X, Natrum muriaticum 6X, Ruta graveolens 6X and Senega officinalis 6X. It is a widely available eye drop solution indicated for the relief of computer-induced asthenopia. To date, no specific research could be found on the effect of this eye drop complex on the symptoms of computer-induced asthenopia.

1.2 Aim of the study
The aim of the study was to determine the effect of a homoeopathic complex eye drop solution on the symptoms of computer-induced asthenopia using a Symptom Index Questionnaire (Appendix E).
1.3 Benefits of the study
The number of computer users is increasing rapidly, with about 70% of computer users’ worldwide experiencing eye discomfort from VDU use. Homoeopathy involves the administration of ultra-dilute medicines prepared according to a method specified in homoeopathic pharmacopoeias, aiming to stimulate the body’s ability to heal itself (Johnson & Boon, 2007). This study will contribute to the knowledge on the use of homoeopathic remedies in the treatment and management of computer-induced asthenopia, and results may lead to further research in this area.

1.4 Hypothesis
The hypothesis states that the homoeopathic complex eye solution, that consists of *Conium maculatum* 6X, *Natrum muriaticum* 6X, *Ruta graveolens* 6X and *Senega officinalis* 6X will be more effective than the placebo in reducing the symptoms of computer-induced asthenopia.

1.5 Null hypothesis
The null hypothesis states that the homoeopathic complex eye solution that consists of *Conium maculatum* 6X, *Natrum muriaticum* 6X, *Ruta graveolens* 6X and *Senega officinalis* 6X will not be more effective than the placebo in reducing the symptoms of computer-induced asthenopia.
CHAPTER TWO
LITERATURE REVIEW

2.1 Anatomy of the eye

The eye is one of the most complex organs in the body; it has a spheroid shape with an average size of 24mm in adults. The eyeball contains the optical apparatus of the visual system, occupying most of the anterior part of the orbit (Moore et al., 2010). The eye is divided into the anterior cavity or aqueous humor, which is between the cornea and the iris (refer figure 2.1), and the posterior cavity space between the iris, ciliary body and the lens, and ends at the retina (refer figure 2.1). The larger posterior cavity is also known as the vitreous chamber as it consists of a gelatinous vitreous body that stabilizes the eye, as illustrated in Figure 2.1. The smaller anterior cavity is further divided into the anterior and posterior chambers, containing the clear aqueous humor (Martini, 2009).
The three layers of the eyeball are the:

- **Fibrous outermost layer:** consists of the cornea and the sclera (Willoughby et al., 2010). The cornea refracts and transmits light to the lens and retina; it also provides protection from infections and structural damage to the deeper parts of the eye (Moore et al., 2010). The sclera protects the eye from external forces and maintains its shape as it is a form of connective tissue (Willoughby et al., 2010). This layer also serves as an attachment site for the extrinsic eye muscles (Martini, 2009).

- **Vascular middle layer:** is composed of the ciliary body, the iris and the choroid (Moore et al., 2010). The ciliary body maintains the shape of the lens and location for the aqueous production; the iris maintains the size of the pupil and controls the amount of light to the retina. The choroid is a vascular layer that provides oxygen and nutrients to the outer retinal layers (Willoughby et al., 2010).

- **Neural innermost layer:** is composed of the retina (Moore et al., 2010), a complex, layered structure of neurons that capture and process light (Willoughby et al., 2010). The pigmented part of the retina absorbs light passing through the neural part and prevents light from bouncing back. It performs preliminary processing and integrates visual information (Martini, 2009).

### 2.2 Extra-ocular muscles of the orbit

The extra-ocular muscles of the orbit consist of six muscles as well as the levator palpebrae superior muscle working together to move the eyeballs and the upper eyelids (Moore et al., 2010).

- **Levator palpebrae superior:** originates from the lesser wing of the spheroid bone, superior and anterior to the optic canal and inserts at the superior tarsus and the skin of the internal eyelids. Its main action is to elevate the superior eyelid (Moore et al., 2010). It is innervated by the oculomotor nerve (Terfera & Jegtvig, 2016).

- **Superior oblique:** originates from the body of the spheroid bone. The tendon passes through a fibrous ring and changes direction where it inserts into the sclera deep to the superior rectus muscle. It functions to abduct, depress and medially rotate the eyeball (Moore et al., 2010). It is innervated by the trochlear nerve (Terfera & Jegtvig, 2016).

- **Inferior oblique:** originates from the anterior part of the floor of the orbit and inserts into the sclera, deep to the lateral rectus muscle. Its main action is to abduct, elevate and laterally rotate the eyeball (Moore et al., 2010). It is innervated by the oculomotor nerve (Terfera & Jegtvig, 2016).
• **Inferior rectus, superior rectus, medial rectus and lateral rectus:** they all originate from the common tendinous ring and insert into the sclera, posterior to the corneo-scleral junction. The superior rectus muscle functions to elevate, adduct and rotate the eyeball medially. The inferior rectus muscle’s main action is to depress, adduct and rotate the eyeball laterally. The medial rectus muscle functions to adduct the eyeball. These three muscles are innervated by the oculomotor nerve (Terfera & Jegtvig, 2016). The lateral rectus muscle’s main action is to abduct the eyeball (Moore *et al.*, 2010) and is innervated by the abducent nerve (Terfera & Jegtvig, 2016).

### 2.3 Refraction and accommodation of the eye

Light passes through the refractive media of the eyeball which consists of: the cornea, aqueous humor, lens and vitreous humor (Moore *et al.*, 2010). The path may be bent or refracted when the light passes from one medium to another with a different density (Martini, 2009). Although the majority of the refraction is produced by the cornea, the lens converges the light again to focus the visual image onto the photoreceptors of the retina. This enables the object to be seen clearly (Sutter *et al.*, 2000).

Accommodation refers to the focusing ability of the eyes (Bhootra, 2014), via the process of changing the shape of the lens for far or near vision (Moore *et al.*, 2010). The lens is held in position by the suspensory ligaments originating from the ciliary body. The contraction and relaxation of the ciliary body produces movement of the suspensory ligaments which results to change the shape of the lens. Figure 2.2 illustrates the focus of both near and far vision; when the ring becomes smaller and the tension on the lens is reduced, the relaxed lens becomes thicker (more convex), bringing near objects into focus (near vision). When the ring becomes larger and the tension of the lens is increased, the tensed lens becomes thinner (more concave) resulting in focus of far-away objects (far vision) (Martini, 2009).
2.4 Visual pathway

The visual pathway performs the function of receiving, relaying and processing visual information. The structures within this pathway include the eyeball, optic nerve, chiasm, optic radiations, striate, cortex and extra striate associated cortices (Prasad and Galetta, 2011), as illustrated in Figure 2.3.

The visual pathway begins at the retina, where the information is passed from the photoreceptors via bipolar cells to the ganglion cells, and ends in the visual cortex of the brain. The axons from the ganglion cells converge at the optic disc and proceed as the optic nerve to the brain. At the optic chiasm in the diencephalon, half of the optic fibers from each optic tract cross over, while the other half proceed on the same side and run towards the lateral geniculate nucleus (Martini, 2009). The majority of the optic tract fibers terminates on neurons in the lateral geniculate nucleus of the thalamus and relays the input received from the eyes to the visual cortex via the optic radiations (Tsuchifani, 1997).
2.5 Visual acuity

Visual acuity is used to evaluate the acuity of central vision rated against a normal standard. The standard vision rating of 20/20 or 6/6 is defined as the level of detail seen at a distance of 20 feet (6 meters) by an individual with normal vision. The most common way to determine visual acuity is by using a Snellen chart, which consists of a series of letters or numbers decreasing in size (Segre & Heiting, 2015). On the 20/20 rating, the first number (numerator) represents the distance at which the test is done and the second number (denominator) represents the distance that the average eye can see the letters on a certain line of the eye chart (Bickley, 2013). In the example the numerator 20 refers to 20 feet. The distance can also be converted to metres.

2.6 Refractive errors

Refractive errors are the most common cause of visual impairment around the world and the second leading cause of preventable blindness (Jamali et al., 2009). Refractive error is present when parallel rays of light entering the non-accommodating eye do not focus on the retina (Coleman, 2013).
The most common refractive errors are the following: astigmatism, hyperopia, myopia and presbyopia. The symptoms which the refractive errors produce are closely linked to the associated asthenopia (Wajuihian, 2015).

2.6.1 Astigmatism
This occurs when the cornea has an irregular curvature, resulting in two focal points on two different locations (or planes) (Badrinath, 2015), as illustrated in Figure 2.4. This creates blurred vision at all working distances (Bhootra, 2014).

2.6.2 Hyperopia
Hyperopia (far-sightedness) occurs when the eye has accommodation at minimum strength, resulting in failure to focus parallel light rays entering the eye on to the retina (Singh, 2013), as illustrated in Figure 2.5. In most cases the axis of the eyeball is too short and the refraction power of the eye is weak; this leads to eyestrain, double vision and headaches, due to the fact that objects that are close appear blurry (Helveston et al., 2010).
2.6.3 Myopia

Myopia (near-sightedness) can be inherited or noticed in the early stages of childhood eye development and progresses as the body develops (Singh, 2013). Myopia occurs when the converging power of the eye’s optical system is too powerful or the axis of the eyeball is too long and the parallel light rays come to focus in front of the retina, as illustrated in Figure 2.6. This results in blurry vision of objects that are viewed at a distance (Helveston et al., 2010).

![Figure 2.6. Myopia (Helveston et al., 2010)](image)

2.6.4 Presbyopia

This occurs when there is a decrease in the ability of the crystalline lens to increase focus in order to see near objects clearly, as illustrated in Figure 2.7. This is generally found in people over the age of 40, as the lens gradually becomes rigid with age (Helveston et al., 2010). Presbyopia only refers to the fact that decreased accommodation is present and therefore can involve myopia, hyperopia or astigmatism. The main problem is that near work becomes a problem as the lens becomes more rigid (Singh, 2013).

![Figure 2.7 Presbyopia (Helveston et al., 2010)](image)
2.7 Treatment of refractive errors

There are many reasons why a person may have a refractive error. It can be inherited, environmentally induced, or due to eye surgery, amongst others.

In order to treat these refractive conditions, each patient needs to be examined properly and appropriate measures taken. This may include giving glasses, fitting the patient with contact lenses or the patient undergoing refractive surgery. In some cases patients with low refractive errors may not require compensation; small changes in refractive corrections in asymptomatic patients are generally not recommended (Prakash, 2012).

2.7.1 Contact lenses

Contact lenses can compensate for a wide range of refractive errors by acting as the initial refractive surface of the eye. There are mainly two types of contact lenses used conventionally in practice. Soft disposable lenses are made from a silicone hydrogel material that allows oxygen to reach the cornea; a soft lens is traditionally about 2-3mm larger than the iris (cornea) (Coleman, 2013). Hard contact lenses are made of a gas-permeable material to allow oxygen to the eye. A hard lens is traditionally about 4mm smaller than the iris (cornea). Physiologically a hard lens allows more oxygen to the cornea and thus is the better choice for the eye. Contact lenses provide clearer vision, as well as comfort to the eyes by minimizing the amount of light rays entering the eyes. It may however be associated with other symptoms such as dryness of the eye etc (Dhaliwal, 2015).

2.7.2 Spectacles

Spectacles (glasses) are the most commonly used means of treating refractive errors; it is a simple and safe means of compensating for a refractive error. Spectacles help to relax accommodation thus reducing the thickness of the lens of the eye and also provide comfort to the eyes (Coleman, 2013). Some spectacle lenses are tinted with a chemical that darkens them when exposed to light, preventing damage to the eye from ultraviolet light when outside (Dhaliwal, 2015). There are various types of lenses used in spectacles including convex lenses and concave lenses. Convex lenses are used in nearsighted individuals; the light passing through the lens bends towards the bottom and top of the lens pushing the focal point towards the retina. Concave lenses are used in far sighted individuals; the light passing the lens bends towards the center, pushing the focal point forward onto the retina (Heiting, 2016).
2.7.3 Refractive surgery

Refractive surgery is a procedure that changes the shape of the cornea to restore the focusing power of the eye. This is known as keratorefractive surgery, refractive keratoplasty or corneal refractive surgery, depending on the procedure used (Coleman, 2013). The two most common refractive surgeries are laser in situ keratomileusis (LASIK) and photorefractive keratectomy (PRK) as shown in Figure 2.8. LASIK is when a thin flap is made on the central part of the cornea with a microkeratome laser; the flap is lifted and a computer-controlled pulse of high ultraviolet light from an excimer laser evaporates small amounts of corneal tissue below the flap to reshape the cornea. The flap is then placed back over the lasered area and this heals with time due to epithelial regeneration. The PRK procedure needs the use of the excimer laser to reshape the cornea; the cells on the surface of the cornea are removed from the start of the procedure, which involves a cooling pulsing beam of ultraviolet light, and is not underneath the flap of the cornea as in LASIK eye surgery (Dhaliwal, 2015).

![Figure 2.8 LASIK VS PRK (Saimovici, n.d.)](image-url)
Other refractive surgeries include:

- **Laser epithelial keratomileusis (LASEK):** an epithelial flap is formed and then the epithelial cells are loosened with the use of an alcohol solution. A laser is used to reshape the cornea and then the flap is replaced.
- **Refractive lens exchange (RLE):** also known as clear lens extraction. The procedure involves making a tiny incision at the edges of the cornea to remove the natural lens of the eye and replace it with silicone. This is a safe way to correct high refractive errors.
- **EpiLASIK:** a thin cell layer is separated from the cornea and then the internal cornea is reshaped with an excimer laser.
- **Presbyopic lens exchange (PRELEX):** is a procedure in which a multifocal lens is implanted to correct presbyopia.
- **Intracorneal ring segments (ICRS):** also known as intacs, is when a tiny incision is made in the cornea and two crescent-shaped plastic rings are placed at the outer edges of the cornea. The ring flattens the cornea, changing the way light rays focus on the retina.
- **Phakic intraocular lens implants:** the plastic implant is injected through a small incision at the edge of the cornea and attached to the iris behind the pupil.
- **Astigmatic keratotomy (AK):** one or two incisions are created at the steepest part of the cornea; the incision causes the cornea to relax resulting in a rounder shape. This is a procedure used to correct astigmatism (Dhaliwal, 2015).

### 2.8 Asthenopia

Asthenopia (eyestrain) is defined as fatigue of the ciliary and extraocular muscles from prolonged near vision work. It results in temporary ocular discomfort, which may affect work productivity and quality of life (Tiwari *et al.*, 2011). This can be caused by any activity involving near work e.g. reading and computer work.

The primary cause of asthenopia results from increased vergence and accommodation in near work to keep everything in focus. There are two types of asthenopia namely: muscular and refractive asthenopia (Amalia *et al.*, 2010). Muscular asthenopia is due to the inability of the eyes to maintain fixation on the task (Saunder, 2007) and it is mostly convergence insufficiency that is involved (tendency of the eyes to drift outward when reading or doing close work) (Borsting *et al.*, 2011).
Refractive asthenopia is due to ametropia (uncorrected refractive error present), onset of presbyopia, or a presence of uncorrected refractive error in combination with accommodative and convergence insufficiencies (inability to maintain binocular function) (Amalia et al., 2010).

2.8.1 Computer-induced asthenopia
The number of computer users is increasing rapidly worldwide, with an estimated 1 billion people using computers in 2008 (Bhanderi et al., 2008), and 5.3 million computer users in 2006 in South Africa (Goldstuck & Laschinger, 2006). Between 64% - 90% of computer users will experience symptoms of asthenopia and it is likely that this number will increase over the years due to increased use (Rosenfield et al., 2010) of electronic devices. In addition to computer users, it is estimated that there are over 3 billion internet users in the world (Internetlivestats.com, n.d) and 14 million internet users in South Africa (Nevill, 2013). In South Africa it is estimated that people spend an average of 431 minutes (7.2 hours) every day looking at cell phones, tablets and other VDU’s. That breaks down to 115 minutes spent watching TV, 126 minutes in front of a computer or laptop, 127 minutes on a smartphone and 63 minutes with a tablet (Berthelette, 2014).

Computer-induced asthenopia occurs at a significant rate and can result in health problems and decreased efficiency at work (Vilela et al., 2015). Han et al. (2013) conducted a study on the prevalence of asthenopia among college students and identified associated risk factors for this condition which includes: psychological state, environmental conditions and dietary habits. One thousand five hundred students were selected according to a multi-stage stratified cluster sampling method. The results showed that in 57% of students a relationship between computer use and asthenopia exist. A similar study by Studeli and Menozzi (2003) on the effect of subjective and objective workload on asthenopia at VDU’s was conducted. The study aimed to investigate ergonomic factors, as well as psychological factors. The results showed that psychological factors had minimal effect when compared to ergonomic factors, which tend to increase the occurrence of asthenopic complaints during computer work. Shrestha et al. (2011) conducted a study on visual problems among VDU users; the purpose of the study was to evaluate the major symptoms and their associations among VDU users. The outcome was that the most common symptoms reported were accommodative insufficiency and eye fatigue.
A study done by Wajuihian (2015) on the prevalence of asthenopia in relation to refractive errors in a clinical setting concluded that the most common symptom of asthenopia is headaches, and astigmatism is the most frequent cause. Agarwal et al. (2013) evaluated factors contributing to ocular complaints in computer users, through a community-based study of 150 participants. The study found that eyestrain is the most common symptom in computer users working for more than 6 hours a day.

2.8.2 Factors associated with the onset of computer-induced asthenopia

The following factors are associated with an increased incidence of asthenopia:

- Duration of computer use: most individuals who work on a computer for more than 4 hours daily experience eye-related discomfort or visual problems;
- Uncorrected refractive errors: Uncorrected refractive errors compound the problem of asthenopia, which may cause added fatigue with computer usage, as the eye fails to bring parallel light to the retina;
- Age >50 years: loss of near focus ability decreases with the increase in age, which further leads to symptoms of computer-induced asthenopia;
- Binocularity dysfunction, accommodation insufficiency or convergence insufficiency disorders: the major cause of computer-induced asthenopia is believed to be eye muscle fatigue due to prolonged accommodation and vergence demands;
- Ergonomic factors: improper positioning of the computer may lead to symptoms associated with computer-induced asthenopia. Numerous studies have shown that placing a computer monitor below the horizontal plane of the eye increases visual comfort;
- Psychological factors: some complaints of visual health described by VDU workers are associated indirectly to psychological distress associated with working conditions; and
- Gender: computer-induced asthenopia is more prevalent in females than males (Vilela et al., 2015).
2.8.2.1 Computer/VDU screens

Figure 2.9 VDT image (Giannattasio, 2009)

The letters on a computer screen are not as well defined as those on printed paper. The image on a computer screen is made up of tiny dots called pixels. The pixels are the result of an electronic beam striking the phosphor-coated rear surface of the screen. These characters have blurred edges, as illustrated in Figure 2.9. This results in a reduced level of contrast of the letters to the background, and it therefore places more strain on the visual system to keep it clear (Matheis, 2012).

Glare and reflections from the computer screen also make it difficult for an individual to view a computer screen for long periods (Barthakur, 2013). When the computer is positioned close to the eyes, it causes the need for increased focus and reduced eye movements. This in turn increases the demand on the visual system (Jeanette, 2014). The severity of the associated symptoms is proportional to the amount of time spent using a VDU device and are substantially reduced after discontinuing usage; even so, they can affect work productivity and quality of life (Barthakur, 2013).

2.8.2.2 Dry eyes

Another contributing factor is believed to be dryness of the eyes caused by a decreased blinking rate that occurs when focusing on a computer screen. The normal blinking rate is between 16-18 times per minute and studies have shown that during computer work, the blinking rate decreases to about 6-8 times per minute (Akinbinu & Mashalla, 2013). Conditions such as rheumatoid arthritis, Sjogren’s syndrome, systemic lupus erythematosus and medications such as antidepressants, beta-blockers and
oral contraceptives may contribute to dryness of the eyes (Andrew & Davis, 2015). Nakaishi and Yamada (1999) conducted a study on abnormal tear dynamics and symptoms of eyestrain in users of VDU’s. The study aimed to clarify the relationship between the prevalence of dry eye syndrome and the subjective symptoms of asthenopia in VDU users. The results showed that more than 30% of workers met the criteria for dry eyes associated with VDU work.

2.8.3 Symptoms of computer-induced asthenopia

Common symptoms of computer-induced asthenopia may include dry eyes (inadequate lubrication of the eyes), burning eye pain, itchy or irritated eyes, eye fatigue (failure of the eye to accommodate), difficulty focusing (inability to keep a focal point), intermittent double vision with near fixation, blurred vision (lack of sharpness of vision resulting in the inability to see fine details) and frontal headaches (aching pains localized around or between the eyes) (Amalia et al., 2010). Individuals with computer-induced asthenopia also complain of photophobia (sensitivity to light) and lacrimation (increased secretion of tears) (Akinbinu & Mashalla, 2013). These symptoms are temporary and are relieved when resting the eyes (Barthakur, 2013). The symptoms described may also be attributed to asthenopia while reading or with normal near work.

2.9 Treatment and prevention of computer-induced asthenopia

2.9.1 Ergonomic measures

There are several ergonomic measures aimed at reducing asthenopia. Lower-wattage lighting matching the amount of light in the room to the computer screen is recommended (Matheis, 2012), and anti-glare filters on the screen are helpful in reducing visual discomfort (Prakash, 2012). The computer should be positioned at least 90-100 cm away from the eye (Barthakur, 2013) and 15-20 degrees below eye level from the center of the screen, as illustrated in Figure 2.10. The 20-20-20 rule suggests that after every 20 minutes of computer use, to take a break for at least 20 seconds and look at objects 20 feet (6m) away (Matheis, 2012). Frequent blinking during computer usage minimizes dry eyes by keeping the eye surface moist (Jeannette, 2014); blinking every 3-4 seconds helps with lubrication of the eyes and one is then able to focus for longer. Eye exercises may also help to reduce asthenopia and increase fixation ability (Sorensen, 2015). Palming of closed eyes (using hands to block light) may relieve stress around the eyes and relax the eyes while taking a break from a computer.
screen. Another technique is to imagine a figure eight rotating; this exercises the muscles of the eyes and increases flexibility (Aitchison, 2016).

![Correct ergonomic postures](image)

**Figure 2.10 Correct ergonomic postures (Aiivalasit, 2015)**

### 2.9.2 Conventional treatment options

Eye drops containing astringents such as zinc sulphate are often recommended for asthenopia. They increase the blood supply to the eyes, moisten the surface of the eye, reduce slight redness and maintain the acidity and salt balance of the eye surface; some eye drops (i.e. gel format) however are high in viscosity and can therefore cause a temporary decrease in visual acuity. In severe cases of dry eyes, punctal occlusion may be helpful (Garin, 2014). This procedure helps decrease the normal drainage of tears by blocking the punctum (small opening) on the lower lid, often with a silicone punctal plug. This may improve visual acuity in dry eye individuals and reduces the symptoms of asthenopia due to a more intact tear layer in the eye. Punctal occlusion is often used as last resort if all other possibilities for relieving dry eyes have been exhausted (Karpecki & Goodman, 2006).
2.9.3 Occupational glasses
Occupational or computer glasses are specially designed for use during computer work; they help to decrease glare and reduce accommodative effort (Garin, 2014), by reducing the thickness of the lens and tension of the eye (Coleman, 2013). While occupational glasses may assist with the visual demands of viewing a computer, in some individuals asthenopic symptoms cannot adequately be compensated for by the use of these glasses (Matheis, 2012). Refractive errors can be compensated for by means of eyeglasses, contact lenses and refractive surgeries, as mentioned in section 2.6.

2.10 Homoeopathy

2.10.1 History of homoeopathy
Homoeopathy is the leading form of complementary medicine (CM) in the world and was founded by a German physician, Dr. Samuel Hahnemann (1755-1843). He developed the laws and principles of homoeopathy (Loudon, 2006). In 1789 he translated a book by William Cullen, who was one of the best physicians of that era. In the book Cullen mentioned the usefulness of Peruvian bark (cinchona) in treating malaria because of its bitter and astringent properties (Ullman, 2015). This interested Hahnemann and he decided to experiment on himself. He started taking large amounts of Cinchona bark and he noticed that he developed all the symptoms of malaria; when he stopped taking Cinchona bark the symptoms disappeared (Loudon, 2006). From this experiment Hahnemann concluded that the reason cinchona was effective was because it caused symptoms similar to those of the disease it was treating (Ullman, 2015).

2.10.2 Principles of homoeopathy

2.10.2.1 The Law of Similars
Homoeopathy is a holistic treatment modality based on the main principle, the “Law of Similars” (Dekkers, 2009). The word homoeopathy originates from the Greek words: “homoios” meaning “similar”, and “pathos” meaning “suffering” (Ullman, 2015). Hahnemann believed that if a person is ill, he could be cured by taking the medicine that produces similar symptoms if given to a healthy person (Loudon, 2006).
2.10.2.2 Hering’s Law of Cure
Hering’s Law of Cure states that cure occurs when:

- Symptoms move from the top of the body downwards, towards the extremities;
- Symptoms move from within outward to the surface of the body;
- Symptoms move from more important organs to less important ones; and
- Symptoms reappear in the reverse order of their first appearance (Griffith, 2008).

2.10.2.3 The Law of Proving
The Law of Proving is the process whereby the practitioner investigates the disease producing power of a drug. The findings constitute the reliable knowledge in respect of their capability to cure a similar symptom complex (Chauhan & Gupta, 2008). Proving is a term used for testing a substance on healthy individuals to find the characteristic symptoms it produces and then the substance is used to treat an illness with the same symptoms (Thiruvelan, 2011).

2.10.2.4. The Law of Minimum Dose and Dynamisation
The Law of Minimum Dose occurs when the vital force which sustains and maintains the body state of being is stimulated (Ullman, 2015). Homoeopathic remedies are highly diluted and potentised to minimize harm, and demonstrate neither toxicity nor addictive properties (Dekkers, 2009). Practitioners potentise remedies to enhance the body’s own curative abilities, enabling the body to heal itself (Ahmad, 2005), in the most efficient and least harmful way. Remedies undergo a process of serial dilution and succession (shaking) (Jones, 2007).

There are three main potency scales: decimal scale, centesimal scale and millesimal (LM) scale. In the decimal scale, the dilutions and triturations are prepared in the proportion of one part of the medicine to nine parts of the vehicle (1 in 10 of the original substance). In the centesimal scale the drugs are diluted in the proportion of 1 in 100. That is 1 part of the drug is diluted in 99 parts of the vehicle (Dekkers, 2009). In the LM scale, the medicine is diluted in a 1:50 000 ratio (Olenev, 2014).
2.10.2.5 Potency and frequency prescribing guidelines

- A 6x is a decimal (1 in 10) dilution. It is considered a very low potency and used mostly in chronic diseases.
- A 6c is a centesimal (1 in 100) dilution. It is a relatively low potency, also used in chronic cases.
- A 30c is a medium potency used in either acute or chronic cases.
- A 200c is a high potency remedy. It is used in acute infectious diseases and conditions with emotional or physical complaints. Usually one dose is repeated every 10 to 15 minutes in acute cases until improvement takes place. In chronic disease a single dose is given.
- A 1M is a 1000c dilution. It is used in a similar manner to the 200c dilution.
- A 10M is a 10 000c dilution, used to strengthen the patient physically, mentally and emotionally and to prevent recurrence at the end of the case. The recommended dose is one dose three times a year in adults and one dose four times a year in children.
- A CM is a 100 000c dilution used in life or death situations that demands an intense, powerful single dose.
- A LM is a (1 in 50 000) dilution that can be used in acute and chronic cases. The recommended dose is one dose daily or one dose weekly or even once a month in sensitive patients (De Schepper, 2010).

2.10.3 The Vital Force

The Vital Force is an energy that allows all living things to preserve life by adapting to environmental changes. In a human being the vital force directs the different body systems to function as a whole (Seebauer, 2006). Hahnemann used the term “spirit-like force” or “dynamics” as he believed that the vital force sustains and maintains the body in a balanced state of wellbeing and that a disease is a disorder of the vital force. When a person is sick, the vital force will produce symptoms which counteract the illness. Homoeopathic remedies act on the vital force to stimulate the immune system to heal the body (Roberts, 2005).

2.10.4 Classical prescribing

Classical prescribing is based on the selection of the remedy matching the totality of symptoms: mental, emotional and physical. The remedy stimulates the vital force which in turn stimulates the
body and maintains coherence amongst all its members. The single remedy that best matches the patients’ totality of symptoms is referred to as the similimum (De Schepper, 2010).

2.10.5 Complex prescribing
A homoeopathic complex is a mixture of several remedies in one vehicle taken in combination, based on their clinical indications (Carroll, 2015).

2.10.6 Homoeopathic complex eye drop solution:
The homoeopathic complex used in this study consists of Conium maculatum 6X, Natrum muriaticum 6X, Ruta graveolens 6X and Senega officinalis 6X. Inactive ingredients include borate buffer, purified water, silver sulphate as a preservative and sodium nitrate (SimilisanUSA.com, n.d.). According to homoeopathic principles, these remedies are indicated for the symptoms of asthenopia (Vermuelen, 2011). The homoeopathic complex eye drop solution is widely available over the counter (OTC), and is indicated for the relief of computer-induced eyestrain. The indications for each homoeopathic remedy are discussed below.

2.10.6.1 Conium maculatum 6X
Common names are poison hemlock, herb bennet and beaver poison. It is a member of the great Umbelliferae family, which is known to be poisonous at early stages of growth. It is a tall (2-4 metres) plant, found on the hedgebanks in isolated meadows in England and Europe. It has elegant foliage with white flowers (Grieve, 2014) as illustrated in Figure 2.11.
Figure 2.11 *Conium maculatum* (Marlow, 2014)

- **Pharmacological action**

*Conium maculatum* has a major effect on the central nervous system leading to ascending paralysis. It has been found to have an action on the spinal cord reflexes, decreases autonomic activity, and in large quantities cause neuromuscular blockage. It also causes nervousness, depression, dilation of the pupils and weariness (Bowman & Sanghui, 2011).

- **Homoeopathic uses**

*Conium maculatum* is homoeopathically indicated for weakness of the eye muscles with defective accommodation (Grieve, 2014). There is a sensation of pressure when reading, writing or doing fine work. There is burning lacrimation, as if salt water was inside the eyes, and the eye pains are worse at night (Vermeulen, 2011). The patient is short-sighted and cannot read for long periods without the letters running together (Grieve, 2014). It is also indicated for dimness of vision worse for artificial light. There is photophobia and lacrimation without inflammation of the eyes that is aggravated by light and heat (Boericke, 2012).
The common name is sodium chloride and it is also known as table salt. In its nature, it occurs as a mineral named *halite*. Sodium chloride consists of cubic, white crystals and granules or powder. It is colourless and transparent or translucent when found in large crystals (Lockie, 2012) as illustrated in Figure 2.12.

---

**Pharmacological action**

Sodium chloride provides regulation of water and salts in the body by means of osmotic pressure (Baxter Health, 2014). Sodium chloride is an essential part of the human diet; deficiency causes fatigue and muscle cramps. It is used to preserve food, acts as an astringent and antiseptic in mouth washes, and is found in bubble baths, bath salts and lotions. It is also used in the manufacturing of soaps and dyes (Vermeulen, 2011). Sodium chloride is also used as a vehicle for the administration of parenteral drugs, extracellular fluid replacement and management of metabolic alkalosis in the occurrence of fluid loss (Rawat, 2011).

**Homoeopathic uses**

*Natrum muriaticum* is indicated for a drawing and stiff sensation of the eye felt when moving them. The vision tends to “give out” and while reading the letters run together. There is burning and smarting in the eyes with light sensitivity and asthenopia (Cowperthwaite, 2010). The patient feels as if the
eyes are drawn together, too large and pressed outwards. Asthenopia is due to insufficiency of the internal recti muscles of the eyes (Vermeulen, 2011). The eyes feel bruised, with a headache and the presence of a zigzag appearance around all objects (Boericke, 2012).

2.10.6.3 Ruta graveolens 6X

*Ruta graveolens* is made from the herb Rue, a family member of the Rutaceae family, also known as the citrus family (Jones, 2014). It is a very bright looking plant, with grey-green foliage and four wide apart petalled bright yellow flowers. The flower head is arranged in an umbellate type raceme (Gibson, 1987) as illustrated in Figure 2.13.

![Figure 2.13 Ruta graveolens (Johansson, 2012)](image)

- **Pharmacological action**

*Ruta graveolens* has an analgesic, anti-inflammatory, antibacterial and spasmodic action. The affinities of the plant are mainly with the eyes, (especially the ocular muscles of the eyes), muscles and tendons in crude form. The plant is rich in the bioflavonoid rutin, which helps increase visual sharpness, and is useful against oedema and hypertension. It can be applied in poultices for rheumatic pains, varicose veins, tendon strains and psoriasis (Agarpanah & Khoshkam, 2012).
**Homoeopathic uses**

This remedy is indicated for eyestrain resulting in painful eyes when reading, blurred vision, a sensation of heat, and burning pains that are worse when using the eyes. Other symptoms of the eyes include lacrimation and twitching of the lower lids. Rubbing the eyes leads to smarting or watering eyes (Gibson, 1987). The eyes feel weary when reading with a deep pressure felt in the orbit; the eyes become hot, red and painful from reading fine print. This remedy is commonly indicated for asthenopia due to weakness of the ciliary muscles (Vermeulen, 2011). It is accompanied by headache and disturbances of accommodation. All symptoms are worse for exertion of the eyes (Boericke, 2012).

2.10.6.4 Senega officinalis 6X

Common names are snake root, rattlesnake root and seneka. This herb is about 30cm tall and commonly found in central and western America. It normally grows on dry rocky soil. The plant has small, narrowed, pinkish-white flowers on a narrow terminal spike, about 2-6 cm long (Botanical.com, 2014) as illustrated in Figure 2.14.

![Senega officinalis](image-url)

**Figure 2.14 Senega officinalis** (Barnes & Francis, 2004)
• **Pharmacological action**

The plant causes catarrhal symptoms, especially of the respiratory system and the eyes (Vermeulen, 2011). In large doses this plant causes heaviness, vertigo and inflammation of the eyes with paresis of the eye muscles and in general vaso-motor system, resulting in capillary congestion that is followed by exosmosis (Botanical.com, 2014).

• **Homoeopathic uses**

This remedy acts on the rectus superior muscles of the eye, causing hyperopia that is better for bending backwards. It is indicated for dry eyes with a sensation as if the eyeball was too large (Boericke, 2012). The eyes feel weak and there is lacrimation on exertion and on continuing to read or write (Vermeulen, 2011).

**2.10 Related Research**

There is very little research related to the homoeopathic treatment of asthenopia that could be found. A study was conducted by Fourie (2002) on the oral administration of *Ruta Graveolens* 30cH, aimed at determining it’s efficacy in the treatment of eyestrain caused by VDU’s; the results were not significant. Hassin (2010) conducted a study aimed at determining the efficacy of *Ruta Graveolens* 6cH in combination with ergonomic interventions in the work place in the treatment of computer vision syndrome (CVS). The study showed some positive results (Hassin, 2010). In 2012, Du Toit aimed at determining the efficacy *Ruta Graveolens* 6cH in the treatment of CVS. There was some improvement in eyestrain symptoms, however these were not significant. All the studies were done with oral preparations and no research could be found to date that has been conducted on the homoeopathic complex eye drop preparation.
CHAPTER Three

METHODOLOGY

3.1 Research sample

The research sample consisted of 30 participants, male and female, between the ages of 18-35 years, recruited by means of purposive sampling. Advertisements were placed at the UJ Health Clinic, on the Doornfontein campus (Appendix A) with relevant permission granted.

Participants were included in the study if they:
- Were male or female, between the ages of 18-35;
- Experienced at least two or more eye-related symptoms of asthenopia (blurred vision, frontal headache, dry eyes, photophobia, lacrimation, slow focusing, burning eye pain, itchy or irritated eyes, eye fatigue and diplopia) when using a VDU;
- Used a VDU for a minimum of 3 hours per day; and
- Experienced eyestrain symptoms for at least one month prior to the study.

Participants were excluded from the study if they:
- Used contact lenses; (Contact lenses may compromise tear layer and have an effect on symptoms)
- Was suffering from frequent ocular infections or allergies, glaucoma, cataracts, styes, and optic nerve atrophy;
- Had eye-related problems such as amblyopia, strabismus or uncorrected refractive error;
- Used medications such as eye drops, anti-histamines, beta-blockers, diuretics, antidepressants, hormone replacement therapy, isotretinoin, anticholinergics or immunosuppressive drugs; or
- Had underlying chronic conditions that may result in dry eyes: These may include- rheumatoid arthritis, systemic lupus erythematosus, hypothyroidism, omega 3 fatty acid deficiency, vitamin A deficiency, Sjogren’s syndrome, scleroderma, connective tissue diseases, hepatitis C, undergoing radiation therapy or have had refractive surgery, epilepsy or other neurological disorders.
- Farsightedness more than +1.00D, astigmatism more than -1.00D and myopia of more than 1.00D uncorrected as determined by autorefraction (as this could cause asthenopia symptoms)
3.2 Research design and procedure

This was a randomised, double-blind, placebo-controlled, one-day study. The sample groups were shared with another researcher who assessed tear-break up time (TBUT) and used a visual analogue scale (VAS) to determine eye discomfort levels. The participants attended an initial consultation at the UJ Optometry Clinic. All participants were requested to read the Information Form (Appendix B), sign the Participant Consent Form (Appendix C) once they had agreed to participate, and complete the Participant Selection Questionnaire to be assessed if they met the inclusion and exclusion criteria (Appendix D). All participants who met the criteria were tested for any refractive errors present by a qualified optometrist using an autorefractor; they were also screened for accommodation and vergence errors. If a participant had any significant uncorrected refractive errors, they were referred to a qualified optometrist at the Optometry Clinic and excluded from the study. Participants proceeded to the UJ computer lab to play a computer game for a two hour period. Participants wearing glasses for reading wore their glasses while using the computer but contact lenses wear was excluded due to reasons mentioned already. After the 2-hour period, all participants were requested to complete the Symptom Index Questionnaire (SIQ) (Appendix E). Participants returned to the computer lab where they were randomly divided into two groups. One group received the homoeopathic complex eye drop solution (treatment group) and the other group received distilled water (placebo group). They were instructed to place two drops into each eye. Participants continued playing the game for a period of 30 minutes, after which they completed the SIQ again.

The homoeopathic complex eye drop solution and distilled water drops were prepared by the manufacturer and randomized by an independent person. Both the placebo and treatment groups received eye drops in identical containers; the eye drops were randomized by an independent person. Sheedy et al. (2003) suggested that symptom questionnaires should be used in order to measure subjective ocular discomfort associated with asthenopia. Currently there is no standardized, validated asthenopic symptom questionnaire; most research studies conducted on asthenopia however, make use of a numerical grading system. Various studies relating to asthenopia have made use of symptom questionnaires,
relating specifically to the parameters measured in the study (Rahman & Sanip, 2011; Shrestha et al., 2011). The Symptom Index Questionnaire was developed by the researcher for the purposes of this study and evaluated the following 11 asthenopic symptoms: eye fatigue, sore or aching eyes, itchy or irritated eyes, lacrimation, dry eyes, hot or burning eye pain, intermittent diplopia at near fixation, blurred vision, photophobia, frontal headache and difficulty focusing. Symptom severity was rated by the participant using a 4-point Likert scale where: 0 = none, 1 = slightly, 2 = moderately, and 3 = severely. Likert scales are a reliable means of evaluating subjective symptom severity (McLeod, 2008).

3.4. Data collection and analysis

All data from the questionnaires were statically analysed by means of frequencies and descriptives, and non-parametric tests. Inter-group comparisons were done using the Mann-Whitney U-test. Comparison within the groups (intra-group) was done using the Wilcoxon Signed Ranks Test (Kuhudzai, 2015).

3.5 Ethical considerations

All participants were fully informed about the requirements, duration, procedure and purpose of the study. They were required to read the information form and sign the consent form. The participants were informed that their participation was on a voluntary basis and if they did not wish to participate in the study any further they had the option to withdraw without consequences. Participants, who wanted to withdraw from the study, were not required to give reasons as to why they did not wish to participate. The participants’ privacy was protected by ensuring that all consultations took place in private consultation rooms; anonymity was protected by using case numbers rather than names. All information was kept in a locked room in the Homoeopathic Clinic; the only people that had access to these files were the researcher and the supervisor, ensuring confidentiality. There were no anticipated risks to participating in the study. At the end of the study all participants who were in the placebo group were offered a bottle of the homoeopathic complex eye drop solution. Any participants who would have experienced any discomfort were referred to their healthcare provider for further treatment if necessary. The results of the study will be made available to the participants on request.
CHAPTER FOUR
RESULTS

4.1 Introduction
This study consisted of a total sample of thirty seven participants. Seven participants were excluded from the study due to uncorrected refractive errors that were outside the stipulated values. The remaining thirty participants were randomly divided into two groups of fifteen each. One group received the placebo and the other group received the homoeopathic complex eye drop solution. All the collected data was analysed using the Wilcoxon Signed-Ranks Test and Mann-Whitney Test. Non-parametric tests were used because of the small sample size and the abnormal distribution of data, as found by the Shapiro-Wilk Test.

4.2 Tests

4.2.1 Wilcoxon Signed-Ranks Test
This is a non-parametric test where two variables are compared in a single sample, such as pre-test and post-test, based on one variable, namely the difference between the two scores. The Wilcoxon Signed-Ranks Test is also known as the Wilcoxon Matched Pairs Test. This test is appropriate when the sample has less than 30 participants (Maree et al., 2011).

4.2.2 Mann-Whitney Test
This test is used when two independent groups need to be compared based on a single variable; this test is also a non-parametric test (Maree et al., 2011).

The statistical terms used to analyse the data are defined as the following:

- Mean (n): the average of all scores; to calculate the mean, all the numbers in a set are added and then the sum divided by the total count of numbers (Rouse, 2016).
- Probability value (p-value): measures of statistically significant result; a p value < 0.05 indicates statistical significance and a p value > 0.05 indicates statistical insignificance (Rouse, 2016).
- Median (md): the middle value in a series of values arranged from the smallest to the largest (Webster, 2015).
- Standard deviation (sd): a measure of variability that is the square root of variance, indicating how values vary about the mean (Webster, 2015).
• Inter-quartile range (IQR): the difference between the upper and lower quartiles (Webster, 2015).
• Normality: normal distribution of a random variable (Webster, 2015).

4.3 Background variables

4.3.1 Age

According to the inclusion criteria all the participants had to be between the ages of eighteen and thirty-five years of age. All the participants complied with the range and the average age for the entire sample was twenty six years. The graph below (Figure 4.1) shows the age distribution in the placebo and treatment groups. The treatment group ranged from 21-35 years and the placebo group ranged from 19-35; the two groups had a similar distribution with regards to age.

![Figure 4.1 Bar graph showing age distribution in the treatment and placebo groups](image)

Figure 4.1 Bar graph showing age distribution in the treatment and placebo groups
4.3.2 Gender and race

There were 4 (26.6%) male and 11 (73.3%) female participants in the treatment group, and 7 (46.6%) male and 8 (53.3%) female participants in the placebo group, as represented by Table 4.1. There were more females in the treatment group, but due to randomization there was no control in terms of gender.

Table 4.1 Gender distribution for the treatment and placebo groups

<table>
<thead>
<tr>
<th>Gender</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>count</td>
<td>%</td>
<td>count</td>
</tr>
<tr>
<td>Treatment</td>
<td>11</td>
<td>73.4</td>
<td>4</td>
</tr>
<tr>
<td>Placebo</td>
<td>7</td>
<td>46.6</td>
<td>8</td>
</tr>
</tbody>
</table>

With regards to race, the majority of the participants were black (93.3%); this is represented by Table 4.2 below. There was only one (6.6%) white participant, who was in the placebo group. Overall the two groups were similar with regards to race distribution. There were no statistically significant difference in the race of the participants; it is also closely related to the race distribution found in SA.

Table 4.2 Race distribution for the treatment and placebo groups

<table>
<thead>
<tr>
<th>Race</th>
<th>Black</th>
<th>White</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>count</td>
<td>%</td>
<td>count</td>
</tr>
<tr>
<td>Treatment</td>
<td>15</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Placebo</td>
<td>14</td>
<td>93.3</td>
<td>1</td>
</tr>
</tbody>
</table>
4.3.3 Hours of computer use per day

The inclusion criteria stated that for participation in the study, a computer should be used daily for at least three hours per day. All participants met the inclusion criteria. The hours of reported computer use among the participants varied from 3-5 hours per day, up to eighteen hours or more per day. Table 4.3 shows the number of hours of computer use for the treatment and placebo groups. The two groups exhibited a similar distribution of computer use per week.

4.3 Number of hours of computer use for the treatment and placebo groups per day

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th></th>
<th>Placebo</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>count</td>
<td>%</td>
<td>count</td>
<td>%</td>
</tr>
<tr>
<td>3-5 hours</td>
<td>2</td>
<td>13.3</td>
<td>2</td>
<td>13.3</td>
</tr>
<tr>
<td>6-12 hours</td>
<td>3</td>
<td>20</td>
<td>4</td>
<td>26.7</td>
</tr>
<tr>
<td>13-17 hours</td>
<td>7</td>
<td>46.7</td>
<td>5</td>
<td>33.3</td>
</tr>
<tr>
<td>18 hours or more</td>
<td>3</td>
<td>20</td>
<td>4</td>
<td>26.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>100</strong></td>
<td><strong>15</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

4.3.4 Duration of symptoms

The study required that the participants should have experienced the computer-induced asthenopia symptoms at least one month prior to the start of the study. Table 4.4 shows that the duration of the symptoms between the two groups was distributed similarly. The majority of participants in both groups has experienced symptoms for at least 7 months.
Table 4.4 Duration of symptoms for the treatment and placebo groups

<table>
<thead>
<tr>
<th>Time period</th>
<th>Treatment</th>
<th></th>
<th>Placebo</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>%</td>
<td>count</td>
<td>%</td>
</tr>
<tr>
<td>One to three months</td>
<td>2</td>
<td>13.3</td>
<td>2</td>
<td>13.3</td>
</tr>
<tr>
<td>Four to six months</td>
<td>4</td>
<td>26.7</td>
<td>5</td>
<td>33.3</td>
</tr>
<tr>
<td>Seven months or longer</td>
<td>9</td>
<td>60</td>
<td>8</td>
<td>53.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>100%</strong></td>
<td><strong>15</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

4.3.5 Various asthenopic symptoms evaluated:

The study evaluated eleven symptoms of asthenopia by means of the Participation Selection Questionnaire (Appendix D), which was completed by the participants prior to the study, to rate the symptoms they usually experience. The most common asthenopic symptoms were tired eyes (100%), photophobia (80%) and slow focusing (66.7%), as illustrated in Table 4.5. The two groups had an overall similar distribution with regards to the occurrence of symptoms.

Table 4.5 Occurrence of symptoms

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Treatment group</th>
<th>Placebo group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyestrain</td>
<td>15 (100%)</td>
<td>15 (100%)</td>
<td>100%</td>
</tr>
<tr>
<td>Tired eyes</td>
<td>15 (100%)</td>
<td>15 (100%)</td>
<td>100%</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>8 (53.3%)</td>
<td>7 (46.7%)</td>
<td>50%</td>
</tr>
<tr>
<td>Watery eyes</td>
<td>5 (33.3%)</td>
<td>4 (26.7%)</td>
<td>30%</td>
</tr>
<tr>
<td>Dry eyes that are scratchy</td>
<td>3 (20%)</td>
<td>5(33.3%)</td>
<td>26.7%</td>
</tr>
<tr>
<td>Burning eye pain</td>
<td>5 (33.3%)</td>
<td>7 (46.7%)</td>
<td>40%</td>
</tr>
<tr>
<td>Double vision</td>
<td>4 (26.7%)</td>
<td>8 (53.3%)</td>
<td>40%</td>
</tr>
<tr>
<td>Frontal headache</td>
<td>9 (60%)</td>
<td>10 (66.7%)</td>
<td>63.3%</td>
</tr>
<tr>
<td>Slow focusing</td>
<td>10 (66.7%)</td>
<td>10 (66.7%)</td>
<td>66.7%</td>
</tr>
<tr>
<td>Itchy/irritated eyes</td>
<td>6 (40%)</td>
<td>10 (66.7%)</td>
<td>53.3%</td>
</tr>
<tr>
<td>Photophobia/light sensitivity</td>
<td>11 (73.3%)</td>
<td>12 (80%)</td>
<td>76.7%</td>
</tr>
</tbody>
</table>
4.3.6. Symptom Index Questionnaire (SIQ)

Figure 4.2 illustrates the mean value for the overall symptom rating between time 1 and 2 for the treatment and placebo group. The treatment group overall mean value decreased from 1.07 to 0.56 and the placebo group overall mean value decreased from 1.18 to 0.3.

![Figure 4.2 Overall mean values for time 1 and 2 for the treatment and placebo group](image)

Participants were randomly divided into the treatment group and placebo group. They played a computer game for a two hour period, and then they were requested to complete the SIQ (time 1), as illustrated in Table 4.6. After the completion of the computer game, the participants administrated the eye drops and then continued playing the game for a period of 30 minutes, after which they completed the SIQ (time 2), as illustrated in Table 4.7.

The symptoms were rated according to severity using the following key.

**Key:**

- **N= No**
- **SL=Slightly**
- **M=Moderately**
- **S=Severely**

<table>
<thead>
<tr>
<th>N</th>
<th>SL</th>
<th>M</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
</tbody>
</table>

**Table 4.6 Sum total of the severity of symptoms pre-treatment**
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Treatment</th>
<th></th>
<th></th>
<th></th>
<th>Placebo</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>SL</td>
<td>M</td>
<td>S</td>
<td>N</td>
<td>SL</td>
<td>M</td>
</tr>
<tr>
<td>Tired eyes</td>
<td></td>
<td>0</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0</td>
<td>46.6%</td>
<td>33.3%</td>
<td>20%</td>
<td>0.0</td>
<td>26.7%</td>
<td>53.3%</td>
</tr>
<tr>
<td>Aching eyes</td>
<td></td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.3</td>
<td>33.3%</td>
<td>33.3%</td>
<td>20%</td>
<td>6.7</td>
<td>26.7%</td>
<td>46.6%</td>
</tr>
<tr>
<td>Irritated/itchy eyes</td>
<td></td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33.3</td>
<td>20%</td>
<td>40%</td>
<td>6.7%</td>
<td>26.7</td>
<td>33.3%</td>
<td>40%</td>
</tr>
<tr>
<td>Tearing eyes</td>
<td></td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40%</td>
<td>26.7%</td>
<td>26.7%</td>
<td>6.7%</td>
<td>46.6</td>
<td>40%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Dry eyes</td>
<td></td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40%</td>
<td>40%</td>
<td>13.3%</td>
<td>6.7%</td>
<td>13.3</td>
<td>66.7%</td>
<td>20%</td>
</tr>
<tr>
<td>Burning/hot eyes</td>
<td></td>
<td>8</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>53.3</td>
<td>40%</td>
<td>6.7%</td>
<td>0.0%</td>
<td>33.3</td>
<td>33.3%</td>
<td>20%</td>
</tr>
<tr>
<td>Double vision</td>
<td></td>
<td>10</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>66.7</td>
<td>26.7%</td>
<td>6.7%</td>
<td>0.0%</td>
<td>53.3</td>
<td>40%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Blurry vision</td>
<td></td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>6</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40%</td>
<td>40%</td>
<td>20%</td>
<td>0.0%</td>
<td>40%</td>
<td>46.7</td>
<td>6.7%</td>
</tr>
<tr>
<td>Sensitive eyes</td>
<td></td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26.7</td>
<td>33.3%</td>
<td>26.7%</td>
<td>13.3%</td>
<td>13.3</td>
<td>26.7%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Frontal headache</td>
<td></td>
<td>7</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>46.7</td>
<td>6.7%</td>
<td>26.7%</td>
<td>13.3%</td>
<td>26.7</td>
<td>26.7%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Difficulty focusing</td>
<td></td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26.7</td>
<td>26.7%</td>
<td>33.3%</td>
<td>13.3%</td>
<td>20%</td>
<td>33.3%</td>
<td>26.7%</td>
</tr>
</tbody>
</table>

Table 4.7 Sum total of the severity of symptoms post treatment
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Treatment</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>SL</td>
</tr>
<tr>
<td>Tired eyes</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>33.3%</td>
<td>53.3%</td>
</tr>
<tr>
<td>Aching eyes</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>46.7%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Irritated/itchy eyes</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>60%</td>
<td>20%</td>
</tr>
<tr>
<td>Tearing eyes</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>53.3%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Dry eyes</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>46.7%</td>
<td>46.7%</td>
</tr>
<tr>
<td>Burning/hot eyes</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>66.7%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Double vision</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>86.7%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Blurry vision</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>80%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Sensitive eyes</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>46.7%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Frontal headache</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>46.7%</td>
<td>33.3%</td>
</tr>
</tbody>
</table>

### 4.4 Individual symptom results

The following graphs illustrates the change of each symptom reported between the groups before (time 1) and after (time 2) treatment was administrated.
4.4.1 Tired eyes

Figure 4.3 illustrates the change in severity of tired eyes over time. For the placebo group the mean value decreased from 1.80 \((sd=0.676)\) to 0.60 \((sd=0.828)\) and for the treatment group the mean value decreased from 1.73 \((sd=0.799)\) to 0.87 \((sd=0.834)\). The intra-group analysis revealed a \(p\) value of 0.005 for the placebo group and a \(p\) value of 0.003 for the treatment group, which means both groups improved over time. The inter-group analysis revealed a \(p\) value of 0.719 for time 1 and a \(p\) value of 0.271 for time 2, which means there were no statistically significant differences between the groups.

4.4.2 Aching eyes

Figure 4.4 illustrates the change in severity of aching eyes between the two groups over time. The treatment group had a mean=1.60 \((sd=0.986)\) and the placebo group had a mean=1.67 \((sd=0.816)\) at time 1; the treatment group had a mean=0.73 \((sd=0.884)\) and the placebo group had a mean=0.40 \((sd=0.828)\) at time 2. The intra-group analysis revealed a \(p\) value of 0.006 for the placebo group and a \(p\) value of 0.004 for the treatment group, which means both groups improved over time. The inter-group analysis revealed a \(p\) value of 0.710 for time 1 and a \(p\) value of 0.160 for time 2, which means there were no statistically significant differences between the groups.
4.4.3 Itchy or irritated eyes

Figure 4.5 Mean values for itchy/irritated eyes for the treatment and placebo groups

Figure 4.5 illustrates the change in severity of itchy/irritated eyes over time. Both groups showed an improvement, with the placebo group showing a greater improvement. The treatment group had an initial mean value of 1.20 ($sd=0.799$) reducing to a mean of 0.60 ($sd=0.594$), and the placebo group
had mean of 1.07 ($sd=1.014$) reducing decreasing to a mean of 0.27 ($sd=0.828$). The intra-group analysis revealed a $p$ value of 0.020 for the placebo group and a $p$ value of 0.024 for the treatment group, which means both groups improved over time. The inter-group analysis revealed a $p$ value of 0.710 for time 1 and a $p$ value of 0.217 for time 2, which means there were no statistically significant differences between the two groups.

4.4.4 Tearing eyes

Figure 4.6 illustrates the change in severity of tearing eyes over time. The treatment group mean value reduced from 1.00 ($sd=1.00$) at time 1 to 0.53 ($sd=0.743$) at time 2. The placebo group mean value reduced from 0.67 ($sd=0.729$) at time 1 to 0.20 ($sd=0.414$) at time 2. The intra-group analysis revealed a $p$ value of 0.035 for the placebo group and a $p$ value of 0.020 for the treatment group, which means both graphs improved over time. The inter-group analysis revealed a $p$ value of 0.387 for time 1 and a $p$ value of 0.035 for time 2, which means the placebo group outperformed the treatment group at time 2.

![Figure 4.6 Mean values for tearing eyes for the treatment and placebo groups](image)

4.4.5 Dry eyes
Figure 4.7 illustrates the change in severity of dry eyes. For the placebo group the mean value decreased from 0.93 (sd=0.594) to 0.20 (sd=0.561) and for the treatment group the mean value decreased from 0.93 (sd=0.961) to 0.60 (sd=0.632). Both groups showed a reduction in the frequency of tearing eyes, with the placebo group showing more improvement. The intra-group analysis revealed a p value of 0.021 for the placebo group and a p value of 0.096 for the treatment group, which indicates a statistically significant improvement, occurred with the placebo group over time, but not in the treatment group. The inter-group analysis revealed a p value of 0.769 for time 1 and a p value of 0.188 for time 2, which means there were no statistically significant differences between the two groups.

Figure 4.7 Mean values for dry eyes for the treatment and placebo groups

4.4.6 Burning eyes
Figure 4.8 illustrates the change in severity of burning eyes between the two groups over time. The treatment group had a mean=0.60 (sd=0.632) and the placebo group had a mean=1.07 (sd=1.100) at time 1; the treatment group had a mean=0.40 (sd=0.507) and the placebo group had a mean=0.33
(sd=0.617) at time 2. The intra-group analysis revealed a \( p \) value of 0.018 for the placebo group and a \( p \) value of 0.180 for the treatment group, which means the participants in the placebo group, experienced a statistically significant improvement over time. The inter-group analysis revealed a \( p \) value of 0.285 for time 1 and a \( p \) value of 0.545 for time 2, which means there were no statistically significant differences between the two groups.

Figure 4.8 Mean values for burning eyes for the treatment and placebo groups

4.4.7 Double vision

Figure 4.9 illustrates the change in severity of double vision between the two groups over time. Both groups showed an improvement, with the placebo group showing more improvement. The treatment group had a mean=0.33 (sd=0.617) reducing to a mean=0.07 (sd=0.258) and the placebo group had a mean=0.53 (sd=0.640) reducing to a mean=0.07 (sd=0.258). The intra-group analysis revealed a \( p \) value of 0.020 for the placebo group and a \( p \) value of 0.046 for the treatment group, which means both groups improved over time. The inter-group analysis revealed a \( p \) value of 0.304 for time 1 and a \( p \) value of 1.00 for time 2, which means there were no statistically significant differences between the two groups.
4.4.8 Blurry vision

Figure 4.10 illustrates the change in severity of blurry vision over time. The treatment group mean value decreased from 0.87 (sd=0.743) to 0.40 (sd=0.632). The placebo group had a mean value decrease from 0.80 (sd=0.862) to 0.13 (sd=0.516). The intra-group analysis revealed a p value of 0.004 for the placebo group and a p value of 0.008 for the treatment group, which means both groups...
improved over time. The inter-group analysis revealed a $p$ value of 0.669 for time 1 and a $p$ value of 0.096 for time 2, which means there were no statistically significant differences between the two groups.

### 4.4.9 Light sensitivity

Figure 4.11 below illustrates the change in severity of light sensitivity of the eyes between the two groups over time. For the placebo group the mean value decreased from 1.73 ($sd=0.961$) to 0.67 ($sd=0.976$) and for the treatment group the mean value decreased from 1.07 ($sd=1.033$) to 0.67 ($sd=0.834$). The intra-group analysis revealed a $p$ value of 0.011 for the placebo group and a $p$ value of 0.005 for the treatment group, which means both groups improved over time. The inter-group analysis revealed a $p$ value of 0.218 for time 1 and a $p$ value of 0.717 for time 2, which means there were no statistically significant differences between the two groups.

![Figure 4.11 Mean values for light sensitivity for treatment and placebo groups](image)

#### 4.4.10 Frontal headache

Figure 4.12 illustrates the change in severity of frontal headache over time. For the placebo group the mean value decreased from 1.33 ($sd=1.113$) at time 1 to 0.13 ($sd=0.356$) at time 2, and for the
treatment group the mean value decreased from 1.07 (sd=1.163) to 0.67 (sd=0.816. The intra-group analysis revealed a $p$ value of 0.003 for the placebo group and a $p$ value of 0.084 for the treatment group. There was therefore a statistically significant improvement over time for the placebo group. The inter-group analysis revealed a $p$ value of 0.476 for time 1 and a $p$ value of 0.020 for time 2, which means the placebo group outperformed the treatment group at time 2.

![Figure 4.12 Mean values for frontal headache for the treatment and placebo groups](image)

**Figure 4.12 Mean values for frontal headache for the treatment and placebo groups**

### 4.4.11 Difficulty focusing

The graph below in Figure 4.13 illustrates the change in severity of difficulty focusing between the two groups over time. The treatment group had a mean value of 1.33 (sd=1.047) and the placebo group had 1.40 (sd=0.986) at time 1, and at time 2 the treatment group had a mean value of 0.67 (sd=0.724) and the placebo group 0.27 (sd=0.799). The intra-group analysis revealed a $p$ value of 0.004 for the placebo group and a $p$ value of 0.008 for the treatment group, which means both groups improved over time. The inter-group analysis revealed a $p$ value of 0.863 for time 1 and a $p$ value of 0.036 for time 2, which means the placebo group outperformed the treatment group at time 2.
4.5. Summary: Intra-group analysis

Table 4.8 below represents the Wilcoxon Signed-Ranks test results for the asthenopia symptoms for both the placebo and treatment groups. A $p$-value $> 0.05$ is considered as non-statistically significant and $< 0.05$ is considered statistically significant. All the symptoms evaluated in the placebo group showed a statistical difference as their $p$ values were less than 0.05. In the treatment group only the symptoms dry eyes ($p=0.096$), burning eyes ($p=0.180$) and frontal headache ($p=0.84$) showed no statistically significant change with a $p$ value of more than 0.05.
Table 4.9 represents the Mann-Whitney U test comparing the results before treatment was administrated for both groups (time 1) and after the administration of treatment (time 2). All the p values at time 1 are greater than 0.05 indicating that the two groups symptoms were very similar before treatment, there was no statistical difference between the symptoms before treatment for both groups. At time 2 there were statistically significant differences for tearing eyes (p=0.035), frontal headache (p=0.020) and difficulty focusing (p=0.036). This indicates that the placebo outperformed the treatment groups for these three symptoms, there were no significant differences between the groups for any of the other symptoms. Overall the treatment group did not outperform the placebo.

### 4.6 Summary: Inter-group analysis

Table 4.9 Mann-Whitney U test results

<table>
<thead>
<tr>
<th></th>
<th>Z</th>
<th>Asymp. Sig (2-tailed)</th>
<th>Z</th>
<th>Asymp. Sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tired eyes</td>
<td>-2.807</td>
<td>0.005</td>
<td>-2.970</td>
<td>0.003</td>
</tr>
<tr>
<td>Aching eyes</td>
<td>-2.765</td>
<td>0.006</td>
<td>-2.919</td>
<td>0.004</td>
</tr>
<tr>
<td>Itchy/irritated eyes</td>
<td>-2.321</td>
<td>0.020</td>
<td>-2.333</td>
<td>0.024</td>
</tr>
<tr>
<td>Tearing eyes</td>
<td>-2.111</td>
<td>0.035</td>
<td>-2.333</td>
<td>0.020</td>
</tr>
<tr>
<td>Dry eyes</td>
<td>-2.309</td>
<td>0.021</td>
<td>-1.667</td>
<td>0.096</td>
</tr>
<tr>
<td>Burning eyes</td>
<td>-2.373</td>
<td>0.018</td>
<td>-1.342</td>
<td>0.180</td>
</tr>
<tr>
<td>Double vision</td>
<td>-2.333</td>
<td>0.020</td>
<td>-2.000</td>
<td>0.046</td>
</tr>
<tr>
<td>Blurry vision</td>
<td>-2.887</td>
<td>0.004</td>
<td>-2.646</td>
<td>0.008</td>
</tr>
<tr>
<td>Light sensitivity</td>
<td>-2.551</td>
<td>0.011</td>
<td>-2.810</td>
<td>0.005</td>
</tr>
<tr>
<td>Frontal headache</td>
<td>-2.994</td>
<td>0.003</td>
<td>-1.730</td>
<td>0.084</td>
</tr>
<tr>
<td>Difficulty focusing</td>
<td>-2.846</td>
<td>0.004</td>
<td>-2.640</td>
<td>0.008</td>
</tr>
<tr>
<td>Condition</td>
<td>Time 1</td>
<td></td>
<td></td>
<td>Time 2</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------</td>
<td>----------------</td>
<td>----------------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>Asymp. Sig (2-tailed)</td>
<td></td>
<td>Z</td>
</tr>
<tr>
<td>Tires eyes</td>
<td>-.360</td>
<td>0.719</td>
<td></td>
<td>-1.101</td>
</tr>
<tr>
<td>Aching eyes</td>
<td>-.197</td>
<td>0.710</td>
<td></td>
<td>-1.406</td>
</tr>
<tr>
<td>Itchy/irritated eyes</td>
<td>-.372</td>
<td>0.710</td>
<td></td>
<td>-1.234</td>
</tr>
<tr>
<td>Tearing eyes</td>
<td>-.865</td>
<td>0.387</td>
<td></td>
<td>-2.105</td>
</tr>
<tr>
<td>Dry eyes</td>
<td>-.293</td>
<td>0.769</td>
<td></td>
<td>-2.105</td>
</tr>
<tr>
<td>Burning eyes</td>
<td>-1.069</td>
<td>0.285</td>
<td></td>
<td>-.605</td>
</tr>
<tr>
<td>Double vision</td>
<td>-1.027</td>
<td>0.304</td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>Blurry vision</td>
<td>-.428</td>
<td>0.669</td>
<td></td>
<td>-1.666</td>
</tr>
<tr>
<td>Light sensitivity</td>
<td>-1.232</td>
<td>0.218</td>
<td></td>
<td>-.362</td>
</tr>
<tr>
<td>Frontal headache</td>
<td>-.713</td>
<td>0.476</td>
<td></td>
<td>-2.318</td>
</tr>
<tr>
<td>Difficulty focusing</td>
<td>-.173</td>
<td>0.863</td>
<td></td>
<td>-2.095</td>
</tr>
</tbody>
</table>

**CHAPTER FIVE**

**DISCUSSION**
5.1 Introduction
Thirty seven participants were initially recruited for this study. Seven participants were excluded from the study due to the presence of refractive errors and were referred to the optometry clinic for a full assessment. A total of thirty participants were randomly divided into two groups of 15 each: the placebo and the treatment groups. Comparative analysis of data between the placebo and treatment groups was done. The aim of the study was to determine the effect of a homoeopathic complex eye drop solution (containing *Conium maculatum* 6X, *Natrum muriaticum* 6X, *Ruta graveolens* 6X and *Senega officinalis* 6X) on the symptoms of computer-induced asthenopia using a Symptom Index Questionnaire (Appendix E).

Non-parametric measures were used to analyse the data for this study; for inter-group analysis the Mann-Whitney U Test was used and for intra-group analysis the Wilcoxon Signed Ranks Test was used.

5.2 Distribution and frequencies: screening questionnaire

5.2.1 Age
The age distribution for the treatment group ranged from 21-35 years of age and for the placebo group ranged from 19-35 years of age. The median value for both groups was 24. Studies have shown that asthenopia is common in college students aged between 18-30 years, with 75% reporting symptoms of computer-induced asthenopia (Wajuihain, 2015; Han *et al.*, 2013).

5.2.2 Gender
The gender distribution for the treatment group was 4 (26.6%) male and 11 (73.3%) female participants and 7 (46.6%) male and 8 (53.3%) female participants in the placebo group. In this study there were more female than male participants. According to Agarwal *et al.* (2013), visual symptoms in VDU users were found to be more prevalent among females than males, and females are more likely to complain about asthenopic symptoms. Other similar studies have also stated that asthenopia occurs more commonly in females (Barthakur, 2013; Taino *et al.*, 2006; Wajuihian, 2015; Kowalska *et al.*, 2011). According to Akinbuni & Mashalla (2013) this may be due to the fact that dry eyes are more prevalent in females. There was a larger number of female participants in the treatment group and this could have had an impact on the results seen. Future studies are recommended to use matched pairs according to gender.
5.2.3 Race
The study sample consisted largely of black participants (96.6%); there was only one white participant (3.33%), who was in the placebo group. As a result both the treatment and placebo groups were similar with regards to race distribution. Most studies do not report a high prevalence of asthenopia in any particular race. Portello et al. (2012) however report that the Hispanic ethnic group shows a significantly higher incidence in asthenopic symptoms over African, Asian, White and other ethnic groups. This study does not however relate to the South African population.

5.2.4 Number of hours of computer use per day
In this study the treatment and placebo groups had a similar distribution in the number of hours of VDU’s use per day. A large number of the participants (40%) in the entire sample reported using VDU’s between 13-17 hours per week.

Chiemeke et al. (2007) reported that asthenopic symptoms can occur after even one hour of computer use, and increases with the increased number of uninterrupted hours spent looking at a computer screen. Most VDU users spend more than 6 hours daily looking at a computer screen and it is reported that the prevalence of VDU symptoms is significantly higher in individuals who spend more than 4 hours daily working on a VDU (Agarwal et al., 2013). Another study reported that nearly 80% of individuals who work on a computer for even just 2 hours a day suffer from asthenopia (Akinbuni & Mashalla, 2013).

These studies report a variance with regards to the number of hours computer use per day needed to induce asthenopia, therefore it can be suggested that computer-induced asthenopia can occur when an individual uses a computer an average between 2-6 hours a day. Most of the participants in this study made use of a VDU for a much longer time period on a daily basis.

5.2.5 Duration of the symptoms
Both groups had a similar distribution with regards to the duration of asthenopia symptoms prior to the study. The treatment group reported 9 (60%) participants suffering from asthenopia for seven months or longer and the placebo group had 8 (53.3%). Most of the participants therefore reportedly suffered from chronic asthenopia, due to the continuous and prolonged computer usage.
The length of time spent using a computer results in long lasting complaints which continue even after discontinuing VDU work (Agarwal, 2013; Akinbuni & Mashalla, 2013). The duration of computer work is directly linked to the eye symptoms related to asthenopia (Agarwal, 2013). Long-term VDU use could gradually damage the regulatory function of the eyes and then result in the formation of long-term visual fatigue (Akinbuni & Mashalla, 2013).

5.2.6 Computer-induced asthenopia symptoms
There were 11 symptoms evaluated for the purpose of this study. Symptoms of computer-induced asthenopia may include tired eyes, aching eyes, irritated eyes/itchy eyes, tearing eyes, dry eyes, burning/hot eyes, double vision, blurry vision and light-sensitive eyes. Most of the participants in this study reported suffering from tired eyes, slow focusing, photophobia and frontal headache.

According to Sheedy et al. (2003) the most frequent visual problems reported amongst computer users are tired and aching eyes, headache, blurred or double vision, dry irritated eyes and photophobia. Other authors have reported a variety of prevalent symptoms. According to Akinbuni & Mashalla (2013), eyestrain (30.9%) and headache (30.9%) were the most common VDU symptoms experienced; Bali et al (2007) reported eyestrain (97.8%) and headache (82.1%) as major presenting VDU symptoms and Chiemeke et al. (2007) also reported eyestrain (96.1%) as being the most common visual symptom experienced by computer users. They also reported blurred distance vision (83.6%), headache (81.6%), double vision (72.9%), redness of the eyes (66%) and lacrimation (48.6%) as other common symptoms associated with computer use.

Therefore these previous findings agree with the results found in this study. Questionnaire developed for the purpose of this study compares fairly accurately to questionnaires found in other studies investigating asthenopia such as in Segui et al. 2015; Cohen et al. 2010; Sheedy & Parsons, 1990; Sheedy et al. 2003; Parihar et al. 2016.

5.3. Symptom Index Questionnaire (SIQ)
In this study it was attempted to create asthenopic symptoms by having the participants play computer games for 2 hours. It was thought that due to the concentration required, some symptoms may be elicited. Participants then rated their symptoms on the SIQ (time 1). The homoeopathic eye drop solution or placebo (distilled water) was then administrated and participants continued to induce
asthenopia for another 30 minutes and then repeated the SIQ (time 2). Symptom severity was rated by the participants using a 4-point Likert scale where: 0 = none, 1 = slightly, 2 = moderately, and 3 = severely.

There was a decrease in the severity of the computer-induced asthenopia symptoms for both the treatment and placebo group after completion, but the placebo group showed slightly more improvement in a few of the symptoms, namely dry eyes, double vision, blurry vision and photophobia symptoms.

5.3.1 Individual Symptom Results
The 11 symptoms were individually evaluated using the mean values rating the severity of each symptom. Both the treatment and placebo groups showed improvements after receiving the eye drops, with the placebo group showing slightly greater improvements. The Wilcoxon signed ranks test measured the change of severity of computer-induced asthenopia symptoms for both the groups over time; the treatment group showed a statistically significant improvement in all symptoms over time except for dry eyes, burning eyes and frontal headache; whereas the placebo group had a statistically significant decline in the severity of all the symptoms evaluated.

The overall inter-group analysis was done using the Mann-Whitney U test; it showed that there was a statistically significant difference between the two groups for the following symptoms: tearing eyes, frontal headache and difficulty focusing. The comparison between the groups indicates that the placebo group outperformed the treatment group for these three variables. However overall there were no significant differences between the groups for any of the other symptoms.

5.4 Factors contributing to the results
5.4.1 Simplex vs. complex prescribing
The treatment medication consisted of a homoeopathic complex, which is a mixture of several remedies in one vehicle, based on their clinical indications. Complexes are believed to be suitable for a wider population base (Carroll, 2015). Complexes provide patients with a number of medicinally dynamic remedies to cover most of the presenting symptoms. Complexes are useful due to the fact that many individuals are given a lot of medications with side effects and thus cannot explain to the
The practitioner the clear case-history of their illness state. Complexes may then help to clear such cases. Complex remedies are also usually prescribed in acute and simple cases that can be easily self-managed (Mittelstadt, 2016).

Simplex or classical prescribing is when one single remedy is given based on its pathogenic similarity to the patients’ disease condition. Simplex remedies provide the practitioner with enough time to see the remedy’s effects and no other remedy interferes with its action. Complex prescriptions may confuse the body and the disease picture because the remedies are more likely to neutralize each other’s effects. Therefore it is advisable to prescribe one remedy at a time to assess the effects of the remedy on the patient. In this study the remedies that constituted the complex were carefully selected, and it was confirmed using a Materia Medica that none of the remedies in the complex antidoted each other’s effects (De Schepper, 2010). Future studies however could make use of simplex prescribing in order to get the maximum effect of the remedy and avoid any possible interference associated with complexes. Also, as most of the participants reported chronic asthenopic symptoms, classical prescribing may therefore be better indicated.

5.4.2 Potency selection
The homoeopathic complex consisted of remedies in a 6cH potency. A low potency is usually recommended in chronic diseases. According to De Schepper (2010), when it comes to potency selection, the following factors should be considered:

- The sensitivity of the patient: individuals do not react the same way to their environment, food, medicine and other factors. Therefore homoeopathic prescriptions are given based on individual responses. Some people are normosensitive (an average individual who responds generally to a homoeopathic remedy at any given potency), hyposensitive (an individual who needs higher potencies and more recurrent repetitions in order to respond), or hypersensitive (an individual who is extremely reactive and sensitive to medication and needs low doses and potencies of the homoeopathic remedy, repeated rarely);
- The nature of the disease: in acute cases, high potencies (200cH and above) are given, in chronic cases low potencies (6cH and LM) are given; and
- The nature of the remedy: some remedies are fast-acting which are therefore more suitable in acute cases and given in high potencies; some remedies are slow acting and are usually prescribed in chronic cases and in lower potencies.
The sensitivity of each participant was not assessed in this study and the potency selection was based on the nature of the disease, as this was a short duration complex prescribing study. This might have had an effect on the outcome of the study, as all the factors are equally important when it comes to potency selection.

5.4.3 Sample size
The study consisted of a small sample size of 30 participants. Conducting a small sample size study results in certain risks such as: failing to find the actual effect because of insufficient statistical power, and not accurately reflecting the population from which the study sample was drawn from. This affects the reliability of the results because it leads to a higher population variability that may lead to bias. It also has inadequate statistical power and increases the chance that the significant differences are falsely positive (Simmons, 2015). Therefore the small sample size did not provide enough data to make powerful statistical conclusions and may have had an effect in terms of the outcomes of the results of the study.

5.4.4 Compliance
The study took place at the UJ computer lab. Participants played the games within the presence of the researchers, and all participants were escorted to the optometry clinic and back to the computer lab. The environment had artificial lights, an air conditioner and a lack of ergonomic measures, all of which helped to induce asthenopia. Environmental factors were therefore similar for all participants. Compliance was assured as the researcher ensured that the participants played the games uninterrupted, and applied the eye drops correctly. Some participants requested the researcher to apply the drops into their eyes. These methods of ensuring compliance are reliable and accurate. Questionnaires were however completed in front of the researcher and this could have resulted in bias.

5.4.5 Duration of the study
This study took place over one-day. The symptoms of asthenopia are temporary and relieved when resting the eyes (Barthakur, 2013). The short duration of the study might have had an influence on the results of the study, therefore more time may be needed to evaluate if the participants’ computer-induced asthenopia symptoms were going to continue to decrease. Generally the improvement in the treatment group was clinically observable but not statistically significant in relation to the placebo. The symptoms were chronic therefore future studies should consider extending the treatment period.
5.4.6 The placebo effect

A placebo is an inactive substance used in scientific experiments to test the effectiveness of a drug and to please patients through psychological means. The word “placebo” comes from the Latin word meaning “I shall please” (Mag-britte, 2009). Placebos have been shown to improve the sense of well-being and bring physical response, but are often successful only temporarily. Placebos are used worldwide and are recognized to have clinically important effects (Freeman, 2016). An individuals’ psychology and desire to please has shown to have an effect on the outcome of research studies, which refers to the tendency for participants to change their behaviour as they are being observed (Mag-britte, 2009).

As a result the placebo effect cannot be overlooked when it comes to the outcome of studies. Participants in the placebo group in this study experienced some decline in the severity of the computer-induced asthenopia symptoms and had a statistically significant improvement. Therefore the null-hypothesis is supported because the treatment group did not outperform the placebo group. Symptoms were only evaluated after half an hour. It is possible that the remedy may have continued to act for a longer period while the effects of the placebo tapered off. Follow-up measurements at later time periods would have proved useful.

It has been established that dry eyes are a trigger for asthenopia, therefore both the homoeopathic complex and distilled water may have helped to lubricate the eyes and act as a tear-replacement solution. Distilled water may have had an impact on the aqueous part of the tear layer as the lipid layer would have been compromised due to the presence of dry eye symptoms. Eye drops generally have less risk of inducing side effects than oral medication. They are fairly easy to administer, as they are used for their local effects and may be absorbed quickly (Le, 2015). Homoeopathic remedies are administrated under the tongue for better absorption of the active properties via the oral mucosa. The oral route of remedy administration has prevalence over any other route of remedy delivery and has been rated high in patient convenience and satisfaction (Mittelstadt, 2012).
CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion
The research was designed to be a one-day, double-blind, placebo-controlled study. The aim of the study was to determine the effect of a homoeopathic complex eye drop solution containing Conium maculatum 6X, Natrum muriaticum 6X, Ruta graveolens 6X and Senega officinalis 6X on computer-
induced asthenopia, by means of Symptom Index Questionnaire, developed by the researcher making use of recommendation indicated by Sheedy and others.

Thirty participants completed this study, and both groups showed a decline in the severity of the computer-induced asthenopia symptoms over the study period. However inter-group analysis showed that the treatment group did not outperform the placebo. Therefore it can be concluded that the homoeopathic complex eye drop solution was not more effective than distilled water in decreasing computer-induced asthenopia symptoms in individuals who have asthenopia. Nevertheless future research should consider using a larger sample group and extending the duration of the study periods that include shortcoming follow-up measurements.

6.2 Recommendations
Future studies are recommended to:

- Increase the number of the participants for more precise statistical analysis and clarification of results.
- Conduct the study over a longer period of time. This would be beneficial in determining the action of the complex remedies.
- Study the effects of different potencies, as this may prove beneficial.
- Conduct a similimum study, using simplex prescribing.
- Use matched pairs according to gender.
- Compare eye drops to conventional eye drops to expand on the difference.

REFERENCES


**APPENDICES**
APPENDIX A

Advertisement

Do you experience the following eyestrain symptoms when using a computer, laptop, tablet or smartphone?

- Dry, painful or burning eyes
- Watering eyes
- Redness of the eyes
- Eyes sensitive to light
- Blurred vision or difficulty focusing

If you answered yes to at least two of the above questions and are between the ages of 18-35, you may qualify to participate in a combined research study conducted through the Department of Homoeopathy on:

The effect of a homoeopathic complex eye dropsolution on the symptoms of computer-induced eyestrain

Ethical clearance number: REC-01-197-2015

Contact number: Glory Makwale 0735188776

APPENDIX B

Participant Information Form

I, Glory Makwale, am Tech Homoeopathy student at the University of Johannesburg. I hereby invite you to participate in a combined research study on the effect of a homoeopathic complex eye drops on eyestrain from computer use.
Eyestrain is a very common condition experienced by people who use computers, laptops, tablets or smartphones. Working for long periods on this device can cause a variety of symptoms, including blurred or double vision, headaches, painful or burning eyes, dry eyes, watery eyes and sensitivity to light. The homoeopathic eye drop solution consists of the following remedies, which are all indicated for eyestrain symptoms: *Conium maculatum* 6X, *Natrum muriaticum* 6X, *Ruta graveolens* 6X, and *Senega officinalis* 6X. The purpose of this study is to determine the effect of this complex on the symptoms of computer-induced eyestrain compared to a placebo. A placebo is an inert substance that has no therapeutic effect.

You are welcome to take part in this study if you are:

- Male or female, between the ages of 18-35;
- Experiencing at least two or more eye-related symptoms of eyestrain (blurred vision, frontal headache, dry eyes, light sensitivity, teary eyes, slow focusing, burning eye pain, itchy or irritated eyes, eye fatigue and double vision) when using a computer, laptops, tablets or smartphones;
- Using a computer, laptop, tablet or smartphone for a minimum of 3 hours per day;
- Experiencing eyestrain symptoms for at least one month prior to the study.

This will be a one day study taking place at the University of Johannesburg’s (UJ) Doornfontein campus. You will attend an initial consultation at the UJ Optometry Clinic. After reading this information form, if you agree to participate in the study, you will be requested to sign a consent form. You will then complete the Participant Selection Questionnaire to see if you meet the criteria in order to take part in the study. Initially at the start of the study, a qualified optometrist will screen you for problems with your eyesight by a qualified optometrist. If you have any problems with your eyesight you will be referred to a qualified optometrist at the UJ Optometry Clinic and will be excluded from the study.

You will then go to the UJ computer lab to play a computer game for a two hour period. If you normally wear glasses for reading, then you are requested to wear your glasses while using the computer. You will then be asked to complete the Symptom Index Questionnaire where you will rate your eyestrain symptoms.
You will be placed into one of two groups. One group will get the homoeopathic complex eye drop solution and the other group will get the distilled water (placebo). The bottles will look identical and neither you, nor the researchers, will know which group you are in until after the research process is over. You will be instructed to place two drops into each eye. You will continue playing the game for a period of 30 minutes after which you will again complete the Symptom Index Questionnaire. The entire study will take about 3 hours. If you fall into the placebo group you will be offered the remedy after the research study has ended.

Your participation in the study is voluntary, and you are free to refuse or withdraw from the study at any time. All the information submitted by you will be kept confidential and stored under locking key for a minimum period of 5 years. Contact details of the researcher and supervisor involved in the study will be made available to you. There are no anticipated risks in this study. Homoeopathic medicine is considered safe for use with no expected side effects. If you experience any discomfort from the usage of the medication please inform the researchers as soon as possible and you will be referred to your healthcare provider.

Your participation in this study will be much appreciated and will contribute to the knowledge on the homoeopathic treatment of computer-induced eyestrain.

The head of the Research Ethics Committee is Professor Poggenpoel. You are welcomed to contact her if you feel that your right have being violated in anyway during the course of the study.

Researchers: Glory Makwale- 073 518 8776
Supervisor contact number: Dr. Pellow (011) 559-6828
Chairperson of Research Ethics Committee: Dr Poggenpoel (011) 559- 6686
Ethical clearance number REC-01-197-2015

APPENDIX C

Participant Consent Form

Declaration by participant
I ________________________________ have been informed about the research study and fully understand by signing this consent form, I realize that this study is completely voluntary and that I can withdraw from the study at any time. I understand that the researcher will answer any questions I may have at any time.
Date____________________
Signature__________________

Declaration by researcher
I, the researcher, have fully discussed the above points with the participant. It is my understanding that the participant understands the procedure and purpose of the study.
Date____________________
Signature__________________

Researchers: Glory Makwale- 073 518 8776

Supervisor contact number: Dr. Pellow (011) 559-6828

Chairperson of Research Ethics Committee: Dr Poggenpoel (011) 559-6686
APPENDIX D

Participant Selection Questionnaire

Participant number: ___________            Selection date: ________________

Please tick the corresponding box

1. **Race :**

<table>
<thead>
<tr>
<th>Race</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>African</td>
<td>1</td>
</tr>
<tr>
<td>Coloured</td>
<td>2</td>
</tr>
<tr>
<td>Indian</td>
<td>3</td>
</tr>
<tr>
<td>White</td>
<td>4</td>
</tr>
</tbody>
</table>

2. **What is your gender?**

<table>
<thead>
<tr>
<th>Gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>1</td>
</tr>
<tr>
<td>Male</td>
<td>2</td>
</tr>
</tbody>
</table>

3. **How old are you?**


4. **Do you use the computer, laptop, tablet or smartphone for 3 hours or more per day?**

<table>
<thead>
<tr>
<th>Answer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
</tbody>
</table>

5. **Approximately how much time do you spend in front of a computer, laptop, tablet or smartphone per week (Monday to Friday)**

<table>
<thead>
<tr>
<th>Time</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0-2.5 hours</td>
</tr>
<tr>
<td>1</td>
<td>3-5 hours</td>
</tr>
<tr>
<td>2</td>
<td>6-12 hours</td>
</tr>
<tr>
<td>3</td>
<td>13-17 hours</td>
</tr>
<tr>
<td>4</td>
<td>18 hours or more</td>
</tr>
</tbody>
</table>
6. Do you experience any of the following symptoms when using a computer, laptop, tablet or smartphone?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Eyestrain</td>
</tr>
<tr>
<td>2</td>
<td>Tired eyes</td>
</tr>
<tr>
<td>3</td>
<td>Blurred vision</td>
</tr>
<tr>
<td>4</td>
<td>Watery eyes</td>
</tr>
<tr>
<td>5</td>
<td>Dry eyes that feel scratchy</td>
</tr>
<tr>
<td>6</td>
<td>Burning eye pain</td>
</tr>
<tr>
<td>7</td>
<td>Double vision</td>
</tr>
<tr>
<td>8</td>
<td>Frontal headache</td>
</tr>
<tr>
<td>9</td>
<td>Slow focussing</td>
</tr>
<tr>
<td>10</td>
<td>Itchy or irritated eyes</td>
</tr>
<tr>
<td>11</td>
<td>Oversensitivity to the light</td>
</tr>
</tbody>
</table>

7. For how long have you been experiencing these symptoms?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Less than one month</td>
</tr>
<tr>
<td>2</td>
<td>One to three months</td>
</tr>
<tr>
<td>3</td>
<td>Four to six months</td>
</tr>
<tr>
<td>4</td>
<td>Seven months or longer</td>
</tr>
</tbody>
</table>

8. Do you experience these symptoms after using the computer, laptop, tablet or smartphone?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
</tbody>
</table>

9. Do you use eye-drops, anti-histamines (for allergies) or steroidal medications, diuretics (for hypertension), beta-blockers (for hypertension), antidepressants, hormone replacement therapy, isotretinoin (for acne), anticholinergics (for asthma, incontinence, gastrointestinal cramps, muscular cramps) or immunosuppressive medications (to suppress immune system)?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
</tbody>
</table>

10. Do you have a history of frequent eye infections or eye allergies?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No</td>
</tr>
</tbody>
</table>
11. **Do you have any of the following?**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lupus erythematosus, Rheumatoid Arthritis</td>
</tr>
<tr>
<td>2</td>
<td>Glaucoma, cataracts, stye, optic nerve atrophy</td>
</tr>
<tr>
<td>3</td>
<td>Hypothyroidism (underactive thyroid)</td>
</tr>
<tr>
<td>4</td>
<td>Strabismus (squint)</td>
</tr>
<tr>
<td>5</td>
<td>Presbyopia (long-sightedness with age)</td>
</tr>
<tr>
<td>6</td>
<td>Amblyopia (lazy eyes)</td>
</tr>
<tr>
<td>7</td>
<td>Untreated refractive error (poor eyesight)</td>
</tr>
<tr>
<td>8</td>
<td>Undergoing radiation therapy</td>
</tr>
<tr>
<td>9</td>
<td>Omega 3 fatty acid deficiency</td>
</tr>
<tr>
<td>10</td>
<td>Vitamin A deficiency</td>
</tr>
<tr>
<td>11</td>
<td>Sjogren’s Syndrome, scleroderma, connective tissue disease</td>
</tr>
<tr>
<td>12</td>
<td>Hepatitis C</td>
</tr>
<tr>
<td>13</td>
<td>Epilepsy or neurological conditions</td>
</tr>
</tbody>
</table>

12. **Do you wear contact lenses**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
</tbody>
</table>

13. **Have you ever had refractive eye surgery?**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
</tbody>
</table>
APPENDIX E  Date: ______________

Symptom Index Questionnaire  Participant number: ____

Instructions:
Please circle a number on the scale below that corresponds to the level of symptoms you are experiencing right now. Use the key below as a guide.

Key:
N= No  SL=Slightly  M=Moderately  S=Severely

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>SL</th>
<th>M</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do your eyes feel tired?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Are your eyes sore or aching?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Do your eyes feel irritated or itchy?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Are your eyes tearing?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Do your eyes feel dry?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Do your eyes feel hot/burning?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Are you seeing double?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Does your vision feel blurry?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Are your eyes sensitive to light?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Do you have a frontal headache?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Do you have difficulty focusing?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>