Zhang, L.; Li, J.; Zhou, L. (2023) EVALUATION OF AMETROPIA RISK FACTORS IN PRESCHOOL CHILDREN AND THEIR IMPLICATIONS FOR COMPREHENSIVE EYE HEALTH AND MENTAL WELLNESS MANAGEMENT. Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte vol. 23 (91) pp. 394-405. **DOI:** https://doi.org/10.15366/rimcafd2023.91.024

ORIGINAL

EVALUATION OF AMETROPIA RISK FACTORS IN PRESCHOOL CHILDREN AND THEIR IMPLICATIONS FOR COMPREHENSIVE EYE HEALTH AND MENTAL WELLNESS MANAGEMENT

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UNESCO Code / UNESCO Code:
Council of Europe classification / Council of Europe classification:

Recibido 13 de abril de 2022 **Received** April 13, 2022
Aceptado 26 de junio de 2023 **Accepted** June 26, 2023

ABSTRACT

This study investigates the multifaceted landscape of ametropia risk factors in preschool children and explores the far-reaching implications for comprehensive eye health and mental wellness management. Ametropia, encompassing refractive errors such as myopia, hyperopia, and astigmatism, is a prevalent concern in early childhood that can have lasting consequences if left unaddressed. Utilizing a rigorous screening process and logistic regression analysis, we analyze a spectrum of variables including genetics, environmental factors, and screen time to discern their respective roles in the development of ametropia. Findings reveal that genetic predisposition, coupled with excessive screen time and limited outdoor activities, contribute significantly to ametropia in preschoolers. This research underscores the paramount importance of regular eye health assessments in preschool children, particularly in those with genetic risk factors or substantial screen exposure. Timely detection and correction of refractive errors can substantially enhance visual acuity and foster overall ocular health. Moreover, we emphasize the indirect yet profound link between ametropia and mental well-being in preschool children. Uncorrected vision issues can hinder learning, social interactions, and self-esteem, potentially leading to anxiety, frustration, and other psychosocial challenges.

Early intervention for ametropia not only has a positive impact on ocular health but also promotes mental wellness in this vulnerable age group. In summary, this study illuminates the intricate web of ametropia risk factors in preschool children, highlighting the critical significance of early eye health evaluations and interventions. The holistic approach to eye care presented here acknowledges the profound connection between vision and mental well-being, thus fostering a more comprehensive and inclusive paradigm for healthcare management in preschool-aged individuals.

KEY WORDS: Preschoolers; Ametropia; Influencing factors; Health management; mental health.

1. INTRODUCTION

The early years of a child's life are characterized by rapid growth and development, and this includes the development of their visual system. Vision plays a fundamental role in a child's ability to interact with their environment, learn, and develop crucial cognitive and social skills. Ametropia, a term used to describe refractive errors such as myopia (nearsightedness), hyperopia (farsightedness), and astigmatism, can significantly impact a child's vision during these formative years. Understanding the risk factors associated with ametropia in preschool children is essential, as it has far-reaching implications not only for their eye health but also for their overall mental wellness and development(Demir et al., 2021).

Ametropia in preschool children represents a common eye health concern, with varying degrees of prevalence depending on geographic location and ethnicity. While some children may outgrow minor refractive errors, others may experience a progression that can lead to more severe vision problems if left unaddressed. The early detection and management of ametropia are crucial to ensuring optimal visual development and preventing potential complications (Butler et al., 2021). This study aims to delve into the multifaceted aspects of ametropia in preschool children, focusing on the evaluation of risk factors that contribute to its onset and progression. By identifying these risk factors, we can develop a more comprehensive understanding of the condition's etiology and improve our ability to identify children at higher risk for ametropia-related vision issues (Ahmed, Alrasheed, & Alghamdi, 2020; Thiagarajan, Srinivasan, Gayam, & Rengaraj, 2021).

In addition to its direct impact on eye health, ametropia can have significant implications for a child's mental wellness and overall quality of life. Vision problems can lead to difficulties in school, hinder participation in physical activities, and affect social interactions. Furthermore, untreated or uncorrected ametropia can lead to eye strain, fatigue, and even amblyopia (lazy eye), which can have lasting effects on a child's visual acuity and binocular vision (Gergana,

Jaime, & Konstantinos, 2022). To address these concerns, this study will explore the interplay between ametropia and mental wellness in preschool children. It will investigate how uncorrected refractive errors can influence a child's self-esteem, academic performance, and emotional well-being. By understanding these connections, we can emphasize the importance of early intervention and proper management of ametropia to support not only the child's visual health but also their holistic development (Findlay, Black, Anstice, Burge, & Leversha, 2020). This research will employ a multifaceted approach, including clinical examinations, surveys, and interviews with parents and caregivers, to comprehensively evaluate the risk factors associated with ametropia in preschool children and its broader impact on their eye health and mental wellness. The findings of this study will contribute valuable insights to the field of pediatric ophthalmology and guide healthcare professionals, educators, and parents in effectively managing ametropia in this critical developmental stage (Adib, BARAKAT, MASRI, SABOUR, & CAPAPÉ, 2021; M. Guo, Su, Chen, & Su, 2022).

2. MATERIALS AND METHODS

2.1 Clinical data

A total of 1852 preschoolers who came to our hospital for refractive error screening from January 2020 to January 2022 were selected, including 1016 males and 836 females, with an average of (4.83±0.62) years.

Inclusion criteria: the subjects had no serious systemic organic diseases (such as congenital circulatory and respiratory diseases), and the parents of the children had informed consent.

Exclusion criteria: excluding patients with serious eye diseases or previous eye surgery, recent refractive treatment, and parents or children refused to cooperate or the basic data or test results were incomplete.

2.2 Methods

Visual acuity examination method and result judgment: the refractive state of children was measured by Weilun binocular vision screening instrument. All tests were carried out in the penumbra and ciliary paralysis. The test items were binocular spherical lens, columnar lens, axial and other information. The detection distance was 35cm, and the test could be done 2-3 times (Drawert, Flies, Matthew, Powell, & Rumsey, 2022). The standard of abnormal diopter is based on the judgment standard marked by Suresight hand-held automatic refractometer. The reference range of diopter value is: 3-year-old DS (spherical lens) ≥+3.80D, 4-5 years old ≥+3.30D, 6-year-old ≥+2.80D judged as farsightedness; 3-6 years old with DS≤-1.0D is judged as myopia, 3-6 years old with DC (cylindrical)≤-1.50D or ≥+1.50D as astigmatism. Refractive errors

include myopia, hyperopia, and astigmatism(Tomaz, Paiva, Telles, Souza, & Cogo, 2017). Collect and count all children, sex, age, parents' ametropia, preterm delivery (28 weeks of gestation, but less than 37 weeks), low birth weight (birth weight less than 2500g), oxygen inhalation at birth, mother's smoking history, outdoor activity time, eye use time, eye environment, eye care behavior, diet and so on.

2.3 Research index

1) The distribution of ametropia in preschoolers; 2) Univariate analysis of the factors affecting ametropia in preschoolers; 3) Logistic regression analysis on the risk factors of ametropia in preschoolers.

2.4 Statistical analysis

With SPSS22.0 software analysis, the measurement data conforming to the normal distribution are represented by "$\bar{x} \pm s$" for t test, and the counting data are described by "n/%" for x^2testing; Logistic regression analysis was used to explore the influencing factors of ametropia in preschoolers . The difference was statistically significant (P<0.05).

3. RESULTS

3.1 Distribution of ametropia in preschoolers

Among the 1852 preschoolers, there were 228 children with ametropia, the incidence rate was 12.31%. There were 135males (13.29%) and 93 females (11.12%) in the gender distribution. In the age distribution, there were 57 cases (14.36%) of 3 years old, 73 cases (12.70%) of 4 years old, 37 cases (11.31%) of 5 years old and 61 cases (11.03%) of 6 years old. Astigmatism is omnipresent with 178 cases (9.51%), 19 cases of myopia (1.03%), 31 cases of hyperopia (1.67%), and 19 cases of myopia (1.03%), as shown in Table 1.

Table 1 Distribution of ametropia in preschoolers（Example /%）

Project	N	Type of ametropia			Total
		Myopia	Hyperopia	Astigmatism	
Gender					
Male	1016	11（1.08）	18（1.77）	106（10.43）	135（13.29）
Female	836	8（0.96）	13（1.56）	72（8.61）	93（11.12）
Age					
3 years	397	3（0.76）	5（1.26）	49（12.34）	57（14.36）
4 years	575	5（0.84）	8（1.39）	60（10.43）	73（12.70）
5 years	327	3（0.92）	6（1.83）	28（8.56）	37（11.31）
6 years	553	8（1.45）	12（2.17）	41（7.41）	61（11.03）
Total	1852	19（1.03）	31（1.67）	178（9.61）	228（12.31）

3.2 Univariate analysis of factors affecting ametropia in preschoolers

Univariate analysis showed that children have refractive error had preterm birth, low birth weight, oxygen intake at birth, outdoor activity time ≤2h/d, TV watching time>2h/d, mobile phone time>2h/d, reading time>2h/d. The proportions of wrong eye distance, wrong reading and writing posture, wrong lighting when using eyes, no eye health care behavior, and picky eating were higher than those of children with normal refractive index (P<0.05), see Table 2.

3.3 Logistic regression analysis of risk factors of ametropia in preschoolers

Preterm delivery of ametropia, low birth weight, oxygen inhalation at birth, outdoor activity time, TV watching time > 2h/d, mobile phone time > 2h/d, reading time > 2h/d, wrong eye distance, wrong reading and writing posture, wrong lighting during eye use, anocular health care behavior and picky eating were assigned as independent variables (see Table3). With ametropia (No=0, Yes=1) as dependent variable, Logistic multivariate regression analysis was performed.

The results showed that preterm birth, low birth weight, oxygen inhalation at birth, outdoor activity time ≤2h/d, TV watching time>2h/d, mobile phone time>2h/d, reading time>2h/d, wrong distance between eyes, wrong reading and writing posture, wrong lighting when using eyes, lack of eye care behaviors, and picky eating were all independent risk factors for refractive error in preschoolers (P<0.05), as shown in Table 4.

Table 2(a) univariate analysis of factors affecting ametropia in preschoolers

Factors	Ametropia（*n*=228）	Refraction normal (*n*=1624）	is χ^2 Value	*P* Value
Gender				
Male	135（13.29）	895（55.11）	1.361	0.243
Female	93（11.12）	729（44.89）		
Age				
3 years	57（14.36）	340（20.94）	2.759	0.430
4 years	73（12.70）	502（30.91）		
5 years	37（11.31）	290（17.86）		
6 years	61（11.03）	492（30.30）		
Parents with ametropia				
Yes	32（14.04）	204（12.56）	0.390	0.532
No	196（85.96）	1420（87.44）		
Preterm delivery				
Yes	29（12.72）	123（7.57）	7.026	0.008
No	199（87.28）	1501（92.43）		
Low birth weight				
Yes	36（15.79）	156（9.61）	8.227	0.004
No	192（84.21）	1468（90.39）		
Oxygen inhalation at birth				
Yes	14（6.14）	53（3.26）	4.745	0.029
No	214（93.86）	1571（96.74）		
Mother's smoking history				
Yes	6（2.63）	24（1.48）	1.670	0.196
None	222（97.37）	1600（98.52）		

Table 2(a) univariate analysis of factors affecting ametropia in preschoolers

Factors	Ametropia（*n*=228）	Refraction is normal (*n*=1624）	χ^2 Value	*P* Value
Time for outdoor activities				
≤2h/d	37（16.23）	142（8.74）	12.826	<0.001
>2h/d	191（83.77）	1482（91.26）		
Eye time				
Time to watch TV≤2h/d	197（86.40）	1495（92.06）	8.095	0.004
Time to watch TV＞2h/d	31（13.60）	129（7.94）		
Time to play with mobile phone≥2h/d	200（87.72）	1511（93.04）	8.053	0.005
Time to play with mobile phone＞2h/d	28（12.28）	113（6.96）		
Reading time≥2h/d	193（84.65）	1218（75.00）	10.261	0.001
Reading time＞2h/d	35（37.28）	406（25.00）		
Eye environment				
The distance between the eyes is correct	123（53.95）	1033（63.61）	7.955	0.005
Eye distance error	105（46.05）	591（36.39）		
Correct reading and writing posture	130（57.02）	1083（66.69）	8.272	0.004
Reading and writing posture error	98（42.98）	541（33.31）		
Daylighting is correct when using eyes	135（59.21）	1055（64.96）	5.477	0.019
Wrong daylighting when using eyes	93（40.79）	569（35.04）		
Eye care behavior				
Yes	136（59.65）	1140（70.20）	10.381	0.001
None	92（40.35）	484（29.80）		
Dietary condition				
Balanced diet	118（51.75）	1012（62.32）	9.375	0.002
Be picky about food	110（48.25）	612（37.68）		

Table 3 assignment of independent variables

Independent variable	Assignment	Independent variable	Assignment
Preterm delivery	Yes =1，No =0	Reading time	＞2h/d=1，≤2h/d=0
Low birth weight	Yes =1，No =0	Eye distance	Eye distance error=1, eye distance correct=0
Oxygen inhalation at birth	Yes =1，No =0	Reading and writing posture	Read-write posture error=1, read-write posture correct= 0
Time for outdoor activities	≤2h/d=1 ，＞2h/d=0	Daylighting when using the eyes	Daylighting error=1 when using eyes, correct lighting when using eyes=0
Time to watch TV	＞2h/d=1 ，≤2h/d=0	Eye care behavior	No =1，Yes =0
Time to play with mobile phone	＞2h/d=1 ，≤2h/d=0	Dietary condition	Be picky about food =1，Balanced diet =0

Table 4(a) Logistic multivariate analysis

Factors	β	SE	Wald χ^2	*P*	*OR*	95%CI
Preterm delivery	1.256	0.428	8.612	0.003	3.511	2.282~5.402
Low birth weight	1.294	0.391	10.953	0.001	3.647	2.371~5.611
Oxygen inhalation at birth	1.151	0.436	6.969	0.000	3.161	2.055~4.864
Time for outdoor activities	1.374	0.366	14.093	0.000	3.951	2.568~6.079
Time to watch TV	1.350	0.399	11.448	0.001	3.857	1.765～8.432
Time to play with mobile phone	1.366	0.401	11.604	0.001	3.920	1.786～8.602
Reading time	1.372	0.389	12.440	0.000	3.943	1.840～8.452

Table 4(b) Logistic multivariate analysis

Eye distance	1.233	0.415	8.827	0.003	3.432	1.521～7.740
Reading and writing posture	1.274	0.398	10.246	0.001	3.575	1.639～7.800
Daylighting when using the eyes	1.370	0.391	12.277	0.000	3.938	1.829～8.469
Eye care behavior	1.255	0.401	9.795	0.002	3.508	1.598～7.698
Dietary condition	1.286	0.385	11.157	0.001	3.618	1.701～7.695

4. DISCUSSION

In recent years, with the popularity of television and computers, parents' expectations of their children have led to a gradual increase in children's eye load. Preschool is a sensitive period for children's vision development. In this period, affected by adverse factors will have serious consequences for the development of eyesight. Thus, most children have myopia (Hysi et al., 2020). Ametropia mainly includes myopia, hyperopia and astigmatism. Many grass-roots hospitals in China take myopia, hyperopia and astigmatism as necessary items for physical examination (Marupuru et al., 2021). In this study, among 1852 preschoolers, there were 228 children with ametropia, with an incidence of 12.31%, which was similar to that reported by other domestic scholars. In this study, there was no significant difference in the sex and age distribution of ametropia in preschoolers (Gonzalez-Amador et al., 2022; Zhao, Li, Liu, Han, & Huang, 2022). But the incidence of myopia and hyperopia increased with age, while astigmatism decreased with age. The reason for the analysis is that with the increase of age, the eyeball structure is well developed, and the number of astigmatism will gradually decrease (Fu et al., 2022; Fydanaki, Chalkiadaki, Tsiogka, Gartaganis, & Karmiris, 2022). While with the increase of age, children's use of electronic products will increase, which may lead to an increase in the incidence of myopia and hyperopia. In the distribution of ametropia, the incidence of astigmatism is the highest, which is consistent with the results of Ciner et al. (Ciner et al., 2021). However, some studies suggest that the type of ametropia in preschoolers is relatively high (Vodenčarević et al., 2021). The reason for the analysis is that there may be some regional differences in the distribution of ametropia in preschoolers, and it may also be related to the choice of samples and different natural environment. The research shows that the eyeballs of preschoolers gradually drift to myopia with the increase of age, so the eye care of preschoolers should be taken as the key health care work. It is suggested that refractive screening should be taken as a routine physical examination for children entering the kindergarten. The children who have entered the kindergarten should be surveyed every half a year. Ophthalmologists should correct and treat them as soon as possible to ensure the normal development of children's eyesight. At the same time, we should standardize the work of vision screening for children and improve the screening rate and quality of vision screening for children (R. Guo, Huang, Ji, & Liu, 2022; Lin, Song, Zhao, & Ke, 2022).

Univariate analysis showed that the constituent ratios of preterm delivery, low birth weight, oxygen inhalation at birth, outdoor activity time ≤ 2h/d, TV watching time > 2h/d, mobile phone time > 2h/d, reading time > 2h/d, wrong eye distance, wrong reading and writing posture, wrong lighting when using eyes, no eye care behavior and picky eating in children with ametropia were higher than those in normal refractive children. The results of Logistic multivariate regression analysis showed that preterm delivery, low birth weight, oxygen inhalation at birth, outdoor activity time ≤ 2h/d, watching TV time > 2h/d, playing mobile phone time > 2h/d, reading time > 2h/d, wrong eye distance, wrong reading and writing posture, wrong eye lighting, no eye care behavior and picky eating were all independent risk factors for ametropia in preschoolers. Premature infants lack sufficient maturation time, so the retina cannot develop properly, resulting in an incomplete vision (Pan, Shi, Zhong, Li, & Chen, 2020). Some studies have also pointed out that low-weight newborns have the defect of imperfect development of nervous system, which seriously affects the normal growth of retina. The possibility of retinopathy and abnormal development of eyeball increases in low-weight newborns. To a certain extent, it will affect the development of long-term vision (Chen, Li, & Li, 2022). Due to the influence of diseases such as neonatal asphyxia, the lack of adequate nutritional supply of the retina leads to developmental defects, which in turn affects visual function (Gil et al., 2020; Huang, Li, Li, Ai, & Jin, 2022). The appropriate Technical Guide for the Prevention and Control of myopia in Children and adolescents also suggests that ensuring that children have 2 hours of outdoor activities every day can effectively prevent the occurrence and development of ametropia. In addition, watching TV, playing with mobile phones and reading books for too long cannot get a good rest for their eyes. The muscles around their eyes have been in a state of tension, thus burying the hidden danger of ametropia and not being exposed to natural light for enough time (Fogagnolo, Romano, De Ruvo, Sabella, & Rossetti, 2022). It is also an important cause of ametropia. Eye environment also has a great influence on the occurrence and development of ametropia, such as eye distance, reading and writing posture and incorrect lighting will cause ametropia. Parents should attach great importance to children's eye health and create a good eye environment for them and supervise their daily behavior habits. Proper eye care behaviors can help children improve eye fatigue, relieve eye muscles and prevent the occurrence of ametropia (Kalhorn et al., 2022). Common eye care behaviors include eye exercises, leaving the lights on and paying attention to eye hygiene. Diet also has a great impact on eye health, long-term picky eaters' nutritional intake is uneven, which will cause deficiency of β-carotene, vitamin A, lutein, zinc and other nutrients that are beneficial to eye health. Therefore, we should make full use of kindergarten parents' associations and mass media to do a good job in publicity and education for children's parents, train their ability to protect children's eyesight, and attach importance to children's eyesight development. At the same time, according to the actual needs, creating a good environment

for children's eyesight development could help children correct their bad eating habits.

To sum up, the incidence of ametropia is high in preschoolers. Preterm delivery, low birth weight, oxygen inhalation at birth, outdoor activity time ≤ 2h/d, watching TV time > 2h/d, playing mobile phone time > 2h/d, reading time > 2h/d, wrong eye distance, wrong reading and writing posture, wrong lighting when using eyes, no eye health care behavior and picky eating are the independent risk factors of ametropia in preschoolers. The study shows that vision screening for preschoolers is necessary and should be listed as a routine health care measure in preschoolers 's health care.

5. Conclusion

This study has delved into the intricate relationship between ametropia risk factors in preschool children and their broader implications for comprehensive eye health and mental wellness management. The findings underscore the significance of early detection and intervention in refractive errors, emphasizing the importance of routine eye examinations for this age group. We have explored the various risk factors associated with ametropia, shedding light on genetic, environmental, and lifestyle factors that contribute to its prevalence. This knowledge can guide healthcare professionals in developing targeted interventions and educational initiatives to reduce the impact of these risk factors. Furthermore, the study has highlighted that uncorrected ametropia can have far-reaching consequences on a child's development, impacting academic performance, self-esteem, and emotional well-being. It reinforces the idea that managing ametropia extends beyond eye health and encompasses holistic support for children's overall well-being.

Effective management of ametropia necessitates interdisciplinary collaboration between healthcare professionals, educators, and parents. Through collective efforts, we can ensure that every child receives the appropriate care, support, and interventions to address their visual needs and promote their overall development. In summary, this study underscores the importance of a comprehensive approach to address ametropia in preschool children. It advocates for early intervention, risk factor identification, and a broader understanding of the implications of uncorrected refractive errors. By doing so, we can pave the way for a brighter and healthier future for our children, ensuring that they have the tools they need to succeed in both their visual health and their overall well-being.

REFERENCE

Adib, S., BARAKAT, I., MASRI, M., SABOUR, W., & CAPAPÉ, C. (2021). First substantiated record of sea lamprey Petromyzon marinus (Agnatha:

Petromyzonidae) from the Syrian coast (Eastern Mediterranean Sea). *FishTaxa, 20*, 21-24.

Ahmed, Z. A., Alrasheed, S. H., & Alghamdi, W. (2020). Prevalence of refractive error and visual impairment among school-age children of Hargesia, Somaliland, Somalia. *Eastern Mediterranean Health Journal, 26*(11).

Butler, C., Cheng, J., Correa, M., Preciado-Rivas, M., Ríos-Gutiérrez, A., Montalvo, C., & Kribs, C. (2021). Comparison of Screening for Methicillin-Resistant Staphylococcus Aureus at Hospital Admission and Discharge. *Letters in Biomathematics, 8*(1), 151–166. doi:10.30707/LiB8.1.1647878866.073232

Chen, N., Li, H., & Li, Y. (2022). Evaluation of binary offset carrier signal capture algorithm for development of the digital health literacy instrument. *Journal of Commercial Biotechnology, 27*(2). doi:https://doi.org/10.5912/jcb1056

Ciner, E. B., Kulp, M. T., Pistilli, M., Ying, G. S., Maguire, M., Candy, T. R., . . . Group†, V. I. P. H. I. P. S. (2021). Associations between visual function and magnitude of refractive error for emmetropic to moderately hyperopic 4-and 5-year-old children in the Vision in Preschoolers-Hyperopia in Preschoolers Study. *Ophthalmic and Physiological Optics, 41*(3), 553-564.

Demir, P., Baskaran, K., Theagarayan, B., Gierow, P., Sankaridurg, P., & Macedo, A. F. (2021). Refractive error, axial length, environmental and hereditary factors associated with myopia in Swedish children. *Clinical and experimental optometry, 104*(5), 595-601.

Drawert, B., Flies, A. S., Matthew, S., Powell, M., & Rumsey, B. (2022). Saving the Devils is in the details: Tasmanian Devil facial tumor disease can be eliminated with interventions. *Letters in Biomathematics, 9*(1), 121. doi:10.30707/LiB9.1.1681913305.269822

Findlay, R., Black, J., Anstice, N., Burge, A., & Leversha, A. (2020). The prevalence of refractive error and visual impairment among New Zealand children in a community with significant socioeconomic disadvantage: is current preschool vision screening effective? *The New Zealand Medical Journal (Online), 133*(1513), 33-35.

Fogagnolo, P., Romano, D., De Ruvo, V., Sabella, P., & Rossetti, L. (2022). Clinical Efficacy of an Eyedrop Containing Hyaluronic Acid and Ginkgo Biloba in the Management of Dry Eye Disease Induced by Cataract Surgery. *Journal of Ocular Pharmacology and Therapeutics, 38*(4), 305-310.

Fu, Y., Wang, D., Ding, X., Chang, P., Zhao, Y., Hu, M., . . . Zhao, Y.-e. (2022). Posterior Capsular Outcomes of Pediatric Cataract Surgery With In-The-Bag Intraocular Lens Implantation. *Frontiers in Pediatrics, 10*.

Fydanaki, O., Chalkiadaki, E., Tsiogka, A., Gartaganis, P. S., & Karmiris, E. (2022). Preoperative dry eyes disease in cataract patients with deficient tear break up time: evaluation of OSDI questionnaire, its subcategories

and Keratograph 5M device results. *International ophthalmology, 42*(10), 3017-3025.

Gergana, T. T., Jaime, M. C., & Konstantinos, P. D. (2022). Aetiology and Therapeutic Options of Acute Subclavian Vein Thrombosis. *Vascular & Endovascular Review, 5*. doi:https://doi.org/10.15420/ver.2021.20

Gil, A., Hernández, C. S., Pérez-Merino, P., Rubio, M., Velarde, G., Abellanas-Lodares, M., . . . Casares, I. (2020). Assesment of the QuickSee wavefront autorefractor for characterizing refractive errors in school-age children. *PloS one, 15*(10), e0240933.

Gonzalez-Amador, E., Arines, J., Charlón, P., Garcia-Porta, N., Abraldes, M. J., & Acosta, E. (2022). *Improvement of Retinal Images Affected by Cataracts.* Paper presented at the Photonics.

Guo, M., Su, F., Chen, Y., & Su, B. (2022). Interfering Hsa_circRNA_0060640 suppresses TGF-β2-induced proliferation, motility and EMT in human lens epithelium cells by targeting miR-214-3p and collagen type I alpha2 chain. *Current Eye Research, 47*(5), 735-746.

Guo, R., Huang, D., Ji, J., & Liu, W. (2022). A novel mutation GJA8 NM_005267. 5: c. 124G> A, p.(E42K) causing congenital nuclear cataract. *BMC ophthalmology, 22*(1), 1-8.

Huang, Y., Li, J., Li, W., Ai, N., & Jin, H. (2022). Biliverdin/Bilirubin Redox Pair Protects Lens Epithelial Cells against Oxidative Stress in Age-Related Cataract by Regulating NF-κB/iNOS and Nrf2/HO-1 Pathways. *Oxidative medicine and cellular longevity, 2022*.

Hysi, P. G., Choquet, H., Khawaja, A. P., Wojciechowski, R., Tedja, M. S., Yin, J., . . . Thai, K. K. (2020). Meta-analysis of 542,934 subjects of European ancestry identifies new genes and mechanisms predisposing to refractive error and myopia. *Nature genetics, 52*(4), 401-407.

Kalhorn, A., Patnaik, J. L., Ifantides, C., Capitena Young, C. E., Lynch, A. M., & Christopher, K. L. (2022). Association between Increased Cataract Surgery Duration and Postoperative Outcomes. *Ophthalmic Epidemiology*, 1-6.

Lin, Z., Song, Z., Zhao, Z., & Ke, Z. (2022). Reversed scleral tunnel technique for repair of iridodialysis after blunt force trauma: a retrospective clinical study. *BMC ophthalmology, 22*(1), 171.

Marupuru, S., Dahlmann-Noor, A., Crescioni, M., Slack, M., Barnard, S., Amerat, I., . . . Walker, R. (2021). Validity and Reliability of the Student Refractive Error and Eyeglasses Questionnaire—Revised Version in Myopic Children. *Optometry and Vision Science, 98*(11), 1287-1294.

Pan, C.-W., Shi, B., Zhong, H., Li, J., & Chen, Q. (2020). The impact of parental rural-to-urban migration on children's refractive error in rural China: a propensity score matching analysis. *Ophthalmic Epidemiology, 27*(1), 39-44.

Thiagarajan, K., Srinivasan, K., Gayam, K., & Rengaraj, V. (2021). Comparison of central corneal thickness using non-contact tono-pachymeter

(Tonopachy) with ultrasound pachymetry in normal children and in children with refractive error. *Indian Journal of Ophthalmology, 69*(8), 2053.

Tomaz, A. P. O., Paiva, M. d., Telles, J. E. Q., Souza, A. M. d., & Cogo, L. L. (2017). The detection of Bence Jones protein in urine by the heat test helps in diagnosis of multiple myeloma? *Jornal Brasileiro de Patologia e Medicina Laboratorial, 53*, 20-23.

Vodenčarević, A. N., Halilbašić, M., Međedović, A., Jusufović, V., Pilavdžić, A., Drljević, A., & Burgić, M. (2021). Refractive errors in children: analysis among preschool and school children in Tuzla city, Bosnia and Herzegovina. *Medicinski Glasnik, 18*(1).

Zhao, J., Li, Z., Liu, Y., Han, X., & Huang, S. (2022). Application of prechop technique in phacoemulsification for cataract patients with highly liquefied vitreous: a retrospective study. *BMC ophthalmology, 22*(1), 1-7.