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PROTOCOL OF A CLINICAL STIJDY

Title: EFFECT OF DEFOCUS IN SOFT CONTACT LENSES ON INTERNAL RETINAL VASCULARIZATION

Principal investigator

Langis Michaud, O.D, M.Sc

In collaboration with

Rémy Marcotte-Collard, O.D, M.Sc. PhD candidate
Oleksandra Pyssarenko, undergraduate student
Catherine Forest , undergraduate student

Partnership: Bausch and Lomb. Role: to supply the contact lenses studied.

Location: School of Optometly Clinic, Uni versité de Monti·éal

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I. Summaiy of the study

Objective: The aim of this reseai·ch project is to gain a better understanding of the retinal vasculai· changes that occur in response to the optical effect of a myopie defocus daily disposable contact lens used in reseai·ch project 19_09_27_CERC-19-071P at the Université de Montréal. The present study will be can ied out on patients aged between 18 and 35, to investigate the physiological changes brought about by this lens. The primaly objective of this study is to quantify retinal vascular density in the superficial and deep plexus following one week's wear of a high peripheral add soft contact lens (myopie defocus). The secondaly objective is to evaluate changes in choroidal thickness at the macular level after one week's wear of the high peripheral addition soft contact lens (myopie defocus).

Materials and methods: 25 myopie paiticipants aged between 18 and 35 will be selected. Each participant will wear a single-vision spherical design soft lens for one week and a peripheral addition soft lens for the same duration. The order in which participants wear the two types of lenses will be detennined randomly. They will be asked to attend three different visits, one week apait. At visit #1, initial measurements of deep and superficial plexus blood vesse! density and choroidal thickness will be taken with an angiographie optical coherence tomograph (OCT-ATriton). These measurements will be re-evaluated at each visit to assess the changes brought about by each type of lens. The results obtained will be compared between the three visits cai1-ied out for each part icipant.

Hypothesis: It is expected that one week's wear of the pe1-ipheral myop ie defo cus contact lens will cause an increase in blood vesse! density and a thickening of the choroidcompared with initial measurements in young adults. A decrease in blood vessel density and choroidal thinning is expected after one week's wear of the spherical soft lens (hyperopic defocus), compared with initial measurements.

II. Project description

1) Literature review

Myopia

The prevalence of myopia is rising rapidly, and an inevitable increase in the number of cases is expected over the next few years. The WHO rep01ts that the prevalence ofmyopia is expected to reach 50% of the world's population by 2050. An increase in the number of cases ofhigh myopia is also predicted, with 10% of the population affected. (1). The onset and rapid progression of myopia is observed particularly in children and adolescents. However, this phenomenon remains frequent in young adults aged between 20 and 30, who have a heavy workload in near vision (2).

Myopia is defined as a refractive disorder in which light rays passing through the pupil fo1m a focused image at the front of the retina, with bluned distance vision as the main symptom. (3). This disorder can easily be conected with glasses or contact lenses (4). Myopia can be characterized as refractive, axial or mixed. Axial myopia is caused by an elongation of the eye's length, while refractive myopia refers to a high degree of curvature of the cornea or lens. Mixed myopia combines an elongated eye with a more cambered comeal cmvature. When myopia progresses in a patient, imaging techniques (axial length measurement and keratometric measurement) make it easier to identify which stru ctural component is plimalil y responsible for the change. (3). Myopia becomes problematic when it results in excessive elongation of the eye's length (axial myopia) (4).

Projected data on the increase in high myopia are wonying, as it is associated with several ocular complications. In fact, it is associated with a higher risk of retinal detachment, cataracts, open-angle glaucoma and maculopathy (see table below). Visual impairment seconda1y to macular disorder is often caused by choroidal neovascularization, macular hole, cenu·al chorioretinal atrophy, foveoschisis, Brnch's membrane rnpture, retinal serous detachn1entor epiretinal membrane (5). These complications are paiticularly common in severe myopes (-6.00 or more), but also apply to less severe cases (6-8). The risk of

developing myopie maculopathy has been associated in paiticular with high axial length, as well as low choroidal thickness (8)

Table 1: Risk of ocular complications according to myopia level (9)

	Glaucoma	ùtaract (PSCC)	Retlnal detachment	Myopie Maculopathy
•LOO to •3.00	2.3	2.1	3.1	2.2
-3.00 to -5.00	3..3	3.1	9.0	9.7
-5.00 to -7.00	3.3	5.5	21.5	40.6
<-7.00			44.2	126.8

The choroid

The choroid is a highly vascularized strncture of the eye whose main function is to provide nutrition for photoreceptors through the pigment epithelium layer (RPE) (10). Recent studies suggest that the choroid also plays an imp01tant role in eye elongation (11). One explanat ion put forward is that the choroid produces several growth factors that could explain the possible presence of a biochemical cascade that would dictate elongation in the eye (11, 12).

In humans, sh01t-te1m vai·iation in choroidal thickness has been linked to several factors such as diurnal variations, physical activity, caffeine, light intensity and wavelength, as well as retinal defocus (13).

Several studies have demonstrated the effect of myopie or hype1m etropic defocus on choroidal thickness and axial eye length. Hypermetropic defocus (negative lens) produces an image behind the patient's retina. A number of studies havedemonstrated that this type

of defocus helps to reduce choroidal thick:ness and increase axial length. This optical effect can be observed in conventional methods of myopia conection (single vision optical glasses and single vision spherical contact lenses). The principle of myopie defocus (positive lens) produces an image in front of the patient's retina. Studies have shown that this type of lens triggers a signal that allows the choroid to thicken, thereby decreasing axial length when the defocus targets the perifoveal region (14, 15). This latter optical process is used in a number of myopia control treatments, such as soft contact lenses, spectacle lenses and orthokeratology contact lenses, to reduce axial elongation. The primaiy aim of these different treatments is to reduce the hypermetropic defocusing on the peripheral retina that occurs in myopes. To achieve this, a variable add value is generated in the periphe1y of the various optical designs to create a positive spherical abe1rntion that brings the focus of peripheral rays fo1wai·d of the retina (16-18).

Retinal vasculai-ization

The retina is vascularized by two distinct systems, each supplying either the inner or outer p01tion of the retina. The choroid contains a layer of choriocapillaris that feed the retinal pigment epithelium and photoreceptors. The inner pait of the retina is vascularized by the central retinal aitery, which emerges at the head of the optic ne1ve. This <livides into three plexuses thatsupply different layers of the retina. The superficial plexus is the most anterior and feeds the innem1ost layers, i.e. the ne1ve fiber layer and the ganglion cell layer. The inte1mediate plexus lies between the ganglion cell layer and the inner nuclear layer. Finally, the deep plexus lies between the inner and outer nuclear layers. These three plexuses can be visualized using the OCT-A imaging technique (19). Changes in retinal blood flow are associated with changes in retinal vasculai· density (20). It is therefore possible to deduce that an increase in retinal vesse! density translates into an increase in blood flow. High myopia is a disorder that can lead to a number of ocular pathologies, as mentioned earlier. The pathological mechanism by which these pathologies develop in this condition is still poorly understood, but could be explained by the presence of oxidative stress. This oxidative stress could be partly responsible for disrnpting the mechanism of axial elongation, while also causing damage to the various strnctures of the eye. Improving

retinal blood flow in such patients could be a beneficial factor in eliminating the retinal hypoxia caused by oxidative stress (21)

Figure 1: Diagram of the biochemical cascade of oxidative stress in the retina (22).

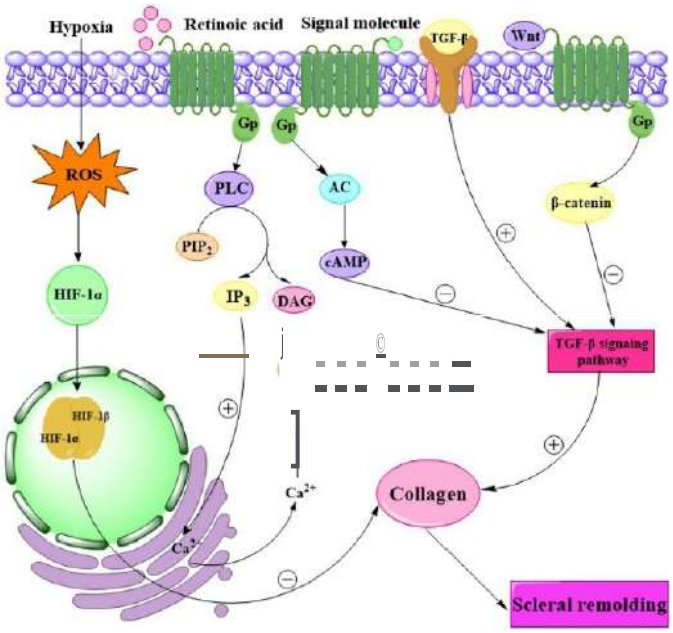

Fig:. 2. R elmed signa Hng pathways of scleral remolding in m)-opia. ROS: Re3Ctiv e oxygen species;-IflF· Ia/ P. Hypoxia-inducible foctor-J(Vjl;PLC: ospholipase C;PIP2: Phcph.acldy llnosltal bipbos,plia u-; [P3: um rol utphoophace; DAG:Dlacylglyc- ol : P KC Pro ceÙI kinase C; ACadenylare cyclase cM tP: Cyellc a<leo odn e monophosphare; TGF-fS: Tr.u.lsforming grovJ:hfactor-}};Gp: G-proeln.

Studies noting choroidal changes following the induction of retinal defocus are ve1y nume rous in the literature. However, to the best of our knowledge, there does not appear to be much data in the literature on retinal defocus and its effect on retinal blood flow. The 2022 study by Swiatczak and associates sought to demonstrate a link between the effect on axial length of induced positive defocus and changes in choroidal blood flow, optic nerve head and retinal vessels. The results of the study show that myopie defocus induces a decrease in axial length (caused by choroidal thickening) and an increa.se in choroida. l blood flow. The results obtained on the con ela.tion between increased a.xia.1 length and decreased blood flow to the optic nerve head were not clinica.lly significa.nt. Fina.lly, the a.uthors rep01ted no con elation between axial elongation of the eye and a. decrea.se in retinal blood flow. However, they did identify an almost significantc01Tela.tion between retinal a.rterio lar blood flow and axial length. The effect on a.rterial blood flow , however, was much weaker than tha.t observed in the choroid. Their study focused mainly on the short-te1meffects of

myopie defocus on changes in blood flow. It would therefore be possible that a c01Telation was not achieved on retinal blood flow due to the too-short period between defocus induction and measurement. (23). Indeed, if we assume that a biochemical cascade originating in the choroid would release vasoconstrictor mediators to the retina, it could be that the onset of their effect is delayed due to the anatomical distance and hematoretinal banier of blood vessels in the inner retina. It is also possible that this effect is different in high myopes than in low-to-moderate myopes. The retinal vascular strncture of high myopes would be at greater risk of pathological alterations due to their long axial length (23).

It would therefore be relevant to test the long-term (1 week) effect of positive (myopie) defocus, mainly used in myopia cont:rol tec hniques, on the change in retinal vascular density.

2) Study objectives

Main objective

1. To evaluate retinal blood vessel density measured by Triton OCT-A in myopie young adults before and after one week's wear of a peripheral myopie defocus soft lens from the Université de Mont:réal study 19_09_27_CERC-19-701P. Compare the data obtained with those from one week's wear of a spherical soft daily disposable contact lens in the samepatients.

Secondaiy objective

2. Evaluate choroidal thickness measured by Triton OCT-A in myopie young adults before and after one week of wearing a peripheral myopie defocus-inducing soft contact lens from the Université de Montréal Study 19_09_27_CERC-19-071P. Compare data with one week of spherical soft daily disposable contact lens wear in the samepatients.

3) Assumptions

1. Wearing the soft lens for 1 week to induce peripheral myopie defocus will cause an increase in blood vessel density measured on OCT-A Triton in young adults. Wearing the spherical lens for 1 week to induce peripheral hyperopic defocus will cause a decrease in blood vessel density measured with OCT-A Triton in young adults.

2. Wearing the soft lens for 1 week to induce peripheral myopie defocus will cause an increase in choroidal thickness measured on OCT-A Tli ton in young adults. Wearing the spherical lens for 1 week to induce peripheral hyperopic defocus will cause a thinning of the choroidal thickness measured with OCT-A Triton in young adults.

4) Materials and methods

a. Search quote

This study is a crossover trial.

b. Study population, sampling and recruitment procedures

The target population for this study is myopie young adults who meet the following criteria:

Inclusion criteria:	Exclusion criteria :
• Astigmatism :'S 1.00 D • Myopia between -0.50 and -4.00D • Aged between 18 and 35	• Recent intake (< 3 months) of medication affecting blood pressure (e.g. hypotensive, anovulant, CNS stimulant, etc.). • Corneal deform ity

• Binocular acuity of 6/6 or better	• Use of topical medications on the ocular surface • Being a smoker • Have contraindications to wearing soft contact lenses • Have undergone myop1a control treatment during the project or in the past (wearing myopically defocused glasses or multifocal or myopically defocused contact lenses) • Hist01y of refractive surge1y • Addiction to drngs or alcohol

Recrnitment will be canied out by posting the research project thumbnail in specific, pennitted areas of the Clinique Universitaire de la Vision. Announcements will also be placed in Facebook groups made upofoptometiy students, so that students and their friends and family can be recrnited. The authors unde1take to ensure the protection of paiticipants' personal data by deactivating comments and the option of "tagging" people. The consent form will be e-mailed to potential pa1t icipants in advance to allow them to familiarize themselves with the reseai·chprocedures, and will be summai·ized dming the first visit to ensure free and inf01med decision-making.

c. Data collection procedure

Data collection will take place during 3 visits to the University Vision Clinic of the Université de Montréal located at 3744 Rue Jean-Brillant Suite 110, Montreal, QC H3T IPl. All participants are advised to abstain from caffeine, tobacco and drngs, and to avoid strenuous sports activities. All visits will be scheduled between 12 p.m. and 4 p.m., to avoid diurnal variations in choroidal thickness and retinal vessel density. (24). The tests perfo1med according to the visit will be as follows:

Tests	Visit 1	Visit 2	Visit 3
Case hist01y	x	x	x
Distancevisual acuity with the patient's best c01Tection	x	x	x
Di stance visual acuity with lenses	x	x	x
Examination of the anterior segment	x	x	x
Axial length (anterion)	x	x	x
Corneal topography (anterion)	x		
Auto-refraction OPD scan	x		
Pupil diameter (neuroptic)	x		
Abenometry without LC (OPD scan) E	x		
Abenometry with LC OPD scan		x	x
Choroidal thickness (OCT-ATriton)	x	x	x
Retinal vascular density (OCT-A Triton)	x	x	x
Lens care and wearing *instrnctions*	x		

First visit

The first visit will begin with a review of the consent fo1m with the pa1ticipant to confüm his/her decision to take pait in the study and his/her qualification with regard to the

inclusion/exclusion criteria. A case history will be requested from the patient before testing begins (see Appendix 1). The paiticipant's visual acuity will be taken monocularly and binocularly with the Snellen cha1t calibrated for 6m, identifying the smallest legible line with the patient's best con-ection in order to identify the patient's visual potential. Next, the anterior segment is examined using the biomicroscope to identify any ocular surface damage that might contraindicate the use of lenses. The eyelids, palpebral conjunctivitis, bulbar conjunctiva and comea will be carefully obse1ved under white light. Next, the patient's pupilla1y diameter will be measured under photopic conditions in the exainination room, using the Neuroptics device. The OPD SCAN III will be used to perform an auto-refraction measurement to help select the prescription for the discounted contact lenses, and an aben ometry measurement without the contact lenses in place to visualize the natural optical abenations induced by the patient's pupil before the lenses are added. The Anterion device will be used to take a baseline measurement of the patient's axial length and to perfo1m comeal topography to mie out the possible presence of ectasia in the pa1ticipants. Finally, a baseline 6.0mm x 6.0mm measurement of choroidal thickness (um) and blood vessel density (%) of the deep and superficial plexus will be analyzed with the OCT-A TRITON.

The patient will receive seven pairs of single-use soft lenses, randomly selected between spherical nesofilcon A lenses (Biotrne, Bausch and Lomb) or peripherally myopie defocus nesofilcon A lenses (Bausch and Lomb). The order of distribution of the type of lenses given at visit 1 and 2 will be dete1mined randomly using the *RANDBETWEEN* function in Excel (see Appendix 4). These lenses are approved by Health Canada, the spherical one being marketed in Canada, the other having received authorization for research purposes in the project already approved by CERC. The paiticipant will have to wear them for the next few days, for 10-12h/day for 6/7 days. Thus, the patient receives 6 pairs of lenses that must be wom and an additional pair in case ofbreakage or loss. The patient will be taught how to insert, remove and care for the lenses. Visual acuity will be re-measured with the contact lenses given to the patient by the research teain. Lens fit will be checked for position and movement under a biomicroscope.

Second visit

The second visit will be scheduledone week after the initial visit. It will begin with a case history focusing on contact lens wear (see appendices 2 and 3). Visual acuity will be taken monocularly and binocularly with the Snellen cha1t cali brated for 6m, identifying the smaUest line legible with contact lenses on the eyes. An abenometry measurement with the OPD Scan III, with a predetennined pupil size of 5mm, will be taken for each eye with the lenses in place, to measure the abenations induced by the presence of the lens on the eye. The patient is then asked to remove his or her contact lenses. Measurements of choroidal thickness (um) and blood vessel density (%) of the deep and superficial plexus will be taken with OCT-A. Axial length will be measured with the Anterion device. Biomicroscopic examination of the anterior segment will be perf01med to identi fy any ocular surface damage that may have been caused by contact lens wear.

The patient will receive seven pairs of the second type of lenses to be tested. He will have to wear them for the next few days for a period of 10-12h/day and for at least 6/7 days. Visual acuity measurements will be taken with the new contact lenses given to the patient by the research team. Lens fit will be checked for position and movement using a biomicroscope. The patient will be reminded of care and hygiene mles before leaving the clinic.

Third visit

The third visit is scheduled 1 week after the second visit. It will begin with a case hist01y focu sing on contact len s wear (see appendix 4). Visual acuity will be measured monocularly and binocularly with the Snellen cha1t cali brated for 6m, identifying the smaUest line legible with contact lenses on the eyes. An abenometry measurement with the OPD Scan III will be taken for each eye with the lenses in place. The patient must then remove the contact lenses. Measurements of choroidal thickness (um) and blood vessel density (%) of the deep and superficial plexus will be taken with OCT-A. Axial length will be measured with theAnterion device. Biomicroscopic examination of the anterior segment

will be perf01med to identify any oculaT smface damage that may have been caused by contact lens wear.

d. Description of variables

The independent variable in om study is :

Lens type: peripheral myopie defocus (Ll) or spherical(peripheral hyperopic defocus) (L2). This is a nominal vaTiable.

The dependent variables in om study are :

Percentage density of deep and superficial plexus retinal blood vessels (%) analyzed over 3 mm in ETDRS areas (1-5). This is a discrete ordinal variable.

Choroidal thickness (um) analyzed over 6 mm in ETDRS areas (1-9). This is a discrete ordinal variable.

e. Description of lenses used

In this research project, pa11icipants will be fitted with two different 1-day contact lenses, both made of Nesofilcon A, a hydrogel material approved by Health Canada. The lens tested has a multifocal profile with a central zone A of 2.5mm, 3.2mm or 4.1mm and a peripheral zone B with a net addition of +5.00D. The profile chosen will be the same for all pa1ticipants, i.e. 4.1mm zone A and a zone B with a +5.00 net addition. This lens has been described and is cunently being investigated for its effect on controlling the progression of myopia as part of project 19_09_27_CERC-19-071P at the Université de Montréal.

The control contact lens is *Bausch&Lomb's Biotrue,* a single v1s1on spherical daily disposable lens with an 8.6mm base cmve.

f. Description of measuring instnnnents

Abberometer - OPD SCAN III

The OPD scan III is a 5-in-l device for comeal topography, wavefront abenometly, auto-refractometly, keratometly and pupillometly. The OPD Scan can measure pupil sizes up to 9.5 mm in dian1eter. In our research, the OPD Scan III is used as an autorefractometer and wavefront aberrometer (25). Aberrometry will enable us to determine the amount of spherical abenation and "natural" coma aberration generated by the size of the patient's pupil. These abe1rntion quantitie s will be compared with those generated by wearing the two different types of lenses.

Axial length - Anterion

The Anterion is a device for measuring comeal topography, tomography and biometly of the eye. It uses swept-source OCT technology, which enables the use of longer wavelengths of light for higher image resolution. (26).

It will be used at the first visit to perfonn a comeal topography to validate whether the patient has a comeal defo1mity that could exclude him or her from the study. Using the ectasy analysis, the score value index would be analyzed. If the value is greater than -0.5, the patient will be excluded.

The Anterion would also be used to dete1mine the axial length of participants' eyes. This measurement will be repeated and compared at each of the three visits. In the Cataract APP analysis, the value measured in the Axial length section should be taken for each of the two eyes. (27).

Angiographie optical coherence tomograph (OCT-A) - Triton

The TRITON agiographic optical coherence tomograph will be used in this research project. OCT-A is a non-invasive angiography that enables changes in retinal vasculruization to be obse1ved. This is achieved by analyzing the movement of e1ythrocytes in blood vessels using a series ofB-scans (28). The TRITON uses swept-source technology that emits long wavelengths, enabling better visualization of the deep vascular layers of the choroid, compared with other instrnments that use shorter wavelengths (29, 30).

This instrnment will be used to visualize choroidal thickness and retinal vascular density at the posterior pole. Three scans will be perfonned: OCT-Angiography at the optic nerve head (peripapilla1y) 6.0mm x 6.0 mm and at the macula 6.0mm x 6.0 mm for analysis of retinal vesse! density, and 3D Macula (H) 6.0mm x 6.0mm for analysis of choroidal thickness in the vrufous ETDRS quadrants. These measurements will be taken with the camera's "photo flash" switched off, so as not to influence the retina's metabolic functions. Choroidal thickness data per quadrant (1-5) will be available in the 6 mm CSI analysis (BM-CSD (31).

f. Statistical analysis plan

An intragroup three-factor repeated measures ANOVA will be perf01med to analyze the change in superficial and deep plexus vascular density and the change in choroidal thickness following weru· of the two different lens types. Analysis will be canied out to compare changes in each of the ETDRS zones measured at different visits for vascular density and choroidal thickness values. A post-hoc analysis using a Bonferonni conection will evaluate the differences in variation of these factors for each contact lens studied.

g. Sample size jus tification

Sample size was detennined using G*Power software for an intragroup three-factor repeated-measures ANOVA. An effect size of 0.3, an alpha en-or of 0.05 and a power of 0.8 were used. Anumber of21 subjects would be needed to study the variation in vascular density of the superficial and deep plexuses and the change in choroidal thickness as a function of different soft contact lens optical designs. In this study, a conse1vative sample of 25 paiticipants will be used to test the effect of contact lens weai· on changes in retinal vascula·i density and choroidal volume.

5) Ethical considerations

The research team undertakes to send each paiticipant a copy of the consent form previously approved by the Université de Montréal Health Reseai·ch Ethics Committee. The decision to participate in the reseai·ch project remains voluntary, and no judgment or criticism will be expressed in the event of refusal to participate or abandonment of the project. The paiticipant may decide to withdraw from the research project at any time. The research team also rese1ves the right to exclude a paiticipant who does not meet the inclusion criteria or who presents an exclusion criterion.

Training in lens cai·e and insertion/removal hygiene will be provided at each paiticipant's first visit, to mini1nize the risk of infections associated with lens wear. Paiticipants will be advised of any side effects that may be associated with lens wear, such as foreign body sensation, minimal discomfort or dryness. Patients will also be infmmed of any abnormal symptoms to watch out for. The research team is available to respond rapidly to any problems encountered by paiticipants, and to monitor their condition closely.

To protect persona! data, only project members will be able to access the database. Each paiiicipant will receive a numerical code linked to their identity. The list linking their identity to a numerical code will be kept solely by the principal investigator in a password-protected electronic file. This infmmation will be kept in an anonymized database for a minimum period of 7 years.

6) Relevance and anticipated benefits

There are ve1y few data in the literature on changes in retinal vascularization following the use of a myopie or hyperopic defocus optical design. Choroidal changes are becoming better understood, and there is a growing body of data on this subject. The mechanism controlling eye elongation still involves a number of unresolved hypotheses. If the results of our research suggest an increase in retinal vessel density, this could provide a new avenue of research in the field of retinal pathology and myopia control. Such a discove1y could strengthen the hypothesis of the possible involvement ofa biochemical message from the choroid to the retinal vascular network. This biochemical effect could be used to increase retinal vascularization in various retinal pathologies where the vascular system is affected.

7) Timetable

November 2023: Protocol submitted to research director

- **December 2023:** Submission of protocol to comse instructor

April 2024: Ethics committee approval

May/August 2024: sta1tof paiticipant recrnitment and testing

August-November 2024: Analysis ofresults

- **December-March 2024:** Drafting of final rep01t, preparation forscientific day

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IV. Appendix 1

Table 2. Case history oriented visit 1

yes	no	
		Are you taking any medication? If yes, please specify :
		Have you ever been diagnosed with a comeal deformity?
		Do you smoke (including vaping)?
		Do you cmTently have myopia control treatment or have you had it in the past?
		Are you pregnant or breast-feeding?
		Have you had refractive surgery in the past?
		Have you consumed caffeine, tobacco, alcohol or done strenuous exercise in the last 24 hours?
		Have you wom soft LCs in the past?

V. Appe ndix 2

Tab le 3: Case history oriented visit 2 and 3

yes	no	
		Have you consumed caffeine, tobacco or alcohol in the last 24 hours?
_	days	In the past week, how many days did you wear the LCs given to you by the research team?
_	h	During the past week, for how many hours on average did you wear the LCs given to you by the research team?

VI. Appendix 3

Questionnaire lenses Visit 2-3 Tried pair
Participant code_____Date_____

What time do you insert your lenses in the moming?

_____

What time do you remove your contact lenses in the evening?

_____

PLEASE MARK EACH OF THE FOLLOWING ITEMS WITH THE NUMBER THAT BEST DESCRIBES YOUR LENS EXPERIENCE.
SCALE (1-10): 0: very bad./ always 10: excellent / never

QlA. Quality of vision (DAY)
from a distance (TV, cinema, etc.) 0 1 2 3 4 5 6 7 8 9 10
intermediate(computer) 0 1 2 3 4 5 6 7 8 9 10
near (reading, telephone) 0 1 2 3 4 5 6 7 8 9 10

Q lB. Quality of vision (NIGHT)
from a distance (TV, cinema, etc.) 0 1 2 3 4 5 6 7 8 9 10
intermediate(computer) 0 1 2 3 4 5 6 7 8 9 10
near (reading, telephone) 0 1 2 3 4 5 6 7 8 9 10

Q2A. Perception of ghost images (glare) - DAY
fu 012345678910
intermediate(computer) 0 1 2 3 4 5 6 7 8 9 10
near (reading, telephone) 0 1 2 3 4 5 6 7 8 9 10

Q2B. Perception of ghost images (glare) - NIGHT
far 012345678910
intermediate(computer) 0 1 2 3 4 5 6 7 8 9 10
near (reading, telephone) 0 1 2 3 4 5 6 7 8 9 10

Q 3A . Vision remains stable (DAY) 0 1 2 3 4 5 6 7 8 9 10

Q3B. Vision remains stable (NIGHT) 0 1 2 3 4 5 6 7 8 9 10

Q4A.Vision in driving, bicycle(DAY) 0 1 2 3 4 5 6 7 8 9 10

Q4b. Driving vision, bicycle(NIGHT) 0 1 2 3 4 5 6 7 8 9 10

Q5. Perception of halos in the evening 0 1 2 3 4 5 6 7 8 9 10

Q6 General satisfaction - vision 0 1 2 3 4 56 7 8 9 10

Q7. General satisfaction - comfort 0 1 2 3 4 5 6 7 8 9 10

VII. Appendix 4

Table showing randomization of lens wear for participants between visit 1 and 2

Participant	1st wk	2nd wk	Participant	1st wk	2nd wk	Participant	1st wk	2nd wk
1	S	B	10	S	B	19	S	B
2	S	B	11	S	B	20	S	B
3	B	S	12	B	S	21	B	S
4	B	S	13	B	S	22	B	S
5	S	B	14	B	S	23	S	B
6	B	S	15	S	B	24	B	S
7	S	B	16	B	S	25	B	S
8	S	B	17	S	B			
9	B	S	18	B	S			

S : Single vision lens

B : Bi focal high-add lens

Université de Montréal

Information and consent form

Title of research project :	Effect of Defocus in Soft Contact Lenses on Internai Retinal Vascularization
Researcher in charge of the project and Research Director:	Dr. Langis Michaud, optometrist, MS Full Professor School of optometry University of Montreal Telephone: (514) 343-6111 ext. 8945 E-mail: langis.michaud@umontreal.ca
Co-investigator	Dr. Rémy Marcotte-Collard, optometrist, MS Clinical lectu rer School of optometry University of Montreal Telephone: (514) 343-6082 E-mail: remy.marcotte.2@umontreal.ca
Co-investigator(s) :	
Student(s):	Catherine Forest Candidate for Doctor of Optometry, 1st cycle School of optometry University of Montreal Telephone: (514) 343-6082 E-mail: cathe rine.forest@umontr eal.ca Oleksandra Pysarenko Candidate for Doctor of Optometry, 1st cycle School of optometry University of Montreal Telephone: (514) 343-6082 E-mail: oleksandra.pysarenko@umontreal.ca
Research project funding :	The lenses used in this project are supplied by Bausch and Lomb.

1. Introduction

We invite you to participate in a research project. However, before agreeing to participate in this project and signing this information and consent form, please take the time to read, understand and carefully consider the following information.

This form may contain words you do not understand. We invite you to ask any questions you may have to the researcher in charge of this project or a member of the research team, and to ask them to explain any words or information that is not clear.

2. Nature and objectives of the research project

As it develops, myopia causes the eye to lengthen, which in turn can lead to pathologiessuch as retinal detachment and glaucoma. In recent years, researchers and manufacturers have developed spectacle lenses or contact lenses

with a special design that slows the progression of myopia. They are therefore prescribed to myopie children whose vision defect is progressing, in order to avoid these long-term complications.

The present study, in which you are invited to take part, aims to recruit a population of adults. It is a known fact that 40% of young adults with myopia continue to develop. Few optical means are available to them. Participants will be required to wear a high addition bifocal lens. Measurements will be taken before and after wearing the lens.

The present study is therefore being carried out to check whether the effects of t his lens, similar to the one tested on younger patients, will be comparable.

In this study, we will measure short -term changes in ret inal blood vessels to determine whether the lens worn has an effect that promotes myopie contrai (increased vessel density) or no effect (reducedvessel density). These results will help predict whether this type of lenscould represent a valid option for controlling myopia in young adults.

To carry out this research project, we plan to recruit around 25 participants (M and F) , aged between 18 and 35.

3. Conducting the research project

3.1 Research project location, duration and number of visits

This research project will take place at the Clinique Universitaire de la Vision. Your part icipation in this project will last 2h30 and will include 3 visits spaced one week apart . These visits will take place in the afternoon, at roughly the same time each time .

3.2 Nature of your participation

By participating in this research project, you will carry out the following activities, procedures and tests :

	Visit 1	Visit 2	Visit 3
Schedule	T=O	T+l week	T+ 2 weeks
Duration (min)	60	45	45
Case history At the 1st visit, the researcher will check that all the criteria allowing you to take part in the study have been met. On visits 2 and 3, the researcher will ask how things have gone, and whether anything new has corne to light.	x	x	x
Distance visual acuity with the patient's best correction You'll need to identify the smallest line of letters you can see, at a distance, while wearing your glasses or contact lenses.	x	x	x
Anterior segment eye health examination At each visit, an examination of the smface of the eye (conjunctiva - white of the eye and cornea - transparent pait in front of the eye color) will be perfo1med to ensure that the eye is healthy and can be tested. Fluorescein staining test: a drop of a yellow dye, called fluorescein, will be placed on the surface of your eyes. This test is used to assess dty eyes and comeal abrasion or scratches.	x	x	x
Optical coherence tomography (OCT-anterior) measurement OCT is a device that scans the superficial layers of the eye (cornea, anterior chamber, c1ystalline lens).	x	x	x

Dynamic refraction and aberrometry This device automatically measures your refractive error (refraction) by scanning a light target in the eye (dynamic). It also measures the dispersion of this light in the eye (aben ometry).	X (without lenses)	X (with lens es)	X (with lenses)
Pupil *diameter* The size of the pupil (black pait of the eye) is measured with a device (pupillometer- like a camera).	x		
Optical coherence tomography (posterior OCT) measurement OCT is a device that scans the deep layers of the retina (back of the eye)	x	x	x
Recommendaitons During visits 1 and 2, you will be given instmctions on how to wear and care for your contact lenses.	x	x	

4 *Participant* **cooperation**

Before att ending the test days, you must not have consumed caffeine, tobacco, drugs or exercised with in the last 12 hours.

S. I ncidental discovery

Alt hough not subject to formai optomeric evaluation, since this is a research project, the result s of all the tests, examinations and procedures carried out as part of this research project may reveal hitherto unknown problems - a so-called chance discovery. This is what we call a chance discovery. That' s why, in the event of a peculiarit y, the researcher in charge of the project will inform you to ensure follow-up.

6. Benefi ts associa ted with the research project

You may der ive some persona! benefit from your participation in this research project, but we cannot assure you of this. On the other hand, the results obtained will contribute to the advancement of scientific knowledge in this field of research.

7. Disadvant ages associated with the research project

The only disadvantages associated with this project are the t ime and t ravel involved.

S. Risks associated with the research project

The associated risks concern contact lens wear. I n this study, single-use (1-day) contact lenses were used. This is the wearing modality associated with the lowest complication rate. However, some participants may experience one or more of the following symptoms. These symptoms are rare with single-use lenses.

- pain
- foreign body sensation in t he eye
- dry eye during wear
- redness of the white of the eye (conjunctiva)
- abnormal secretions of tears or mucus (a beige deposit on the edge of the eyelids, which stretches when removed)
- allergies to any of the mater ials or solutions in the lens packaging
- reduced vision (in case of inflammat ion or infect ion)

Light sensitivity in some tests performed

If necessary, a break will be taken to help you recover. I f you agree, the tests will be resumed at a time of your choosing.

Risks associat ed with fluorescein :

The dye may be detectable in breast milk, so it is recommended that breast-feeding mothers wait 8 to 12 hours after the tests before feedingthe baby.

9. Voluntary part icipation and right of wit hdraw al

Your part icipation in t his research project is voluntary. You are therefore free to refuse to take part. You may also withdraw from t his project at any t ime, without giving any reason, by informing the research team.

Your decision not to part icipate or to withdraw from this research project will not affect the quality of care and services, present or future, to which you are ent it led at the Universit y Vision Clinic.

The researcher responsible for this research project or the Clinical Research Ethics Committee may terminate your part icipation without your consent . This can happen if new findings or information indicate that your participation in the project is no longer in your best interest, if you fail to comply with the researchproject' s inst ructions, or if t here are administrative reasonsfor abandoning the proj ect.

I f you withdraw or are withdrawn from the project, the information and material already collected as part of the project will neverthelessbe retained, analyzed or used to ensure the int egrit y of the project.

Any new knowledge acquired during the course of the project that could have an impact on your decision to continue part icipating in this project will be communicated to you promptly.

10. Privacy

During your part icipation in this research project, the researcher in charge of this project and the members of the research team will collect, in a research file, the information concerning you and necessary to meet the scientific objectives of this research project.

This may include information about your past and present health and lifest yle, as well as your answers to questionnaires and the results of all act ivities, tests, examinat ions and procedures that will be performed. Your fil e may also include ot her informat ion such as your name, gender, date of birth and ethnie origin.

Ali informat ion collected will remain confidential. To preserveyour identity and the confidentiality of this information, you will be identified only by a code number. The code key linking your name to your research file will be kept by t he researcher responsible for this researchproject.

This research data will be kept for at least 7 years by the researcher responsible for this research project.

Research data may be published or discussed in scientific meetings, but it will not be possible to identify you.

For surveillance, cont rol, prot ectio n and security purposes, your research file may be consulted by a person mandated by t he Universit é de Montréal or the Clinical Research Et hics Committee. These individua ls and organizations adhere to a confidentiality policy.

You have the rig ht to consult your researchfile to verify the information collected and have it corrected if necessary.

11. Participati on in furt her studies

Do you agree that the researcher in charge of t his research project, or a member of his or her research staff, may contact you again to propose that you participate in other research projects approved by the Clinical Research Ethics Comm itt ee of the Université de Montréal? Of course, at the t ime of contact, you will be free to accept or refuse to participatein the proposed resea rch projects. ☐ **Y es o No**

12. Seco nd a ry u se of re sea rch dat a

Do you agree that your research data may be used by the responsible researcher to carry out other research projects in the field of optometry?

These research projects will be evaluated and approved by the Clinical Research Ethics Committee before they are carried out. The Committee will aise ensure follow-up. Your research data will be stored securely on Université de Montré al computer servers. To preserve your identity and the confidentiality of your research data, you will be identified only by a code number, and measures will be taken to keep this information confidential.

Your research data will be kept for as long as it is useful for the advancement of scientific knowledge. When it is no longer useful, your research data will be destroyed. Please note that you may request that your research data not be used at any time by contacting the researcher in charge of the research project.

Do you agree to your research data being used under these conditions? □ **Yes** □ **No**

13. Marketing potential

Research result s resulting from your participation could lead to the creation of commercial products and generate profits. However, you will not benefit financially.

14. CompensatioB

You will not receive any financial compensation for your participation in this research project.

15. In the event of loss

Should you suffer any harm whatsoever as a result of your participation in the research project, you will receive all the care and services required by your state of health.

By agreeing to participate in this research project, you do not waive any of your rights and you do not release the researcher responsible for this research project , and the Université de Mont réal from their civil and professional liabilit y.

16. Medical emergency procedures

Please note that the Université de Mont réal does not offer emergencyservices. Therefore, in the event of a medical condit ion requiring immediate attention, first aid will be provided by the staff on hand and arrangementswill be made to transfer you, if necessary to a nearby hospital emergency room.

17. Reporting general results

The results obtained from this research project could be present ed as a poster at a scient ific day organized by the Université de Montréal School of Optometry. They could also be presented at conferences or in the form of a scientific article.

18. Contacts

I f you have any questions about the research project or if you wish to withdraw from the research project, you can contact the researcher in charge of this research project at the following coordinates: Dr Langis Michaud Optom etrist, MS. École d'optométrie de l'U de M. 3744 Jean-Brilla nt, suite 6462. Montreal H3T 1P1. Tel: 514-343-6111 ext. 8945. E-mail: langis.michaud@umo ntre al. ca

Complaints concerning this research may be addressed to the Université de Montréal Ombudsman at (514) 343-2100 or ombudsman@umontreal.ca. The ombudsman accepts collect calls. He speaks English and French and takes calls between 9 a.m. and 5 p.m.

19. Monitoring the ethical aspects of the research project

The Clinical Research Ethics Committee of the Université de Montréal has approved the research project and will ensure its follow-up.

Consent .

Title of research project : Effect of myopie and hyperopic peripheral defocus in soft contact lenses on inner retinal vascularization

1. Participant consent

I have read the information and consent form. The research project and this information and consent form have been explained to me. My questions have been answered and I have been given sufficient time to make a decision. After careful consideration, I consent to participate in this research project under the conditions stated herein.

Name and signature of participant Date

2. Signature of the person who obtained the consent, if different from the researcher responsible for the research project

I explained the researchproject and this information and consent form to the participant and answered any questions he asked.

Name and signature of persan obtaining consent Date

3. Signature and commitment of the researcher responsible for this research project

I certify that t his information and consent form has been explained to the participant and that any questions have been answered.

I undertake, together with the research team , to respect what has been agreed in the informat ion and consent form.

Name and signature of the researcher responsible for this research project Date