



A REVIEW ON THE EFFECT OF KERATOCONUS PATIENT'S WELFARE

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ARTICLE INFO

Received:

01 Dec 2022

Received in revised form:

28 Mar 2023

Accepted:

05 Apr 2023

Available online:

28 Apr 2023

Keywords: Keratoconus, Health, Corneal damage, Pharmacotherapy

ABSTRACT

Improving the quality of life of patients is one of the main problems of modern medicine. The emergence of new modern methods of treatment has significantly slowed the progression of many diseases. Diseases associated with the cornea are one of the primary causes of visual impairment. According to statistics, every fourth patient with vision problems has a corneal disease. The problem of keratoconus is one of the most urgent all over the world. The disease is widespread, affecting the young able-bodied population. Many scientists in their scientific papers consider options for the development of keratoconus: hereditary, environmental, mechanical damage, allergic and many others. The development of the disease leads to a deterioration in the standard of living of patients. The improvement of indicators coincided with the surgical method of treatment – crosslinking. The results showed that the level of anxiety decreased in patients, which led to an improvement in indicators. Thanks to the new diagnostic capabilities of medicine, it becomes possible to study the quality of life of patients with this disease and try to improve it during treatment.

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To Cite This Article: Umarchadzhiev TA, Lotareva EMT, Gulyan VG, Knurenko MV, Aushev MM, Tepsuev YS. A Review on the Effect of Keratoconus Patient's Welfare. *Pharmacophore*. 2023;14(2):79-84. <https://doi.org/10.51847/7sKGPbOIFP>

Introduction

Keratoconus is one of the socially significant diseases that cause special attention from doctors. It is characterized by progressive thinning of the cornea, its deformation, and the appearance of ametropia with irregular astigmatism, which leads to a decrease in visual acuity [1]. The prevalence of the disease depends on social and regional factors. Keratoconus has a special prevalence among young people, active development is observed in the puberty period, but with age, it stops in development [2]. The prevalence of the disease ranges from 50 to 265 cases per 100 thousand people. In 4.3–15% of cases, patients have unilateral keratoconus, over the next 16 years, ophthalmologists observe the development of the disease in the second eye in 50% of cases [3]. Keratoconus significantly worsens the quality of life of patients, as visual acuity decreases and the risk of severe moral and mental states increases.

The division of the keratoconus at this stage has been proposed by many doctors, but the classification of T.D. Abugova has received a practical application [4]. The following types were identified: island-top, blunt-top, peak-shaped, peak-shaped atypical, low-top, and low-top atypical. Also, the researchers, depending on the nature of the disease, identified three forms of keratoconus:

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- non-progressive;
- slowly progressing;
- rapidly progressing.

Depending on the progression of the disease, treatment methods vary, but their main goal is to improve vision indicators, slow down the progression of the disease, as well as increase the comfort of life. Depending on the stage, doctors have developed the following treatment methods:

- correction with glasses and soft contact lenses (early stage);
- rigid gas-permeable lenses (with progression);
- corneal transplantation (at a late stage) [5, 6].

Treatment is complicated by the fact that keratoconus may be part of the pathology of the eye, bearing a genetic basis. That is why this topic remains one of the most promising for doctors and scientists to study.

Keratoconus: Developmental Possibilities and Classification

Many scientists in their scientific works consider variants of the development of keratoconus: hereditary, environmental, mechanical damage, allergic, and many others [7]. The ecological situation completely affects human health, including an increase in eye diseases. In places with increased radiation pollution, the incidence of patients with keratoconus is the highest [8]. The endocrine theory has also been confirmed since in this disease, doctors revealed dysfunction of the endocrine glands. The disease most often debuts in the pubertal period of life, when the production of hormones in the endocrine glands is at its maximum level [9].

It is very difficult for keratoconus to occur in combination with other diseases, such as diabetes. Keratoconus can be associated with autoimmune disorders such as hypersensitivity to allergens, asthma, irritable bowel syndrome, ulcerative colitis, and many others. In approximately 50% of cases, an association of keratoconus with atopic diseases can be established [10]. In many scientific sources, one can find confirmation of the mechanical theory of the development of the disease. Factors contributing to damage to the cornea include frequent rubbing of the eyes, and wearing lenses. Genetic predisposition will also be one of the important factors [11].

The theory of heredity of keratoconus is proven since cases of the familial course of the disease have been encountered in medical practice [7].

There are many classifications of keratoconus in the scientific literature. The first classifications were based on the stages of development and the determination of visual acuity without correction, but this indicator was recognized as unstable [12].

The classification of M. Amsler was singled out by experts as the most optimal [13]. He predicted distinguishing four stages of the disease (**Table 1**).

Table 1. Classification of keratoconus according to M. Amsler.

Stage of keratoconus	Changes taking place
I	- manifestation of nerve fibers of the cornea - changes in endothelial cells - minor ophthalmometric changes
II	- the appearance of lines of keratoconus - distortion of ophthalmometric marks
III	- Cloudiness of Bowman's membrane - pronounced changes in the ophthalmometric picture
IV	- clouding of the stroma - changes in Descemet's membrane

But, since at present the possibilities of medicine allow us to see changes at the micro level, this classification is losing its relevance. The most important for the doctor is the identification of the disease at the subclinical stage.

Consider another classification (**Table 2**) [14].

Table 2. Classification of keratoconus according to J. Buxton.

Stage of keratoconus	Changes taking place
I	- corneal radius about 7.5 mm - irregular astigmatism
II	- corneal radius from 7.5 to 6.5 mm - distortion of ophthalmometric marks
III	- corneal radius less than 6.5 mm

The classification proposed by A.A. and E.A. Kasparov is very extensive. They distinguish the following stages of keratoconus [15]:

Stage I - chronic progressive. It is divided into early, developed, and advanced stages.

Stage II - acute (initial or advanced stages).

Stage III - complicated forms of the disease (subluxation of the lens or Castroviejo syndrome).

All stages are considered by scientists in terms of treatment recommendations.

But with the development of modern technologies, even the most ambitious classifications need improvements and new approaches to considering the stages of the disease [16].

In the rehabilitation of patients, the main thing for the doctor is the implementation of three goals:

- correction of existing optical disorders;
- process stabilization;
- restoration of the properties and structure of the damaged cornea [17].

There are two main methods of treatment: surgical and non-surgical.

Non-surgical methods of treatment include spectacle and contact correction. Many scientists suggest using glasses as long as it completely satisfies the patient, but due to the growth of astigmatism, this method does not always have a positive trend [18].

Contact correction comes to replace spectacle correction with the progression of ectasia. There are different types of lenses:

- soft;
- rigid gas-permeable;
- scleral;
- hybrid [19].

The most effective is the wearing of rigid gas-permeable contact lenses, which allow you to correct refractive errors and correct the regularity of the anterior surface of the cornea. But at the same time, there are also disadvantages when using them. Rigid lenses can cause corneal erosion and infection [20].

Scleral lenses may be used at various stages of the disease. They can reduce the load on the corneal surface [21].

But the process of the effect of stabilizing the disease when wearing contact lenses causes a lot of controversy among doctors and scientists. Some talk about the progression of keratoconus as a consequence of wearing lenses, since by exerting a mechanical effect, they can cause various inflammations of the cornea and reduce its density. Others, on the contrary, talk about the stabilization of the patient's condition with this method.

There are more surgical treatments. They are suggested to be used when it is impossible to conduct contact or spectacle correction. For example, many scientists suggest introducing femtolasers refractive autokeratoplasty at stage III or IV of keratoconus [22]. This method, using a deep two-stage non-penetrating resection of the stroma, allows you to return the conically changed cornea to its original state.

The method of corneal collagen crosslinking allows not only to stabilize the disease but also contributes to its treatment. This method allows you to increase the density of the cornea by forming bonds between collagen molecules. Some authors introduce such a definition as collagen crosslinking [23]. These changes are made possible by a photochemical reaction. Doctors do not recommend using this method with a cornea thickness of fewer than 400 microns.

Thus, with the help of corneal collagen crosslinking, it is possible to reduce the cylindrical and myopic component of refraction, as well as to reduce the degree of disease progression [24].

The result obtained after this method is maintained for three years, then the level of collagen renewal decreases. At the same time, there may be a decrease in vision in 2.9% of cases, and the progression of the disease occurs in 7.6%.

Scientists have developed another technique for stopping keratoconus at stages I and II - a combination of photorefractive keratectomy and phototherapeutic keratectomy [25]. The use of this method is recommended for patients over 40 years of age, as well as for those who cannot tolerate contact lenses.

The operation makes it possible to form a fibrocellular membrane, around which structures corresponding to the normal cornea could be formed (increases its strength) [26].

Femtolasers circular keratotomy, using a deep circular incision that stimulates connective tissues, allows creating of a circular framework for a weak cornea, reducing astigmatism, and thereby improving vision [27].

Such a method as epikeratoplasty can reduce astigmatism and align the anterior surface of the cornea, but at the same time, patients experience a very long recovery. The main advantage of this method is the low risk of immunological and postoperative complications, thereby minimizing the risk of implant rejection [28].

In acute keratoconus, the main treatment is penetrating keratoplasty. Transparent engraftment occurs in almost 95% of cases. During this operation, there is a high risk of postoperative complications [29].

Intrastromal or interlayer keratoplasty has become widespread [30]. By exfoliating the cornea, a graft is introduced into the formed space, which is completely isolated from extraneous influences of tears, air, etc., which contributes to its engraftment. The positive aspects of this method are a high degree of transparent engraftment and a high degree of tissue compatibility [31].

The Impact of Keratoconus on the Patient's Welfare

Many researchers, studying keratoconus, in their works consider such an aspect as the personality of the patient with this disease. Thus, several authors recorded that in patients with this diagnosis, similarities in character traits can be found [32]:

- reduced level of adaptability;
- disorganization;
- paranoid;
- anxiety;
- Passive aggression.

Other researchers argue that these characteristics are inherent in patients with other chronic eye diseases, and not just in the presence of keratoconus. This is due to less fitness due to a decrease in visual acuity [33].

Depending on the time of manifestation and development of the disease, keratoconus can affect the psychosocial development of the patient [34]. Scientists conducted a study during which they refuted the theory of the development of a "keratoconic" personality. Among patients with myopia (from -6.0) and keratoconus, a survey was conducted to identify the relationship between keratoconus and personality attributes, but no clear differences were found.

Many researchers in their scientific works pay considerable attention to such an aspect as the relationship between keratoconus and mental illness in patients [35, 36]. For example, in one of the works, the following clinical case was considered. The patient had schizophrenia and keratoconus, which began to develop at the age of seventeen. A history of the use of psychotropic substances was recorded. Four years later, after the development of the disease (at the age of 21), the patient experienced an exacerbation of schizophrenia, at the same time bilateral keratoplasty was performed. The patient associated the deterioration of his condition, illogical speech, and incoherence of thoughts with the implantation of corneal segments.

Three more cases of keratoconus in patients with schizophrenia presented in the scientific literature were also considered [37]. In patients whose ages ranged from 20 to 27 years, symptoms such as disorganization, suicidal tendencies, and body dysmorphic disorder were observed.

Despite all the research in this area, the relationship between keratoconus and schizophrenia has not been established reliably. However, doctors have found that mental illness can indirectly affect the development of keratoconus [38]. This becomes possible due to a violation of body functions or loss of self-control in patients who can mechanically damage the cornea of the eye. Due to constant eye friction (mechanical irritation), keratectasia may develop. Regular damage to the corneal epithelium can lead to its stretching, thinning, and violation of the integrity of the fibrillar matrix [39].

The rapid progression of the disease (bilateral corneal ectasia) was observed by physicians in a patient with bilateral keratoconus. The reason for the rapid development of the disease is Tourette's syndrome (a neurological disease characterized by repetitive motor tics), which led to compulsive eye rubbing [40].

With the development of the disease, a deterioration in the standard of living of patients is also fixed. Improvement of indicators coincided with the surgical method of treatment – crosslinking [41]. Prakika shows that the level of anxiety has decreased in patients. Also, in the scientific literature, there are many cases of improvement in the quality of life in patients a year after surgery: crosslinking, and corneal transplantation, which persists for a long time [42-44].

Conclusion

Such a concept as the quality of life began to be considered by scientists in the 60s of the twentieth century. It began to be defined as the optimal state of a person and the stage of satisfaction of his physical, social, and emotional needs. Health assessment is one of the main factors in determining the quality of human life. That is why this concept has become one of the components of the list of medical tasks. Improving the patient's quality of life is one of the indicators of the effectiveness of treatment.

A closer look at the quality of life of patients with keratoconus is of particular importance since the impact of visual impairment on it exceeds the impact of diseases on the cardiovascular system.

Acknowledgments: The authors are thankful to colleagues from North Ossetian State Medical Academy for consultancy during review.

Conflict of interest: None

Financial support: None

Ethics statement: None

References

1. Santodomingo-Rubido J, Carracedo G, Suzaki A, Villa-Collar C, Vincent SJ, Wolffsohn JS. Keratoconus: An updated review. *Cont Lens Anterior Eye*. 2022;45(3):101559. doi:10.1016/j.clae.2021.101559
2. Davidson AE, Hayes S, Hardcastle AJ, Tuft SJ. The pathogenesis of keratoconus. *Eye (Lond)*. 2014;28(2):189-95. doi:10.1038/eye.2013.278
3. Sheludchenko VM, Osipyan GA, Arestova ON, Djalili RA, Khraystin Kh. Comparative assessment of the quality of life of keratoconus patients before and after intrastromal keratoplasty. *Vestn Oftalmol*. 2021;137(5):40-6.
4. Abugova TD. Clinical classification of primary keratoconus. *Mod Optim*. 2018;4:17-23.
5. Romero-Jiménez M, Santodomingo-Rubido J, Wolffsohn JS. Keratoconus: a review. *Cont Lens Anterior Eye*. 2010;33(4):157-66. doi:10.1016/j.clae.2010.04.006
6. Cassidy D, Beltz J, Jhanji V, Loughnan MS. Recent advances in corneal transplantation for keratoconus. *Clin Exp Optom*. 2013;96(2):165-72. doi:10.1111/cxo.12047
7. Lucas SEM, Burdon KP. Genetic and Environmental Risk Factors for Keratoconus. *Annu Rev Vis Sci*. 2020;6:25-46. doi:10.1146/annurev-vision-121219-081723
8. Jurkiewicz T, Marty AS. Correlation between Keratoconus and Pollution. *Ophthalmic Epidemiol*. 2021;28(6):495-501. doi:10.1080/09286586.2021.1879173
9. Ozer MD, Batur M, Mesen S, Tekin S, Seven E. Long-Term Results of Accelerated Corneal Cross-Linking in Adolescent Patients with Keratoconus. *Cornea*. 2019;38(8):992-7. doi:10.1097/ICO.0000000000001975
10. Weng SF, Jan RL, Wang JJ, Tseng SH, Chang YS. Association between atopic keratoconjunctivitis and the risk of keratoconus. *Acta Ophthalmol*. 2021;99(1):e54-e61. doi:10.1111/aos.14509
11. Mas Tur V, MacGregor C, Jayaswal R, O'Brart D, Maycock N. A review of keratoconus: Diagnosis, pathophysiology, and genetics. *Surv Ophthalmol*. 2017;62(6):770-83. doi:10.1016/j.survophthal.2017.06.009
12. Belin MW, Jang HS, Borgstrom M. Keratoconus: Diagnosis and Staging. *Cornea*. 2022;41(1):1-11. doi:10.1097/ICO.0000000000002781
13. Ortiz-Toquero S, Rodriguez G, de Juan V, Martin R. Repeatability of Wavefront Aberration Measurements with a Placido-Based Topographer in Normal and Keratoconic Eyes. *J Refract Surg*. 2016;32(5):338-44. doi:10.3928/1081597X-20160121-04
14. Belin MW, Kundu G, Shetty N, Gupta K, Mullick R, Thakur P. ABCD: A new classification for keratoconus. *Indian J Ophthalmol*. 2020;68(12):2831-4. doi:10.4103/ijo.IJO_2078_20
15. Kasparova EA, Kasparov AA. Six-year experience with excimer laser surgery for primary keratoconus in Russia. *J Refract Surg*. 2003;19(2 Suppl):S250-4. doi:10.3928/1081-597X-20030302-17
16. Aatila M, Lachgar M, Hamid H, Kartit A. Keratoconus Severity Classification Using Features Selection and Machine Learning Algorithms. *Comput Math Methods Med*. 2021;2021:9979560. doi:10.1155/2021/9979560
17. Seitz B, Daas L, Hamon L, Xanthopoulou K, Goebels S, Spira-Eppig C, et al. Stage-appropriate treatment of keratoconus. *Ophthalmologe*. 2021;118(10):1069-88. [In German]. doi:10.1007/s00347-021-01410-8
18. Mohammadpour M, Heidari Z, Hashemi H. Updates on Managements for Keratoconus. *J Curr Ophthalmol*. 2017;30(2):110-24. doi:10.1016/j.joco.2017.11.002
19. Downie LE, Lindsay RG. Contact lens management of keratoconus. *Clin Exp Optom*. 2015;98(4):299-311. doi:10.1111/cxo.12300
20. Siddiqui SA, Singh P, Khan S, Fernando I, Baklanov IS, Ambartsumov TG, et al. Cultural, Social and Psychological Factors of the Conservative Consumer towards Legal Cannabis Use—A Review since 2013. *Sustainability*. 2022;14(17):10993. doi:10.3390/su141710993
21. Schornack MM. Scleral lenses: a literature review. *Eye Contact Lens*. 2015;41(1):3-11. doi:10.1097/ICL.0000000000000083
22. Abdallah MM, Ammar HG. Femtosecond Laser Implantation of a 355-Degree Intrastromal Corneal Ring Segment in Keratoconus: A Three-Year Follow-Up. *J Ophthalmol*. 2019;2019:6783181. doi:10.1155/2019/6783181
23. McKay TB, Priyadarsini S, Karamichos D. Mechanisms of Collagen Crosslinking in Diabetes and Keratoconus. *Cells*. 2019;8(10):1239. doi:10.3390/cells8101239
24. Saad S, Saad R, Jouve L, Kallel S, Trinh L, Goemaere I, et al. Corneal crosslinking in keratoconus management. *J Fr Ophtalmol*. 2020;43(10):1078-95. doi:10.1016/j.jfo.2020.07.002
25. Fay J, Juthani V. Current trends in pain management after photorefractive and phototherapeutic keratectomy. *Curr Opin Ophthalmol*. 2015;26(4):255-9. doi:10.1097/ICU.0000000000000170
26. Nagpal R, Maharana PK, Roop P, Murthy SI, Rapuano CJ, Titiyal JS, et al. Phototherapeutic keratectomy. *Surv Ophthalmol*. 2020;65(1):79-108. doi:10.1016/j.survophthal.2019.07.002
27. Kubaloglu A, Sari ES, Cinar Y, Cingu K, Koytak A, Coşkun E, et al. Comparison of mechanical and femtosecond laser tunnel creation for intrastromal corneal ring segment implantation in keratoconus: prospective randomized clinical trial. *J Cataract Refract Surg*. 2010;36(9):1556-61. doi:10.1016/j.jcrs.2010.04.028

28. Mezhidov BS, Belyaeva AA, Bimarzaev KSM, Bektashev AS, Shekhshebekova AM, Dzgoeva MG, et al. Prospects for Creating 3D Models of Internal Organs Based on Computer and Magnetic Resonance Imaging Images in Emergency Surgery and Resuscitation. *Pharmacophore*. 2021;12(1):8-14.
29. Osipchuk GV, Povetkin SN, Nagdalian AA, Rodin IA, Vladimirovna MI, Ziruk I, et al. The issue of therapy postpartum endometritis in sows using environmentally friendly remedies. *Studies*. 2019;10(2):82-4.
30. Lopes D, Loureiro T, Carreira R, Rodrigues Barros S, Nobre Cardoso J, Campos P, et al. Transepithelial or intrastromal femtosecond laser arcuate keratotomy to manage corneal astigmatism at the time of cataract surgery. *Arch Soc Esp Oftalmol (Engl Ed)*. 2021;96(8):408-14. doi:10.1016/j.oftale.2020.09.008
31. Soleimani M, Shahbazi A, Mohammadi N, Tabatabaei SA. Complications of intrastromal bevacizumab injection in lamellar keratoplasty. *Int J Ophthalmol*. 2020;13(2):356-8. doi:10.18240/ijo.2020.02.22
32. Wahrendorf I. How to live with keratoconus. *Klin Monbl Augenheilkd*. 2006;223(11):877-88. German. doi:10.1055/s-2006-927144
33. Tatematsu-Ogawa Y, Yamada M, Kawashima M, Yamazaki Y, Bryce T, Tsubota K. The disease burden of keratoconus in patients' lives: comparisons to a Japanese normative sample. *Eye Contact Lens*. 2008;34(1):13-6. doi:10.1097/ICL.0b013e3180515282
34. Moschos MM, Gouliopoulos NS, Kalogeropoulos C, Androudi S, Kitsos G, Ladas D, et al. Psychological Aspects and Depression in Patients with Symptomatic Keratoconus. *J Ophthalmol*. 2018;2018:7314308. doi:10.1155/2018/7314308
35. Aslan MG, Besenek M, Akgoz H, Satilmaz MF, Hocaoglu C. Evaluation of Personality Features and Mental State of Keratoconus Patients. *Beyglu Eye J*. 2021;6(4):272-9. doi:10.14744/bej.2021.24482
36. Maslova AY, Tskaeva AA, Ashurova ZA, Abazova A, Ismailov MM, Ismailova MM, et al. Study of the effect of Baricitinib on the Course of COVID-19. *J Pharm Res Int*. 2021;33(35A):204-13. doi:10.9734/jpri/2021/v33i35A31890
37. Mannis MJ, Ling JJ, Kyrillos R, Barnett M. Keratoconus and Personality-A Review. *Cornea*. 2018;37(3):400-4. doi:10.1097/ICO.0000000000001479
38. Moreira LB, Alchieri JC, Belfort R Jr, Moreira H. Psychological and social aspects of patients with keratoconus. *Arq Bras Oftalmol*. 2007;70(2):317-22. Portuguese. doi:10.1590/s0004-27492007000200023
39. Cavanna AE, Seri S. Tourette's syndrome. *BMJ*. 2013;347:f4964. doi:10.1136/bmj.f4964
40. Rindner EC. Living with Tourette's syndrome. *J Psychosoc Nurs Ment Health Serv*. 2007;45(8):19-23. doi:10.3928/02793695-20070801-05
41. Magomedova AS, Sheripovna DK, Kunkueva SA, Muskhanov MI, Ibragimov AK, Khazamova SO, et al. Application of a Simulation System Using Augmented Reality to Practice the Skills of Minimally Invasive Spine Surgery. *J Pharm Res Int*. 2021;33(42A):66-73. doi:10.9734/jpri/2021/v33i42A32385
42. Algahtani FD. Healthy Lifestyle among Ha'il University Students, Saudi Arabia. *Int J Pharm Res Allied Sci*. 2020;9(1):160-7.
43. Hanawi SA, Saat NZ, Zulkafly M, Hazlenah H, Taibukahn NH, Yoganathan D, et al. Impact of a Healthy Lifestyle on the Psychological Well-being of University Students. *Int J Pharm Res Allied Sci*. 2020;9(2):1-7.
44. Salehzadeh H, Ebrahemzadih M, Nourani MR, Kourghi M, Taheri RA. The impact of lead contamination on psychiatric disorders and quality of life. *J Biochem Technol*. 2019;10(2):18-27.