

Mental and behavioral disorders in people with myopia

Vladymyr Drozdov

British Ophthalmological Center

The aim. The work was to determine the features of mental and behavioral disorders in myopia.

Materials and methods. 200 patients with myopia were examined at the British Ophthalmological Center in Kyiv. Pathopsychological diagnostics, the "Methodology of Multilateral Personality Research", "Personal questionnaire of the Bekhterev Institute" were used. The study was conducted in accordance with the principles of the Declaration of Helsinki of the World Medical Association. Mathematical processing of the study results was performed using mathematical statistics methods.

Results. Among people with myopia, affective disorders (mood disorders) were diagnosed in 20,5 % of cases: mild depressive episode (9,0 %), dysthymia (11,5 %); in 65,0 % - neurotic, stress-related and somatoform disorders: mixed anxiety-depressive disorder (11,0 %), neurasthenia (55,5 %), hypochondriac disorder (11,0 %); in 2,0 % - persistent personality changes not related to brain damage or disease: other persistent personality changes (2,0 %).

Conclusions. Violation of social and psychological adaptation, due to the formation of maladaptive types of attitude towards the disease in 92,7-100,0 % of people with myopia, significantly complicated the process of their rehabilitation.

Introduction

Today, myopia affects almost 28,3 % of the world's population (approximately 2 billion people); of these, 277 million (4,0 % of the total population) have high myopia (HM) [1]. It is expected that by 2050, 1 billion people (9,8 % of the world's population) will suffer from myopia [2, 3]. The high prevalence of high myopia (up to 38,0 % of the total number of cases) significantly increases the risk of complications such as glaucoma, cataracts, retinal detachment, and myopic macular degeneration [4].

A meta-analysis of 29 studies conducted between 2001 and 2008 assessed quality of life, social support, anxiety, and depression/mental health in people with myopia [5]. It has been found that patients with myopia have lower levels of social functioning and mental health, but no evidence of an association with anxiety or depression has been found.

The classification of mental and behavioral disorders in myopia is carried out within the framework of the concepts of reaction to illness (asthenic, neurotic and affective reactions) [6, 7] and pathological behavior in illness (behavior that affirms and denies illness) [8]. Behavior that affirms illness includes conscious motivation of actions and unconscious somatoform disorders; behavior that denies illness is based on conscious motivation of actions, disagreement with treatment and anosognosia [9].

Mental and behavioral disorders are formed both at the psychological (internal picture of the disease) and at the psychopathological level (syndrome and its register) [10]. Hypernosognosis

reactions to the disease include: neurotic (anxiety-phobic, somatized), psychopathic reactions with the formation of supervalued ideas (hypochondria of health, rigid hypochondria with ideas of "rationalization of therapy", litigious), affective (anxious or hypochondriacal depression), nosogenic reactions (with the search for new types of treatment). Hyponosognosis reactions are: neurotic (with the syndrome of beautiful indifference), psychopathic with the formation of supervalued ideas (with the phenomena of antihypochondria), affective (with the syndrome of euphoric pseudodementia), nosogenic reactions (with delusions of persecution, deliberate exaggeration by doctors of the severity of the somatic disease) [11, 12].

The aim

Determine the features of mental and behavioral disorders in myopia.

Materials and methods

200 patients with myopia were examined at the British Ophthalmological Center in Kyiv. The clinical diagnosis of myopia was established by the Order of the Ministry of Health of Ukraine No. 827 dated 08.12.2015 [13], IMI - Clinical Management Guidelines Report [14], Myopia control strategies recommendations from the 2018 WHO/IAPB/BHVI Meeting on Myopia [15]. All the studies were conducted according to implemented guidelines in consideration of GCP-ICH and the Declaration of Helsinki (World Medical Association Declaration of Helsinki, 2013). All patients signed the «Informed Voluntary Consent of the Patient for Diagnostics, Treatment and Operation and Analgesia» [16].

The inclusion criteria for the study were: patients with mild, moderate or high myopia in combination with mild myopic astigmatism; absence of any type or degree of amblyopia, strabismus and opacities of the optical media; constant use of optical correction. The exclusion criteria were: presence in the anamnesis of patients with myopia of bacterial, viral or fungal diseases of the cornea; keratoconus or keratoglobus; corneal dystrophy; congenital cataract; corneal or vitreous opacities that reduce visual acuity; glaucoma and diseases of the macular zone of the retina or optic nerve of any etiology.

200 patients with moderate myopia and mild myopic astigmatism in both eyes were examined. 58 men and 142 women aged $29,3 \pm 0,44$ years participated in the study. Independent distance visual acuity of the patients was $0,04 \pm 0,01$ IU, and the maximum corrected visual acuity was $0,87 \pm 0,10$ IU. The optical indicators of the eye were determined in conditions of cycloplegia using autorefractometry. Spherical refraction was $-4,27 \pm 0,734$ Dptr., and cylindrical - $-0,68 \pm 0,52$ Dptr; length of the anterior-posterior axis of the eye - $25,31 \pm 0,80$ mm; thickness of the cornea in the central point - $544,18 \pm 29,73$ μ m.

To study the personality characteristics of patients with myopia, we used the "Methodology of Multifaceted Personality Research"; we determined the corrective indicators (L, F, K), Hs-hypochondria, D-depression, Hy-hysteria, Pd-psychopathy, Mt-masculinity-femininity, Pa-paranoia, Pt-psychasthenia, Sc-schizoidity, Ma-hypomania, Si-social introversion. "Personal questionnaire of the Bekhterev Institute" - for assessing the types of attitudes towards the disease: we diagnosed sensitive, euphoric, paranoid, neurasthenic, anxious, obsessive-phobic, ergopathic, melancholic, harmonious, hypochondriac, egocentric, anosognosic, apathetic types of attitude towards the disease (TAD) [17, 18].

Mathematical processing of the research results was carried out using the methods of mathematical statistics. The statistical description of the research indicators was carried out using the methods of primary statistical analysis [19, 20].

Results

When studying the mental status of people with myopia, we identified a certain typology of disorders present in them [21]:

I. Affective disorders (mood disorders) – 41 people (20,5 %):

1. Mild depressive episode, F 32.0 (43,9 %).

2. Dysthymia, F 34.1 (56,1 %).

II. Stress-related neurotic and somatoform disorders – 130 people (65,0 %):

1. Mixed anxiety-depressive disorder, F 41.2 (16,9 %).

2. Neurasthenia, F 48.0 (66,2 %).

3. Hypochondriasis, F 45.2 (16,9 %).

III. Persistent personality changes not related to brain injury or disease – 4 individuals (2,0 %):

1. Other persistent personality changes, F 62.8 (100,0 %).

Dysthymia was found in 11,5 % of patients with myopia. In them, the disorder arose after the appearance of a subdepressive mood for several years. Periodically appeared episodes of pronounced depression, decreased energy and activity, insomnia, feelings of inferiority, difficulty concentrating, feelings of hopelessness or despair, pessimistic view of the future, social isolation. These individuals are characterized by hypochondria, focusing on the features of their own health (increased Hs-hypochondria), impulsive, uncontrolled behavior (increased Pd-psychopathy), a masculine lifestyle in men and a desire to be protected in women (decreased Mt-masculinity-femininity), anxiety and distrust (decreased Pt-psychasthenia), problems with interpersonal interaction (increased Si-introversion).

In patients with myopia and dysthymia, the severity of hypochondriacal, egocentric, and euphoric TAD increased, and decreased. Pure TADs were determined in 17,4%, mixed ones in 78,2 %, and in 4,3 % the type of reaction to the disease (TRD) was not established. In the structure of pure TADs, the most common were sensitive and euphoric; in the structure of all diagnosed types, neurasthenic, anxious, obsessive-phobic, paranoid. The most frequent combinations were combinations of neurasthenic, obsessive-phobic, egocentric, and euphoric TADs. Social and psychological adaptation due to disharmonious TRDs was impaired in 91,3 % of people with dysthymia and myopia.

Mixed anxiety-depressive disorder was diagnosed in 11,0 % of people with myopia. In the clinical picture of such patients, both symptoms of anxiety and depression are present without a clear dominance, even thoughts about possible complications cause anxiety of anticipation. People with myopia and this disorder are characterized by pessimism and anxiety (increased D-depression), a tendency to skepticism (decreased Hy-hysteria), impulsive behavior (increased Pd-psychopathy), affective rigidity (increased Ra-paranoia), anxiety and distrust (decreased Pt-psychasthenia), introversion (increased Si-introversion).

Patients with myopia and mixed anxiety-depressive disorder are characterized by the severity of obsessive-phobic and reduced – euphoric TRDs. In the structure of pure TADs, the most common are sensitive and neurasthenic; in the structure of all diagnosed types – neurasthenic, sensitive, euphoric, ergopathic and paranoid with frequent combinations of anxious, apathetic, neurasthenic, euphoric and anosognosic types. Social and psychological adaptation was impaired in 90,9 % of people, which significantly disrupted the rehabilitation process.

A mild depressive episode was diagnosed in 9,0 % of patients with myopia [22]. These individuals had a constantly reduced mood and activity, self-esteem and self-confidence, interest in professional and everyday activities, they blamed themselves for no reason and felt guilty. Individuals with myopia and a mild depressive episode were characterized by pessimism (increased D-depression), a tendency to get stuck in negative experiences (increased Ra-paranoia), nonconformity and egocentrism (decreased Pt-psychasthenia), detachment from reality (increased Sc-schizoidity), decreased general activity (decreased Ma-hypomania), difficulties in interpersonal interaction (increased Si-introversion).

In patients with myopia and a mild depressive episode, the severity of hypochondriac, neurasthenic and egocentric TRDs increase. In the structure of pure TADs, only anosognosic and anxiety types were diagnosed; in the structure of all diagnosed types, neurasthenic, obsessive-phobic, sensitive, ergopathic and paranoid were most often detected with frequent combinations of neurasthenic and egocentric types. Adaptation was impaired in 94,4 % of patients, which significantly complicated the process of their rehabilitation.

Neurasthenia affects 43,0 % of people with myopia [21, 22]. These individuals complained of fatigue during mental and physical exertion, decreased professional and everyday activity. Patients with myopia and neurasthenia are characterized by a focus on their own health (increased Hs-hypochondria), a desire to impress others (decreased D-depression), emotional instability (increased Hy-hysteria), getting stuck in negative experiences (increased Pa-paranoia), dominance in interpersonal relationships in men, softness in women (decreased Mt-masculinity-femininity), nonconformity and egocentrism (decreased Pt-psychasthenia), emotional immaturity (increased Ma-hypomania), sufficient sociability (decreased Si-introversion).

In individuals with myopia and neurasthenia, there is a decrease in the expressiveness of euphoric and anosognosic TRDs. In the structure of pure TAD, the most common were sensitive, ergopathic and paranoid; in the structure of all diagnosed types – neurasthenic, sensitive, ergopathic, paranoid and euphoric with frequent combinations of anxious, obsessive-phobic, egocentric, euphoric and paranoid types. The social and psychological attitude to the disease was inadequate in 94,1 % of those examined with neurasthenia.

Hypochondriasis was diagnosed in 11,0 % of people with myopia [23]. These patients were convinced that they had a serious somatic disease with a progressive course, constantly presented many somatic complaints, sought medical help from different doctors and sought additional functional examinations. People with myopia and hypochondriasis are characterized by excessive attention to their own health (increased Hs-hypochondria), pessimism (increased D-depression), affective rigidity (increased Pa-paranoia), detachment from reality (increased Sc-schizoidity), decreased activity (decreased Ma-hypomania), and difficulties in interpersonal contacts (increased Si-introversion).

In patients with myopia and hypochondriacal disorder, the expressiveness of harmonic, euphoric, anosognosic TRDs decreased and anxiety, hypochondriacal, apathetic, neurasthenic, and obsessive-phobic TADs increased. In the structure of pure TADs, the most common was sensitive, and in the structure of all diagnosed types, sensitive, neurasthenic, and anxiety types. In mixed TRDs, combinations of hypochondriacal, obsessive-phobic, and anosognosic types were the most common. Social and psychological adaptation was impaired in 95,4 % of the examined.

Other persistent personality changes were diagnosed in 2,0 % of people with myopia [21]. These patients constantly felt tense, were haunted by difficult premonitions, were not sure of their own safety and their position, felt inferior. Patients with myopia and other persistent personality changes are characterized by excessive self-control (increased Hs-hypochondria), pessimism and a tendency to experience (increased D-depression), insufficient spontaneity in social interaction (decreased Nu-hysteria), dissatisfaction with life, a sense of one's own inadaptability (increased Pd-psychopathy), uncontrolled behavior (increased Pt-psychasthenia), detachment from reality

(increased Si-introversion), decreased general activity (decreased Ma-hypomania).

In people with myopia and other persistent personality changes, the expressiveness of euphoric and ergopathic TRDs were reduced. In the structure of pure types, only paranoid and sensitive were determined; in the structure of all diagnosed types, neurasthenic, sensitive, euphoric and paranoid were most often diagnosed with frequent combinations of sensitive and euphoric types. Social, psychological and socio-psychological adaptation was impaired in 100.0% of these examined, which significantly complicated the process of their rehabilitation.

Discussion

A study by Gholamhoseyn Aghai et al., 2016 showed that 24 % of children (5-12 years old) with refractive errors had behavioral disorders. In hyperopia, their prevalence reached 37,5 %, in hyperopia-astigmatism - 35,7 %, in simple astigmatism - 21,4 %, in myopia-astigmatism - 16,7 %, in myopia - 14,3 % [24]. In the works of Chen L. et al., 2023, Ravens-Sieberer U, 2008 it was found that 14,5 % of adolescents with myopia aged 7-17 years had mental disorders [25, 26]. A study by Schuster AK et al., 2019 showed that anxiety, behavioral, affective, and substance use disorders were the most common among adolescents with myopia [27]. While Chen L. et al., 2023 found that the prevalence of emotional disorders in myopic individuals reached 46 %, and anxiety and depression were less common [25]. In our study, the prevalence of neurotic disorders related to stress and somatoform disorders reached 65 %, affective disorders - 20,5 %, and persistent personality changes not related to brain damage or disease - 2,0 % [21].

It was found that somatic diseases or mental health problems in adolescence increased the risk of myopia progression in early adulthood [25]. Nielsen S. et al., 2007 and Das M et al., 2010 noted a higher prevalence of hyperopia and astigmatism in adolescents with developmental delay than in healthy ones [28, 29]. Su CC et al., 2019 indicated a prevalence of high myopia in young people in 4,1 %, and high astigmatism in 19,8 % of people with myopia in the presence of cognitive impairment [30].

The existence of a relationship between myopia and internet addiction, anxiety disorders and depression has been proven [25, 31, 32]. Sandfeld Nielsen L, Skov L, Jensen H., 2007 reported that adolescents aged 6-17 years with strabismus had a higher prevalence of depression, anxiety, and alcohol use in China [28]. Several studies have shown that myopic patients have a high risk of developing psychiatric disorders [33, 34], while others have shown a moderate association [35]. Esotropia, exotropia, and hypertropia are associated with increased mental health problems, and mental retardation, emotional disorders, and adjustment disorders are associated with an increased risk of amblyopia [25].

In previous studies, we have established that dysthymia predominates among mood disorders in people with myopia; neurotic - neurasthenia; persistent personality changes - other persistent personality changes. People with myopia and affective disorders are characterized by hypochondria, impulsivity, anxiety, difficulties in interpersonal interaction, introversion; with neurotic disorders - meticulous attention to health, mood lability, affective rigidity, high self-esteem, sufficient level of sociability; with personality changes - pessimism, impulsivity, individualism, originality of interests, decrease in general activity [21].

Conclusions

1. Affective disorders (mood disorders) were detected in 20,5 % of people with myopia, neurotic, stress-related and somatoform disorders in 65,0 %, persistent personality changes not associated with brain damage or disease in 2,0 %, and no mental or behavioral disorders in 12,5 %.
2. 11,5 % of people with myopia were diagnosed with dysthymia, 9,0 % with a mild

depressive episode, 11,0 % with mixed anxiety-depressive disorder, 43,0 % with neurasthenia, 11,0 % with hypochondriac disorder, and 2,0 % with other persistent personality changes.

3. Patients with myopia and affective disorders were characterized by pessimism, affective rigidity, nonconformity and egocentrism, individualism, unpredictability of actions, and difficulties in interpersonal interaction. The most frequent combinations were combinations of neurasthenic, obsessive-phobic, egocentric, and euphoric TADs. Social and psychological adaptation due to disharmonious TRDs was impaired in 92,7 % of all people with myopia and affective disorders.
4. Individuals with myopia and neurotic, stress-related and somatoform disorders were characterized by a focus on their own health, a desire to impress others, lability and emotional instability, affective rigidity, a tendency to pedantry, lack of caution and prudence in actions, optimism, an active life position, high self-esteem, and a sufficient level of sociability. Frequent combinations of TRDs were a combination of anxious, obsessive-phobic, egocentric, euphoric and paranoid types, which made social and psychological adaptation difficult in 94,6 % of those surveyed.
5. Patients with myopia and other persistent personality changes were characterized by attention to their own health, pessimism, dissatisfaction, a tendency to introversion, skepticism, dissatisfaction with life, impulsivity, uncontrolled behavior, individualism, originality of interests, and a decrease in general activity. Most often, they combined sensitive and euphoric TADs, which disrupted social and psychological adaptation in all such individuals and significantly complicated the process of their rehabilitation.

References

1. Xu L, Wang Y, Li Y, Wang Y, Cui T, Li J, Jonas JB. Causes of blindness and visual impairment in urban and rural areas in Beijing: the Beijing Eye Study. *Ophthalmology*. 2006 Jul;113(7):1134.e1-11. <https://doi.org/10.1016/j.ophtha.2006.01.035>.
2. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, Wong TY, Naduvilath TJ, Resnikoff S. Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. *Ophthalmology*. 2016 May;123(5):1036-42. <https://doi.org/10.1016/j.ophtha.2016.01.006>.
3. Li K, Wang Q, Wang L, Huang Y. Cognitive dysfunctions in high myopia: An overview of potential neural morpho-functional mechanisms. *Front Neurol*. 2022 Nov 3;13:1022944. <https://doi.org/10.3389/fneur.2022.1022944>.
4. Guo LY, Sun H, Hu M, Jiang YH, Luo ZH. Mental health status of parents of young patients with high myopia. *J Int Med Res*. 2020 Jan;48(1):300060519873474. <https://doi.org/10.1177/0300060519873474>.
5. Nyman SR, Gosney MA, Victor CR. Psychosocial impact of visual impairment in working-age adults. *Br J Ophthalmol*. 2010 Nov;94(11):1427-31. <https://doi.org/10.1136/bjo.2009.164814>.
6. Fava GA, Sonino N. Psychosomatic medicine. *Int J Clin Pract*. 2010 Jul;64(8):1155-61. <https://doi.org/10.1111/j.1742-1241.2009.02266.x>.
7. Fava GA, Offidani E. Psychosomatic renewal of health care. *Panminerva Med*. 2010 Sep;52(3):239-48. PMID: 21045781.
8. Wise TN. Psychosomatic medicine: an approach needed now more than ever. *Int J Clin Pract*. 2010 Jul;64(8):999-1001. <https://doi.org/10.1111/j.1742-1241.2009.02268.x>.
9. Eydmiller E. G., Yustitskiy V. V. *Psikhologiya i psikhoterapiya sem'i*. SPb.: Piter, 1999, 656 [in Russian]
10. Fava GA, Cosci F, Sonino N. Current Psychosomatic Practice. *Psychother Psychosom*. 2017;86(1):13-30. <https://doi.org/10.1159/000448856>.
11. Fabbri S, Fava GA, Sirri L, Wise TN. Development of a new assessment strategy in psychosomatic medicine: the diagnostic criteria for psychosomatic research. *Adv Psychosom Med*. 2007;28:1-20. <https://doi.org/10.1159/000106793>.
12. Porcelli P, Bellomo A, Quartesan R, Altamura M, Iuso S, Ciannoneo I, Piselli M, Elisei S.

- Psychosocial functioning in consultation-liaison psychiatry patients: influence of psychosomatic syndromes, psychopathology and somatization. *Psychother Psychosom.* 2009;78(6):352-8. <https://doi.org/10.1159/000235739>.
13. Ministerstvo okhorony zdorov'ya Ukrayiny. Nakaz Ministerstva okhorony zdorov'ya Ukrayiny «Unifikovannyi klinichnyy protokol pervynnoyi, vtorynnoyi (spetsializovanoyi), tretynnoyi (vysokospetsializovanoyi) medychnoyi dopomohy porushennya refraktsiyi ta akomodatsiyi: miopiya, hipermetropiya, astyhmazyzm, anizometropiya, presbiopiya, porushennya akomodatsiyi, ambliopiya, keratokonus, kontaktna korektsiya zoru» № 827. Kyiv: MOZ Ukrayiny; 2015. https://www.dec.gov.ua/wp-content/uploads/2019/11/2015_827_ykpm_d_porref.pdf. [in Ukrainian].
 14. Gifford KL, Richdale K, Kang P, Aller TA, Lam CS, Liu YM, Michaud L, Mulder J, Orr JB, Rose KA, Saunders KJ, Seidel D, Tideman JWL, Sankaridurg P. IMI - Clinical Management Guidelines Report. *Invest Ophthalmol Vis Sci.* 2019 Feb 28;60(3):M184-M203. <https://doi.org/10.1167/iovs.18-25977>
 15. Ang M, Flanagan JL, Wong CW, Müller A, Davis A, Keys D, Resnikoff S, Jong M, Wong TY, Sankaridurg P. Review: Myopia control strategies recommendations from the 2018 WHO/IAPB/BHVI Meeting on Myopia. *Br J Ophthalmol.* 2020 Nov;104(11):1482-1487. <https://doi.org/10.1136/bjophthalmol-2019-315575>.
 16. Ministerstvo okhorony zdorov'ya Ukrayiny. Nakaz Ministerstva okhorony zdorov'ya Ukrayiny «Pro zatverdzhennya form pervynnoyi oblikovoyi dokumentatsiyi ta Instruksiyi shchodo yikh zapovnennya, shcho vykorystovuyut'sya u zakladakh okhorony zdorov'ya nezalezno vid formy vlasnosti ta pidporyadkuvannya» № 110. Kyiv: MOZ Ukrayiny; 2012. http://search.ligazakon.ua/l_doc2.nsf/link1/RE20974Z.html. [in Ukrainian]
 17. Raygorodskiy D. Prakticheskaya psikhodiagnostika. Metodiki i testy. Samara: BAKHRAKH-M; 2000. 672 s. [in Russian]
 18. Yeliseyev O. Praktikum po psikhologii lichnosti. Spb.: Piter; 2005. 509 s. [in Russian]
 19. Afifi A, Eisen S. Statistical analysis. Approach using EVM. M.: Myr; 1982. 488 s. [in Ukrainian]
 20. Babak VP, Bilets'kyy AYA, Prystavka OP, Prystavka PO. Statystychna obrobka danykh. K.: MIVVTS, 2001. 388 s. [in Ukrainian]
 21. Drozdov V. Nosogenies in patients with myopia: clinical and psychological features. *Ukrainian scientific medical youth journal*, 2025, Issue 1 (152) 69-76. [https://doi.org/10.32345/USMYJ.1\(152\).2025.69-76](https://doi.org/10.32345/USMYJ.1(152).2025.69-76)
 22. Drozdov VO. Characteristic features of patients with myopia depending on the expressiveness of anxiety/depression. *Wiad Lek.* 2024;77(5):902-908. <https://doi.org/10.36740/WLek202405104>.
 23. Drozdov VO., Skrypnyk R L. Hypochondriac disorders in patients with myopia: personal characteristics and their role in the formation of the internal picture of the disease. *Ukrainian Scientific Medical Youth Journal* 150(4):96-101. [https://doi.org/10.32345/USMYJ.4\(150\).2024.96-101](https://doi.org/10.32345/USMYJ.4(150).2024.96-101)
 24. Gholamhoseyn Aghai, Parvin Dibajnia, Esmat Ashkesh, Mohammadreza Nazari, Khalil Ghasemi Falavarjani, Behavior disorders in children with significant refractive errors, *Journal of Current Ophthalmology*, Volume 28, Issue 4, 2016, Pages 223-225, <https://doi.org/10.1016/j.joco.2016.07.007>.
 25. Chen, L., Sun, L., Xue, C. et al. Refractive errors and ocular findings in children and adolescents with mental disorders: a retrospective study. *BMC Ophthalmol* 23, 4 (2023). <https://doi.org/10.1186/s12886-022-02704->
 26. Ravens-Sieberer U, Wille N, Erhart M, Bettge S, Wittchen HU, Rothenberger A, Herpertz-Dahlmann B, Resch F, Hölling H, Bullinger M, Barkmann C, Schulte-Markwort M, Döpfner M; BELLA study group. Prevalence of mental health problems among children and adolescents in Germany: results of the BELLA study within the National Health Interview and Examination Survey. *Eur Child Adolesc Psychiatry.* 2008 Dec;17 Suppl 1:22-33. <https://doi.org/10.1007/s00787-008-1003-2>.
 27. Schuster AK, Elflein HM, Pokora R, Schlaud M, Baumgarten F, Urschitz MS. Health-related quality of life and mental health in children and adolescents with strabismus - results of the

- representative population-based survey KiGGS. Health Qual Life Outcomes. 2019 May 7;17(1):81. [https://doi.org/ 10.1186/s12955-019-1144-7](https://doi.org/10.1186/s12955-019-1144-7).
28. Sandfeld Nielsen L, Skov L, Jensen H. Visual dysfunctions and ocular disorders in children with developmental delay. II. Aspects of refractive errors, strabismus and contrast sensitivity. *Acta Ophthalmol Scand*. 2007 Jun;85(4):419-26. <https://doi.org/10.1111/j.1600-0420.2007.00881.x>.
 29. Das M, Spowart K, Crossley S, Dutton GN. Evidence that children with special needs all require visual assessment. *Arch Dis Child*. 2010 Nov;95(11):888-92. <https://doi.org/10.1136/adc.2009.159053>.
 30. Su CC, Tsai CY, Tsai TH, Tsai IJ. Incidence and risk of attention-deficit hyperactivity disorder in children with amblyopia: A nationwide cohort study. *Clin Exp Ophthalmol*. 2019 Mar;47(2):259-264. [https://doi.org/ 10.1111/ceo.13465](https://doi.org/10.1111/ceo.13465).
 31. Wang BQ, Yao NQ, Zhou X, Liu J, Lv ZT. The association between attention deficit/hyperactivity disorder and internet addiction: a systematic review and meta-analysis. *BMC Psychiatry*. 2017 Jul 19;17(1):260. [https://doi.org/ 10.1186/s12888-017-1408-x](https://doi.org/10.1186/s12888-017-1408-x).
 32. Kuss DJ, Lopez-Fernandez O. Internet addiction and problematic Internet use: A systematic review of clinical research. *World J Psychiatry*. 2016 Mar 22;6(1):143-76. [https://doi.org/ 10.5498/wjp.v6.i1.143](https://doi.org/10.5498/wjp.v6.i1.143).
 33. Olson JH, Louwagie CR, Diehl NN, Mohny BG. Congenital esotropia and the risk of mental illness by early adulthood. *Ophthalmology*. 2012 Jan;119(1):145-9. [https://doi.org/ 10.1016/j.ophtha.2011.06.035](https://doi.org/10.1016/j.ophtha.2011.06.035).
 34. Schuster AK, Elflein HM, Pokora R, Schlaud M, Baumgarten F, Urschitz MS. Health-related quality of life and mental health in children and adolescents with strabismus - results of the representative population-based survey KiGGS. Health Qual Life Outcomes. 2019 May 7;17(1):81. [https://doi.org/ 10.1186/s12955-019-1144-7](https://doi.org/10.1186/s12955-019-1144-7).
 35. Lee YH, Repka MX, Borlik MF, Velez FG, Perez C, Yu F, Coleman AL, Pineles SL. Association of Strabismus With Mood Disorders, Schizophrenia, and Anxiety Disorders Among Children. *JAMA Ophthalmol*. 2022 Apr 1;140(4):373-381. [https://doi.org/ 10.1001/jamaophthalmol.2022.0137](https://doi.org/10.1001/jamaophthalmol.2022.0137)