Chapter 140

Refractive errors during pregnancy: A bibliographic review

https://doi.org/ 10.56238/devopinterscie-140

Ana Paula Cavalli
Medical student, University of Contestado UNC. Mafra SC Brasil
E-mail: ana.cavali@hotmail.com

Paulo Sérgio Loiácono Bettes
Graduated in Medicine from the Evangelical Faculty of Medicine of Paraná. Master's and Doctorate from UFPR. Professor at the University of Contestado. Mafra. Santa Catarina. Brazil
E-mail: paulobettes@gmail.com

Ana Paula Friedrich
Medicine student, University of Contestado UNC. Mafra SC. Brazil
E-mail: friedrichana@hotmail.com

Bruna Hammes
Medicine student, University of Contestado UNC. Mafra SC. Brazil
E-mail: bruna.hammes@hotmail.com

Beatriz Peruzzolo Boldori
Medicine student, University of Contestado UNC. Mafra SC. Brazil
E-mail: beatrizboldori63@gmail.com

Erika Sampaio
Medicine student, University of Contestado UNC Mafra SC. Brazil
E-mail: eri.sampaio@outlook.com

Julia Buquera Bettes
Medical student, University of North Carolina at Chapel Hill. NC. United States
E-mail: jbettes@unc.edu

ABSTRACT
Introduction: During pregnancy, many physiological changes occur in women secondary to the metabolic demands of the fetus, placenta, and uterus and the increasing levels of sex hormones. The hormonal peak is characterized by the increase in estrogen, progesterone, and androgen which have receptors in various tissues, with the ability to modify them. The purpose of the research is to analyze the emergence/progression of refractive errors during pregnancy, describe the pathophysiology, identify if there is an improvement in the postpartum period, if there is a need for treatment, and verify the relationship between the mode of delivery and the RE. Material and methods: A bibliographic review was carried out with research restrictions from 2000 to 2022, being selected thirty-one studies. It also had a theoretical basis in books and reports. Results and discussions: Since the gestational period is related to physiological, pathological changes or changes in certain conditions, we have to take into account that the ocular tissues can change. The presence of sex hormone receptors in eye tissues been observed, which are affected during pregnancy, causing eye disorders to be exacerbated or ameliorated. Conclusion: Most authors conclude that RE can occur during pregnancy, however, many have inconclusive results. RE are physiological changes during this period, not requiring treatment, as they tend to regress after delivery. Changes in the RE and the mode of delivery should not be taken into account. More research is needed on the subject, as many articles contradict each other, despite the changes in the cornea being confirmed.

Keywords: Eye changes, Refractive surgery, Pregnancy physiology, Ocular physiology, Pregnancy, Refraction.

1 INTRODUCTION

During pregnancy, many physiological changes occur in women. Among them, we can observe hematological, cardiac, renal, respiratory, water metabolism, alimentary tract, endocrine, glucose metabolism, proteins, lipids, and calcium alterations in the woman's skeleton. “These changes, in the first weeks of pregnancy, are secondary to the metabolic demands of the fetus, placenta, and uterus and the increasing levels of sex hormones” (BUJOR; UNGUREANU; IANCU, 2021, p. 1). The next quarters already tend to show structural changes, due to the increase in the size of the uterus and the hormonal peak. All these processes are essential for the fetus to develop properly.

The hormonal peak is characterized by an increase in estrogen, progesterone, and androgen, which have receptors in various tissues and can modify them. “Ocular tissue, such as the eyelid, lacrimal gland, Meibomian gland, bulbar and palpebral conjunctiva, cornea, iris, ciliary body, lens, retina (retinal pigment epithelium) and choroid” (BUJOR; UNGUREANU; IANCU, 2021, p. 2) are some of the tissues that have receptors that are capable of maintaining a connection with these hormones. For this reason, during pregnancy and the hormonal peak (after the second trimester, accentuated during the third trimester) the eye tends to undergo several changes. Most of them tend to regress after delivery.

According to the Pan American Health Organization (PAHO) “globally, it is estimated that approximately 1.3 billion people live with some form of visual impairment” (World Vision Report, 2021, p. 26), such as refractive errors (RE), which include myopia, hyperopia, astigmatism, and presbyopia.

As previously mentioned, researchers observed changes in the ocular tissue during pregnancy, since it has receptors that have an affinity for hormones that are elevated during this period (estrogen, progesterone, and androgen). “These ocular changes may be physiological, pathological or maybe a modification of a pre-existing condition” (EBEIGBE; IGHOROJE, 2012, p. 298). For this reason, pregnancy is considered a risk factor for the occurrence of RE.

Because it is a topic that is not yet widespread and analyzed in the literature, and since the ophthalmological examination is not routine for pregnant women, the relevance of developing a bibliographic review on refractive errors in pregnancy is justified, analyzing their emergence /progression, to describe the pathophysiology, identify whether there is an improvement in RE after delivery, detecting whether there is a need for an indication of treatment during this period and verifying the relationship between the mode of delivery and refraction problems.

2 MATERIAL AND METHODS

A bibliographic review of studies on the relationship of refractive errors in pregnant women was carried out, where the articles were searched and obtained from the databases Pubmed, SciELO, Eric, EBSCO System, Obstetrical & Gynecological Survey, Survey of Ophthalmology, Comprehensive Ophthalmology Update, Ophthalmologica, British Journal of Ophthalmology, Graefe's Archive for Clinical

and Experimental Ophthalmology. It was theoretically based on works in the field of ophthalmology and obstetrics and a world vision report.

Publication date restrictions were applied, from the year 2000 to 2022, and thirty-one studies were selected. These were chosen by independent evaluations, following the topics addressed, which are: physiological changes during pregnancy, refractive errors during pregnancy, pregnancy, and the eyes, delivery methods and refractive eye changes, treatment of refractive errors during pregnancy, changes ocular physiological and pathological conditions during pregnancy, physiology of pregnant women and refractive errors. Studies that did not present refractive errors in ophthalmological problems in pregnant women and that did not have an objective conclusion on the topics that were addressed were excluded from the study.

The research ended on June 30, 2022, in the municipality of Mafra, after carrying out the bibliographical research.

3 RESULTS AND DISCUSSION

During pregnancy, the woman undergoes important anatomical and physiological changes to nourish and accommodate the developing fetus. These modifications start after conception and influence all organic systems in the body (SOMA-PILLAY; TOLPPANEN; MEBAZAA, 2016). These physiological changes that occur in the woman's body result from the pregnancy hormones, which come from the maternal ovaries and the fetoplacental unit, according to Kohlhepp, et al. (2018).

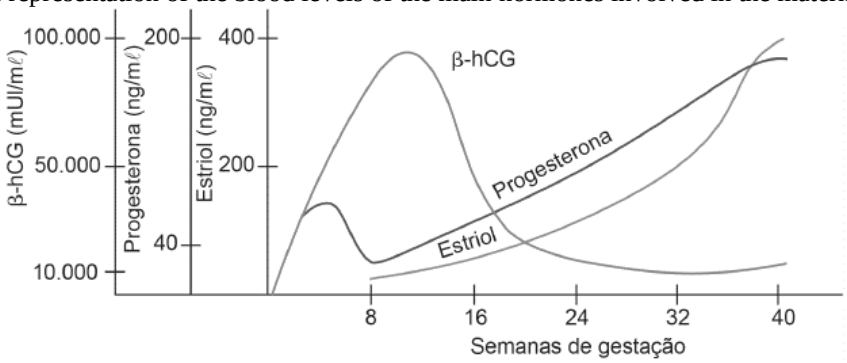
> Within the gravid uterus, the deciduous-fetoplacental unit produces an extraordinary amount of steroid hormones, proteins, and neuropeptides. These new units lead to the unidirectional flow of nutrients from the mother to the conceptus, and provide a favorable environment for in-utero development, cell growth, and maturation, in addition to signaling the moment when the product is ready for extrauterine life. In other words, the neuroendocrine events that unfold within and between compartments (maternal, fetoplacental, and amniotic) are critical for proper fetal maturation, the onset of labor, and lactation (MONTENEGRO; REZENDE FILHO, 2011, p. 79).

The changes that occur in the first weeks of gestation are secondary to the metabolic demands of the fetus, placenta, and uterus and increasing levels of sex hormones (BUJOR, et al., 2021). After the second trimester of pregnancy, the changes that occur in the woman's body are dependent on the uterus, with a hormonal peak in this period, which is of paramount importance, since the development of the fetus depends on it (BUJOR; UNGUREANU; IANCU, 2021).

“During the first, second, and third trimester of pregnancy, hormone levels in the blood gradually increase and, postpartum, their values decrease rapidly in a few days” (BOJUR; UNGYREANU; IANCU, 2021, p. 2). The hormones that are elevated during pregnancy are human chorionic gonadotropin, progesterone, steroid hormones (estrone, estradiol, estriol, and estetrol), relaxin, and oxytocin, among others. Physiologically, each hormone plays an important role in maintaining pregnancy. Human chorionic gonadotropin (hCG) is considered the hormone of pregnancy, its main function is to promote the formation

of progesterone by the gravid corpus luteum for a period of up to 3 to 4 weeks after implantation. Progesterone is responsible for maintaining pregnancy, influencing catabolism, and stimulating the growth of the mammary glands, with the interruption of premature uterine contractions being its main function. Estrogens play an important role in angiogenesis, ensuring vasodilation and preparing for uterine contraction, in addition to promoting catabolic metabolism and enlargement of the mammary glands. Relaxin is responsible for vasodilation and increased kidney function. Oxytocin plays a central role in childbirth, especially during the ejection period (KOHLHEPP; HOLLERICH; VO; HOFMANN-KIEFER; REHM; LOUWEN; ZACHAROWSKI; WEBER, 2018).

Figure 1 – Schematic representation of the blood levels of the main hormones involved in the maternal-fetal placental unit



Source: Montenegro (2011)

Since the gestational period is related to physiological, pathological changes or modifications of certain conditions, we have to take into account the tissue changes that may occur (OMOTI, et al., 2008). In most women who become pregnant and do not have complications, the alterations tend to disappear after the conception of the fetus, with minimal residual effects. For this reason, it is important to understand the normal physiological changes that occur during pregnancy, to differentiate them from abnormal adaptations (SOM-PILLAY, et al., 2016).

The presence of estrogen, progesterone, and androgen receptors was observed in the cornea, lens, iris, ciliary body, lacrimal glands, meibomian glands, and conjunctiva, according to ATAş, et al. (2014). Already, according to Bojur, et al. (2021), in addition to the previously mentioned sites, the affinity of the tissues of the eyelid, retina (retinal pigment epithelium), and choroid were detected. For this reason, there is a correlation between pregnancy and ocular alterations, which can be present in both the anterior and posterior segments.

It is then concluded that "All tissues, including the eye, are affected during this period so that ocular disorders can be exacerbated or improved" (EFE; UGURBAS; ALPAY; UGURBAS, 2012, p. 150). These tissue alterations generally tend to be physiological and transitory, with involution a few months after childbirth, while others may be pathological and cause harm to the woman's body. Myopia is an example of a common pre-existing ocular alteration during pregnancy (G.; COVILTIR; IANCU; CORBU, 2013).

Table 1 – Physiological changes of the eye during pregnancy

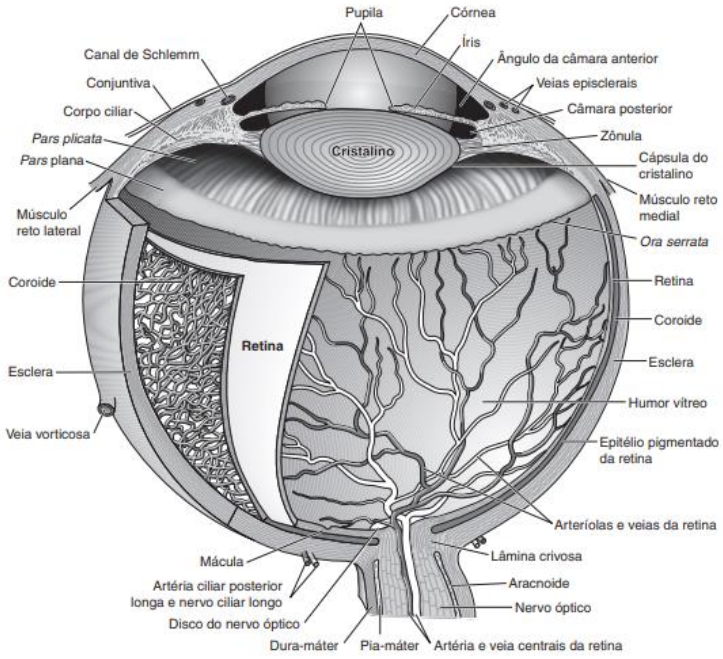
	Physiology	considerations	Quarter	Prognosis
Eyebrows/ Chloasma	increased pigmentation	dry eye syndrome	Third	Reversible
tear film	modified, diminished		Third	Reversible
pupil	Increased photopic and mesopic diameter	Intolerance to contact lenses	Third	Reversible
Cornea	Decreased sensitivity, increased thickness, and curvature		second and third	Reversible
Crystalline	Temporary loss of accommodation		All	Reversible
Iris	Krukenberg's spindle (pigment deposit around the cornea)		first and second	Reversible
IOP (intraocular pressure)	IOP decrease	Exception for pre-eclampsia and unaltered macula	Third	Reversible
choroid	Decreased thickness of the choroid	asymptomatic	First	Reversible
visual field	minimal changes		Third	Reversible
Hemeratopia	Difficulty seeing in bright light	Postpartum blood pressure monitoring	Third	Reversible
Hyposphagma	10%, conjunctival hemorrhage	dry eye syndrome		Reversible

Source: Mackensen, et al. (2014)

"The ability of the eye to focus the image depends on the refractive optical system of the eye working together: the cornea and the crystalline lens" (SILVA; FERREIRA; PINTO, 2013, p. 27). "The change in the thickness of the cornea can also alter the refractive index of the cornea, thus altering the refraction during pregnancy" (AKAR; YUCEL; AKAR; ZORLU; ARI, 2005, p. 41).

The beams of light pass through various structures in the eye until they reach the retina. The path comprises approximately 24 mm, crossing the tear film, the cornea, the aqueous humor, the crystalline lens, and the vitreous body (DANTAS, 2011).

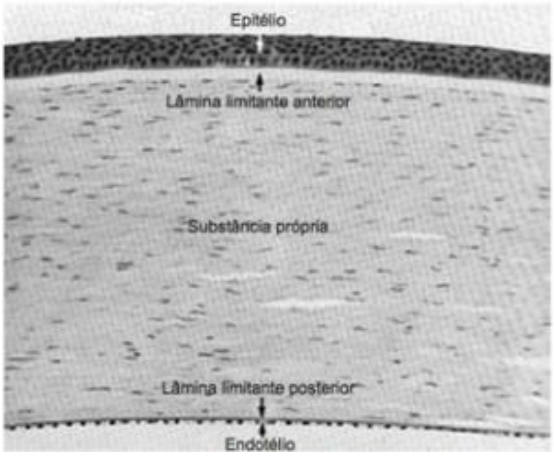
Figure 2 – Internal structures of the human eye



Source: Riordan-Eva (2011)

The cornea is an avascular and transparent tissue measuring 10 to 11 mm (millimeters). Anteriorly it is bathed by tears and posteriorly by aqueous humor. It has a more curved shape and its anterior curvature radius is about 7.7 mm, presenting a refractive index that comprises about 74% of the total dioptric power of the eye (DANTAS, 2011). About 90% of the thickness of the cornea is formed by the stroma, which can give it greater rigidity, so the stroma is responsible for the elasticity capacity and viscoelastic behavior, according to the biomechanical point of view. It is formed by collagen fibers and extracellular matrix (proteoglycans and glycosaminoglycans) (BUJOR; UNGUREANU; IANCU, 2021). It can transmit light beams from ultraviolet to infrared and is anatomically formed by five layers: epithelium, anterior limiting lamina, proper substance, posterior limiting lamina, and endothelium (DANTAS, 2011).

Figure 3 – Histology of the human cornea



Source: Dantas (2011)

The epithelium has the function of forming a barrier to hinder the entry of microorganisms and the entry of the tear film. The anterior limiting lamina (also called Bowman's membrane) is an acellular layer formed by collagen fibers and proteoglycans. The substance itself (also called stroma) is the largest portion of the cornea, consisting of an extracellular matrix, keratocytes (responsible for the synthesis of collagen and proteoglycans), and nerve fibers. The posterior limiting lamina has an elastic characteristic and distends in cases of edema. The endothelium is important for regulating the content of water and substances in the cornea (DANTAS, 2011).

The tear film is the liquid that bathes the eye anteriorly. Its main functions are: to smooth the surface of the cornea, provide protection, supply nutrients to the corneal epithelium, lubricate the eyelids, and dilute irritating substances. It is classically formed by three layers: (1) lipid layer (superficial), (2) aqueous layer (intermediate), and (3) mucous layer (internal). Under normal conditions, its volume is around 7 microliters (DANTAS, 2011).

Aqueous humor is a transparent fluid that fills the anterior and posterior chambers of the eye and functions to nourish avascular tissues (cornea and lens). Its transparency allows the transmission of light to occur (DANTAS, 2011).

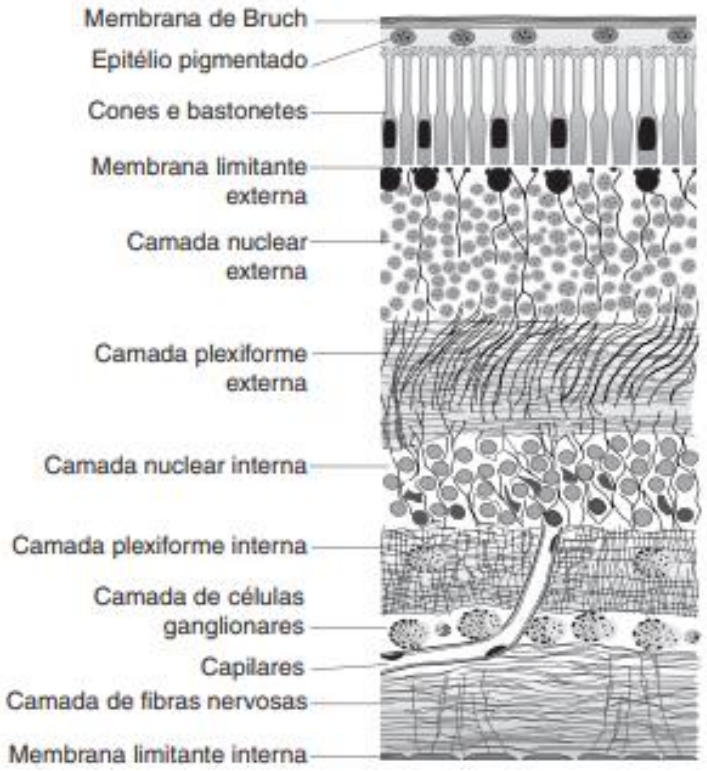
The choroid is formed by a pigmented vascular tissue, whose functionality is the supply of oxygen to the pigmented epithelium and photoreceptors and the regulation of ocular temperature (DANTAS, 2011).

The lens is a biconvex, avascular, nerveless, colorless structure. Its function is to focus light on the retina. It performs the accommodation process, that is, a mechanism that changes the focus of a distant object to have a close image. This change in the shape of the lens occurs due to the action of the ciliary muscle and zonular fibers (DANTAS, 2011).

The vitriol body fills the posterior region of the eyeball, occupying 80% of the volume of the eye. It is composed of water, collagen, and hyaluronic acid (DANTAS, 2011).

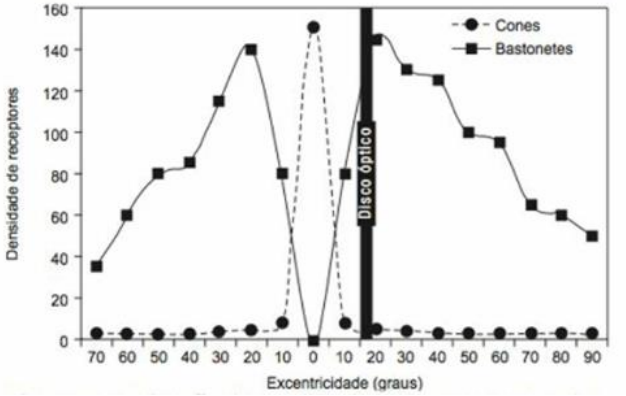
The retina has two layers: the retinal pigment epithelium (outer layer) and the sensory retina (inner layer), formed by photoreceptor cells and synaptic connections. The photoreceptors present in the inner layer are the rods and cones. The cones are in greater concentration in the central fovea and work in cases of medium to high luminosity, being responsible for color vision. The rods, on the other hand, are located more on the periphery of the retina, that is, they are not found in the central fovea, and they work with low levels of illumination (DANTAS, 2011).

Figure 4 – Layers of the retina



Source: Riordan-Eva (2011)

Figure 5 – Distribution of cones and rods in the retina

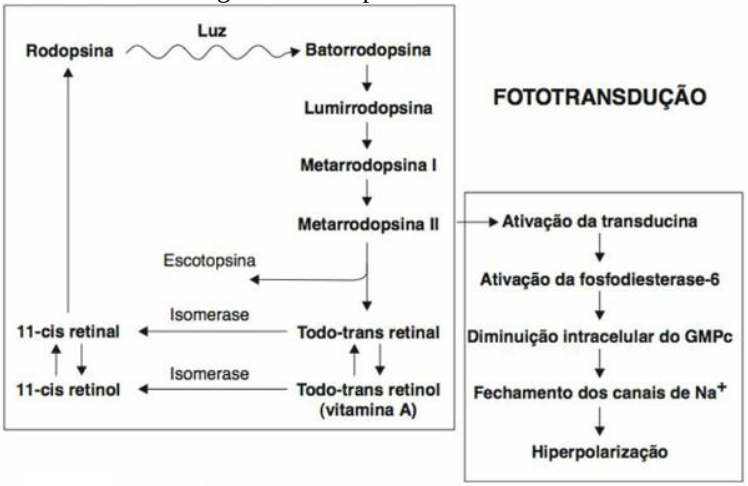


Source: Dantas (2011)

The electromagnetic radiation that reaches the eye must be between 400 and 700 nm (nanometer) to be considered visible light to the human eye. It is absorbed by rods and cones in the stratum nervous of the retina. These cells can emit inhibitory and excitatory nerve impulses that are modified and reach the nerve fibers that make up the optic nerve (DANTAS, 2011).

The mechanism for converting light into a nerve impulse is called phototransduction. In the human body there are four different types of photopigments (opsins): (1) rhodopsin, which is the photopigment of rods, (2) blue-sensitive opsin, (3) green-sensitive opsin, and (4) red-sensitive opsin. The phototransduction process occurs as follows: initially, a photon of light is absorbed by rhodopsin, for example, which transforms the 11-cis retinal into the trans retinal and activates the transducin protein (protein G). Transducin activates the phosphodiesterase enzyme, which hydrolyzes cGMP molecules (cyclic guanosine monophosphate). The reduction of intracellular cGMP causes the closure of sodium channels to occur. Thus, when light is present, the channels of the plasmatic membrane that are sensitive to cGMP close and cause hyperpolarization of the plasmatic membrane and an alteration of the electrical signal that is transmitted to the rod, initiating the electrical signal that in the brain is interpreted as light (DANTAS, 2011).

Figure 6 – Rod phototransduction



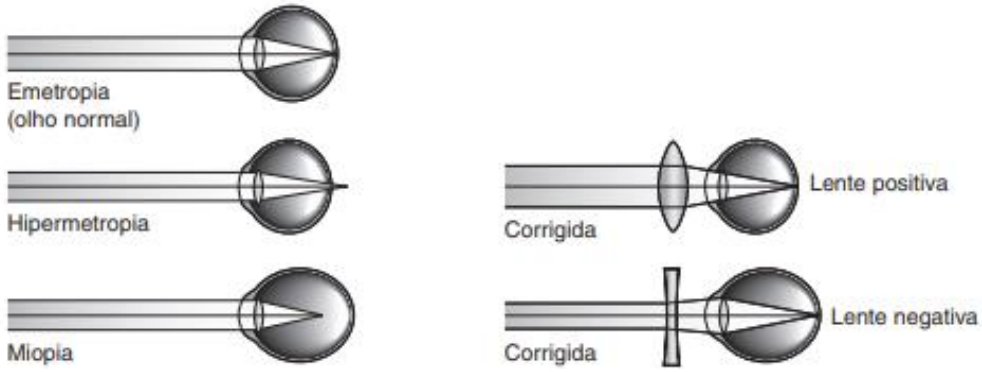
Source: Dantas (2011)

Then the electrical impulse follows through the chiasm and optic tract until it reaches the brain, being processed by several visual centers, which interact with the cerebral cortex, thus forming visual images. Brodmann's area is the primary visual area, so all the information that arrives in the primary cortex is distributed to three processing pathways of the analytical cortex, which will encode the quality information of the visual sensation. This decoded information will unite in the synthetic inferotemporal cortex (place held with short-term memory and visual learning) and then is taken to the perirhinal and entorhinal cortex, the hippocampus, and the amygdala (place linked to memory and emotion). This process occurs in fractions of seconds (DANTAS, 2011).

In summary, refraction is defined as the rays of a beam of light from the environment, which, when crossing the eyeball, unite in the retina, transforming this reflection into an electrical signal, sent to the brain and transformed into an image, according to the Instituto of the Eyes of Rio de Janeiro (2020). Refractive errors occur when this beam of light crosses the eyeball, but its rays are diverted and do not arrive focused on the retina, causing the image to lack sharpness. An emmetrope eye has a natural focus for long-distance vision. An ametropic eye (that is, with the presence of a refractive error, such as myopia, hyperopia, or astigmatism) needs correction to present an adequate focus for distance vision (RIORDAN-EVA, 2011).

> In hyperopia ("far-sightedness"), light rays from a distant target focus behind the retina, causing the image on the retina to become blurred. A (+) biconvex lens corrects this by increasing the eye's refractive power and shifting the focus point forward. In myopia ("the ability to see close up"), light rays focus in front of the retina, as the eyeball is too long. Placing a biconcave (–) lens in front of the eye diverts incoming light rays; this effectively weakens the eye's optical power enough that the focus is shifted back and onto the retina. In astigmatism, the eye produces an image with numerous focal points or lines (RIORDAN-EVA, 2011, p. 30).

Figure 7 – Overview of refractive errors and lens correction



Source: Riordan-Eva (2011)

"The refractive error is one of the problems commonly encountered during pregnancy" (DIRESS; YESHAW; BANTIHUN; DAGNEW; AMBELU; SEID; AKALU, 2021, p. 2). One example of refractive errors is myopia. This is considered as low (< -6 diopters), moderate (-2 to -6 diopters), and high (> -6 diopters) and has genetic and environmental risk factors. In a survey by Fernandez-Montero, et al. it was discovered that pregnancy is considered a risk factor for myopia progression (RZESZOTARSKA;

SZCZAPA-JAGUSTYN; KOCIECKI, 2020). Through specialized studies, the structural alterations present in the cornea during pregnancy were identified:

> Increased corneal thickness, increased corneal curvature, changes in corneal sensitivity, decreased intraocular pressure (IOP), changes in refraction, visual field defects, contact lens intolerance, and variations in corneal biomechanics (BUJOR; UNGUREANU; IANCU, 2021, p. 2).

Most of these corneal changes occur due to pregnancy because hormones present their peak activity (higher in the third trimester) (EBEIGBE; IGHOROJE, 2012). The amount of increase in corneal thickness ranges from 1 to 16 microns. A possible cause of the increase in its thickness is fluid retention during pregnancy" (SHARMA; REKHA; SHARMA; DOWNEY, 2006). However, "these changes are transient because several weeks after delivery, all hormonal activities return to their pre-pregnancy state" (EBEIGBE; IGHOROJE, 2012, p. 298).

According to the study by Nkiru, et al. (2018), simple myopia was the most common refractive error observed among participants. The greatest change in myopia was observed in patients who already had the predisposing disease in the study. This change in myopia that occurs during the gestational period has already been observed in other studies and may be responsible for the reduction in VA (visual acuity) for distance found in pregnant women, especially during the third trimester. According to a study by Mehdizadehkashi, et al. (2014), most ER is temporarily associated with gestational periods. According to the study by ATAş, et al. (2014) corneal thickness returns to its normal level 3 months after delivery. This occurs due to fluid retention throughout the body, including the cornea, or because the cornea is directly affected by the hormones present during pregnancy. These authors also believe that corneal edema can cause refractive changes.

"One should keep in mind the fact that pregnancy can cause changes in the parameters of the anterior chamber" (ATAş; DURU; ULUSOY; ALTđNKAYNAK; DURU; AÇMAZ; ATAş; ZARARSđZ, 2014, p. 449). A study carried out by Pizzarello (2003) with 240 pregnant women showed that all women had worsening myopia during the pregnancy period, observing a very significant difference in refraction between the pre and postpartum period concerning the control group. All these changes were resolved after delivery. Temporary loss of accommodation may be evident during pregnancy and breastfeeding. According to the study by Diress, et al. (2021), the prevalence of refractive errors in pregnant women was high, especially myopia. It was evident that the factors that influenced the occurrence of this alteration were advanced age, increased gestational age, increased parity, and regular use of computers and television.

However, according to Ebeigbe, et al. (2012), although some articles show changes in the RE during the different trimesters of pregnancy, these changes do not become significant because they did not report considerable changes in the refractive error during pregnancy. In the study by Naderan and Jahanrad (2017), although a pattern of change was observed with the values before pregnancy and in the postpartum period, "the topographic and biomechanical parameters of the cornea were not significantly different compared to the initial measurements". "However, the results in the literature remain disparate and several studies show

the opposite" (MILAZZO; MIKOU; BERTHOUT; BREMOND-GIGNAC, 2010, p. 369). According to Akar, et al. (2005, p. 41), "no significant change in mean keratometry or refractive error values was observed in pregnant women and controls during the study". Studies by Taradaj, et al. (2018) did not find a relationship between pregnancy and cylindrical refractive error and the axis of astigmatism.

The table below shows the analysis of the researched articles, showing the results found on the relationship between refractive errors and the pregnancy period.

Table 2 – Analysis of articles and results regarding the relationship between RE and pregnancy

ARTICLES	NUMBER
ER is associated with pregnancy	16
ER has no association with pregnancy	1
Nothing significant in the association of ER with pregnancy	9
TOTAL	26

Source: Survey data (2022)

3.1 TREATMENT OF REFRACTIVE ERRORS DURING PREGNANCY

Surgery to correct refractive errors acts on the cornea, changing its shape or the way the eye focuses light internally. It aims to reduce or eliminate ER, such as "myopia, distorted vision (astigmatism) or hyperopia and reduce a person's dependence on glasses and contact lenses" (SHARMA; REKHA; SHARMA; DOWNEY, 2006, p. 186).). It is performed using two laser techniques, PRK (photorefractive keratectomy) and LASIK (excimer laser-assisted in situ keratomileusis). In PRK, the corneal epithelium is removed just to perform the laser, unlike LASIK in which the corneal epithelium is removed and replaced after the laser (RIORDAN-EVA, 2011). It is advisable to postpone refractive surgery until refraction is stable postpartum or to avoid pregnancy for 1 year after surgery as this change may appear physiological.

> Sharif studied the refractive outcomes of 18 eyes of 9 women who received PRK for myopia and became pregnant over a 12-month follow-up period. He concluded that postoperative pregnancy affected refractive results in PRK. Twelve (6 patients) of 18 eyes had myopic regression (DINN; HARRIS; MARCUS, 2003, p. 141).

For Dinn, et al. (2003, p. 141), the recommendations for refractive eye surgery in women are:

Table 3 – Recommendation for refractive surgery for women

Refractive eye surgery recommendations for women
Candidates must not intend to become pregnant for 1 year after surgery
Candidates must not be pregnant.
Candidates must have a stable postpartum refractive prescription document.

Source: Dinn, et al. (2003)

"Contact lens intolerance is common, secondary to the modification of the tear film, but it does not systematically contraindicate the use of lenses" (MILAZZO; MIKOU; BERTHOUT; BREMOND-GIGNAC, 2010, p. 368). This contact lens intolerance is usually due to decreased sensitivity in pregnant women and due to corneal edema, which occurs due to fluid retention, resulting in a chronically red and

irritated eye. This fluid retention affects refraction as well, making current glasses or contact lenses temporarily too strong or too weak. According to Wu, et al. (2019), pregnant women have a refractive change in this period and it is important to note that the previous prescription for glasses is not significant and a longer time for the last prescription should be considered. 1040).

3.2 DELIVERY METHOD AND REFRACTIVE ERRORS

According to Mackensen, et al. (2014), there are no contraindications according to ophthalmology for vaginal delivery. Even though high myopia is considered a risk factor for retinal detachment, it is not a contraindication for spontaneous vaginal delivery. Cesarean section is indicated for patients with degenerative myopia with choroidal neovascularization, but for those with high myopia, this delivery method is not considered a choice. The method of anesthesia should not take into account the patient's ophthalmological conditions. “Until more evidence is available, vaginal delivery should be the standard for patients with eye problems in the absence of contraindications” (G.; COVILTIR; IANCU; CORBU, 2013, p. 199).

4 CONCLUSION

During the pregnancy period, many changes occur in the woman's body, both hormonal and structural. Hormonal changes are of paramount importance for the maintenance and development of the fetus. These hormonal spikes can cause tissue changes in women that have receptors for these hormones. Ocular tissues have ligands capable of connecting with hormones, causing their differentiation to occur. One of the places that undergo alteration is the cornea, mainly in its thickness, causing a change in its structure and possibly the occurrence of the appearance/progression of RE.

Refractive errors, one of the most common eye problems, occur due to changes in the cornea and lens, units that refract the eye. For this reason, most authors conclude that there is a relationship between the onset/progression of refractive errors during pregnancy. On the other hand, many articles present inconclusive results for the occurrence of RE in pregnancy, while others point to a negative result for their correlation.

But it is known that most of these alterations, both in the eyes and in any other tissues, tend to regress about 3 months after delivery. Therefore, we can conclude that the refractive errors that arise in pregnancy occur due to physiological changes depending on the hormonal increase and/or due to fluid retention and tend to regress in the postpartum period, not causing complications for the woman afterward. In this way, treatment is not necessary. Refractive surgeries should be postponed until refraction levels remain the same as before pregnancy. The glasses used by pregnant women do not need to be changed, as the refraction values tend to return to the standard after childbirth. These physiological changes in women also cause intolerance to contact lenses due to fluid retention, making the eye drier, but its use is not contraindicated.

Regarding the delivery routes, there are no contraindications for normal delivery. Although high myopia is considered a risk factor for the occurrence of retinal detachment, it is evident that natural childbirth is the most indicated. The method of anesthesia during childbirth should not take into account ophthalmological changes.

However, more research is needed on the subject, as many articles contradict each other on the occurrence of the emergence/progression of ER during pregnancy, although the changes that occur in the cornea are conclusive in all articles.

REFERENCES

AGRAWAL, Nisha; T, Lalit Agarwal; LAVAJU, Poonam; CHAUDHARY, Sanjib Kumar. Physiological Ocular Changes in Various Trimesters of Pregnancy. Nepal J Ophthalmol, [S.I], v. 10, n. 19, p. 16-22, 2018.

AKAR, Yusuf; YUCEL, Iclal; AKAR, Munire Erman; ZORLU, Gurkan; ARI, Eylem Seker. Effect of Pregnancy on Intraobserver and Intertechnique Agreement in Intraocular Pressure Measurements. Ophthalmologica, [S.L.], v. 219, n. 1, p. 36-42, 2005. S. Karger AG. http://dx.doi.org/10.1159/000081781.

ATAş, Mustafa; DURU, Necati; ULUSOY, Döndü Melek; ALTđNKAYNAK, Hasan; DURU, Zeynep; AÇMAZ, Gökhan; ATAş, Fatma Kaya; ZARARSđZ, Gökmen. Evaluation of anterior segment parameters during and after pregnancy. Contact Lens And Anterior Eye, [S.L.], v. 37, n. 6, p. 447-450, dez. 2014. Elsevier BV. http://dx.doi.org/10.1016/j.clae.2014.07.013.

BONFADINI, Gustavo. O que são erros refrativos. IORJ - Instituto de Oftalmologia do Rio de Janeiro. Disponível em: <https://iorj.med.br/o-que-sao-erros-de-refracao/>. Acesso: 19 de junho de 2022.

BUJOR, Inna Adriana; UNGUREANU, Emil; IANCU, George. Corneal Biomechanical Changes in Third Trimester of Pregnancy. Medicina, [S.I], v. 57, n. 600, p. 1-11, 10 jun. 2021.

CHAWLA, Sushil; CHAUDHARY, Tarun; AGGARWAL, S.; MAITI, G.D.; JAISWAL, Kulharsh; YADAV, Jairam. Ophthalmic considerations in pregnancy. Medical Journal Armed Forces India, [S.L.], v. 69, n. 3, p. 278-284, jul. 2013.

CHEN, Wei; LI, Li; ZHANG, Hongyuan; LI, Yan; CHEN, Xu; ZHANG, Yue. Macular choroidal thickness in highly myopic women during pregnancy and postpartum: a longitudinal study. Bmc Pregnancy And Childbirth, [S.L.], v. 18, n. 1, p. 1-6, 8 jun. 2018. Springer Science and Business Media LLC. http://dx.doi.org/10.1186/s12884-018-1865-3.

DANTAS, Adalmir Morterá. Essencial em oftalmologia. Rio de Janeiro: Guanabara Koogan, 2011.

DIRESS, Mengistie; YESHAW, Yigizie; BANTIHUN, Minychil; DAGNEW, Baye; AMBELU, Adugnaw; SEID, Mohammed Abdu; AKALU, Yonas. Refractive error and its associated factors among pregnant women attending antenatal care unit at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia. Plos One, [S.L.], v. 16, n. 2, p. 1-13, 12 fev. 2021.

EBEIGBE, Ja; EBEIGBE, Pn; IGHOROJE, Ada. Ocular changes in pregnant Nigerian women. Nigerian Journal Of Clinical Practice, [S.L.], v. 15, n. 3, p. 298-301, 2012. Medknow. http://dx.doi.org/10.4103/1119-3077.100624.

EFE, Yasemin Kozluca; UGURBAS, Silay Canturk; ALPAY, Atilla; UGURBAS, Suat Hayri. The course of corneal and intraocular pressure changes during pregnancy. Canadian Journal Of Ophthalmology, [S.L.], v. 47, n. 2, p. 150-154, abr. 2012. Elsevier BV. http://dx.doi.org/10.1016/j.jcjo.2012.01.004.

G., Iancu; COVILTIR, Valeria; IANCU, Raluca; CORBU, Catalina. Particularities of myopia in pregnancy. Gineco.Eu, [S.L.], v. 9, n. 34, p. 196-199, 20 dez. 2013. Gineco.EU. http://dx.doi.org/10.18643/gieu.2013.196.

GARG, P; AGGARWAL, P. Ocular changes in pregnancy. Nepalese Journal Of Ophthalmology, [S.L.], v. 4, n. 7, p. 150-161, 2012. Nepal Journals Online (JOL). http://dx.doi.org/10.3126/nepjoph.v4i1.5867.

GOTOVAC, Marta; KASTELAN, Snjezana; LUKENDA, Adrian. Eye and Pregnancy. Coll. Antropol., [S.I], v. 37, n. 1, p. 189-193, 2013.

INN, Robert B.; HARRIS, Alon; MARCUS, Peter S.. Ocular Changes in Pregnancy. Obstetrical And Gynecological Survey, [S.I], v. 58, n. 2, p. 137-144, 2003.

KALOGEROPOULOS, Dimitrios; SUNG, Velota Ct; PASCHOPOULOS, Minas; MOSCHOS, Marilita M.; PANIDIS, Panagiotis; KALOGEROPOULOS, Chris. The physiologic and pathologic effects of pregnancy on the human visual system. Journal Of Obstetrics And Gynaecology, [S.L.], v. 39, n. 8, p. 1037-1048, 13 jun. 2019.

KOHLHEPP, L. M.; HOLLERICH, G.; VO, L.; HOFMANN-KIEFER, K.; REHM, M.; LOUWEN, F.; ZACHAROWSKI, K.; WEBER, C. F.. Physiologische Veränderungen in der Schwangerschaft. Der Anaesthesist, [S.L.], v. 67, n. 5, p. 383-396, 13 abr. 2018. Springer Science and Business Media LLC. http://dx.doi.org/10.1007/s00101-018-0437-2.

MACKENSEN, Friederike; PAULUS, Wolfgang E.; MAX, Regina; NESS, Thomas. Ocular Changes During Pregnancy. Deutsches Ärzteblatt International, [S.L.], v. 111, p. 567-576, 18 ago. 2014. Deutscher Arzte-Verlag GmbH. http://dx.doi.org/10.3238/arztebl.2014.0567.

MARCOS-FIGUEIREDO, Pedro; MARCOS-FIGUEIREDO, Ana; MENÉRES, Pedro; BRAGA, Jorge. Ocular Changes During Pregnancy. Revista Brasileira de Ginecologia e Obstetrícia, [S.I], v. 40, p. 32-42, 2018.

MEHDIZADEHKASHI, Khashayar; CHAICHIAN, Shahla; MEHDIZADEHKASHI, Abolfazl; JAFARZADEPOUR, Ebrahim; TAMANNAIE, Zeinab; MOAZZAMI, Bahram; PISHGAHROUDSARI, Mohaddeseh. Visual Acuity Changes during Pregnancy and Postpartum: a cross-sectional study in iran. Journal Of Pregnancy, [S.L.], v. 2014, p. 1-4, 28 set. 2014. Hindawi Limited. http://dx.doi.org/10.1155/2014/675792.

MILAZZO, S.; MIKOU, R.; BERTHOUT, A.; BREMOND-GIGNAC, D. Comprendre les troubles de la réfraction et les problèmes oculomoteurs pendant la grossesse. Journal Français D'Ophtalmologie, [S.L.], v. 33, n. 5, p. 368-371, maio 2010. Elsevier BV. http://dx.doi.org/10.1016/j.jfo.2010.03.001.

MONTENEGRO, Carlos Antonio Barbosa. REZENDE FILHO, Jorge de. Obstetrícia fundamental, Rezende. 14 ed. Rio de Janeiro : Guanabara Koogan, 2019.

NADERAN, Mohammad; JAHANRAD, Ali. Anterior, posterior and biomechanical parameters of cornea during pregnancy in healthy eyes: a cohort study. British Journal Of Ophthalmology, [S.L.], v. 102, n. 3, p. 309-312, 29 jul. 2017. BMJ. http://dx.doi.org/10.1136/bjophthalmol-2017-310247.

NKIRU, Znwachukwu; OBIEKWE, Okoye; LILIAN, Okwesili; DANIEL, Cnwachukwu; UCHENNA, Inwagha; RICH, Umeh. Visual acuity and refractive changes among pregnant women in Enugu, Southeast Nigeria. Journal Of Family Medicine And Primary Care, [S.L.], v. 7, n. 5, p. 1037-1041, 2018.

OMOTI, Afekhide e; WAZIRI-ERAMEH, Joseph M; OKEIGBEMEN, Valentina W. A Review of the Changes in the Ophthalmic and Visual System in Pregnancy. African Journal Of Reproductive Health, [S.I], v. 12, n. 3, p. 185-196, dez. 2008.

PIZZARELLO, Louis D. Refractive changes in pregnancy. Graefe'S Archive For Clinical And Experimental Ophthalmology, [S.L.], v. 241, n. 6, p. 484-488, 8 maio 2003. Springer Science and Business Media LLC. http://dx.doi.org/10.1007/s00417-003-0674-0.

Relatório mundial sobre a visão. Dispinível em: <https://apps.who.int/iris/bitstream/handle/10665/328717/9789241516570-por.pdf>. Acesso: 21 de março de 2022.

RIORDAN-EVA, Paul. WHITCHER, John P. Oftalmologia Geral De Vaughan & Asbury. 17 ed. Tradução para português: AMGH Editora Ltda. 2011.

RZESZOTARSKA, Anna; SZCZAPA-JAGUSTYN, Justyna; KOCIECKI, Jaroslaw. Ophthalmological problems in pregnancy — a review. Via Médica: Ginekologia Polska, [S.I], v. 91, n. 8, p. 473-477, 2020.

SHARMA, Sushma; REKHA, Wuntakal; SHARMA, Tarun; DOWNEY, Gabrielle. Refractive issues in pregnancy. Australian And New Zealand Journal Of Obstetrics And Gynaecology, [s. l], v. 46, p. 186-188, 2006.

SILVA, Jailton Vieira. FERREIRA, Bruno Fortaleza de Aquino. PINTO, Hugo Siqueira Robert. Distúrbios refrativos e presbiopia. Ceará, p. 27-30, fev. 2013.

SOMA-PILLAY, Priya; SOMA-PILLAY, Priya; TOLPPANEN, Heli; MEBAZAA, Alexandre. Physiological changes in pregnancy. Cardiovascular Journal Of Africa, [S.I], v. 27, n. 2, p. 89-94, 2016.

TARADAJ, Karol; et al. Pregnancy and the eye. Changes in morphology of the cornea and the anterior chamber of the eye in pregnant woman. Via Médica: Ginekologia Polska, [S.I], v. 89, n. 12, p. 695-699, 2018.

WU, Frances; SCHALLHORN, Julie M.; LOWRY, Eugene A. Refractive status during pregnancy in the United States: results from nhanes 2005-2008. Graefe'S Archive For Clinical And Experimental Ophthalmology, [S.L.], v. 258, n. 3, p. 663-667, 10 dez. 2019.

YENEREL, Nursal Melda; KÜÇÜMEN, Raciha Beril. Pregnancy and the Eye. Turkish Journal Of Ophthalmology, [s. l], v. 45, n. 5, p. 213-219, 2015.

AGRADECIMENTO: Agradeço a minha família e amigos pelo apoio e suporte por todo esse período e ao Prof. Dr. Paulo Sérgio Loiácono Bettes por ter me orientado e auxiliado para que esse projeto fosse concluído.