CORNEAL DISEASE:
NEW APPROACHES TO THE TREATMENT

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Modern healthcare is developing in a close connection with socio-economic changes happening in the country. Taking into account a certain shortage of financial resources in the industry, searching for optimal treatment technologies is one of the priority tasks that allow for providing healthcare services to the general public and for a rational use of available financial resources. A new operational model of treating patients with cornea decease based on the use of soft contact lenses was implemented in the Republic of Tatarstan. In this monograph, results, clinical and economic aspects of this process are presented.

This monograph is intended for ophthalmologists, healthcare managers, hospital managers and general practitioners.


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INTRODUCTION

At the current stage of development of socio-economic relations in the country, implementation of new, effective medical technologies and innovative ways of treatment is a priority task for the healthcare (Avksentieva M.V., Vorobyov P.A., 2002; Slyahto E.V., Shevchenko I.A., 2004; Artukhov I.P., Morozova T.D., 2009; Starodubov V.I., 2009). Many professionals note that under current conditions, when elements of market economy are increasingly present in the industry, problems of rational use of the available resources is increasingly more important (Blohin A.B., 2003; Alekseev N.A., 2004; Kanunnikova L.V., 2006; Solodskiy V.A., Perhov V.I., Stupakov I.N., Samorodskaya I.V., 2006). Thus, it is becoming obvious, that evaluation of economic efficiency of proposed means of treatment is becoming an integral part of a healthcare system. Furthermore, the priority of this direction is defined by the slowness of integrating of effective scientific innovations into diagnostic and treatment of deceases. This, in the opinion of healthcare institutions' managers, is largely explained by the lack of necessary financial resources (Kadirov 1998, Alekseev 2001). However, in a number of cases, under a more scrupulous examination, improving medical treatment methods does not require significant investments (Galkin R.A., Pavlov V.V., Kuznetsov S.I., 1996; Boltenko N.N., Labzovskaya A.G., 1999, Vardosanidze S.L., 2000, Kalininskaya A.A., Shapekina O.V., Slyafer S.I., Dementyeva N.D., 2000; Kulagina E.N., Vvedenskaya I.I., 2005).

Developing economically justified healthcare programs are especially emphasized while providing medical treatment to patients with developed nosological forms of deceases. According to recent statistics, eye deceases are pretty frequent (Ziyatdinov K.S., Gilmanov A.A., Sherputovskiy V.G., Molokovich N.I. et al. 2001, 2002), of which nearly 25% are cornea deceases, which sometimes leads to worsening or complete loss of eyesight (Maychuk U.F., 2000). According to World Health Organization’s research in 61, 7% of countries, blindness resulting from cornea diseases are one of the leading causes of eyesight loss (5 %) (Maychuk U.F., 1990; WHO Library Cataloguing-in-Publication Data, Global Initiative for the Elimination of Avoidable Blindness: action plan 2006-2011).

Throughout last decades number of cornea deceases is steadily increasing. This is associated with an increased workload that person's eye is coping with today, irrational use of antibacterial remedies, increased frequency of eye trauma, increased use of surgical means of treatment for ophthalmologic pathologies and so on (Maychuk U.F., 1990, 2000; Sakovich V.N., 1991; Kasparov A.A., 1994; Lazarenko V.I., Sichev G.S., Gaydukova E.A., Lubanets E.B., 1996; Hotim V.E., 1996; Inoue I., Asari S., Tahara K., Hayashi K. et al., 1998)

At the same time, means of medical treatment of patients with cornea decease are increasing. Some researchers are proposing to use soft contact lenses (SCL) as one of the means of effective cornea rehabilitation. They protect the cornea from external damaging factors and also extend the length of medical exposure on the cornea tissue when saturated with medicamental solutions (Gendrolis A.Y., 1988; Novikov S.A., 1993, Zakharov I.A., Novokreshchenova I.G., Tupitsina T.V., 1996;
Grandmother A.E., 1999; Krejci L., 1972; Praus R., 1974; Leibowitz H., 1975; Gasset A.R., Lobo L., 1976; Astin C.L., 1994; Assil K.K., Massry G., Lehmann R., 1997; Azem H., 1997). However, regardless of obvious advantages of these technologies, in the literature, there is no evidence of widespread introduction of this method into the general medical practice. We explain this by the lack of complete medico-economic analysis of this method's efficiency in treating patients with the given pathology.

Based on what was said earlier, there is a need to further research of optimization of medical treatment of patients with cornea decease based on using SCL and further justification of medico-economic efficiency of introducing this method, taking into account current and prospective needs of the healthcare industry.

Aims of this research are: to study prevalence of eye deceases, including cornea deceases, in the Republic of Tatarstan and definition of medico-biological factors influence on its occurrence; analysis of the state of ophthalmologic help in Republic of Tatarstan's various regions and with this data in mind, development of an organizational model of optimal medical treatment of patients with cornea decease; evaluation of medical efficiency and economical practicality of introducing the new technology of treating the abovementioned deceases with SCL.

Practical value of this research is to increase the efficiency of treating patients with cornea decease, by introducing the new organizational model of optimal medical treatment based on the implementation of SCL, in achieving economic savings by decreasing an average amount of time required for hospitalization and time lost due to temporary disablement.

The developed model will enable a more complete use of Republic of Tatarstan's hospitals, including day hospitals that offer ophthalmologic services to the public, will increase the availability and quality of the offered medical help in remote locations by introducing general practitioners into the process. Also, using nurses will increase labor productivity of medical staff and considerably decrease the time spent by doctors on dealing with patients.

Results of this study can be used by healthcare managers of all levels, ophthalmologic clinics and hospitals.
CHAPTER I

1.1. MAIN DIRECTIONS OF IMPROVING THE ORGANIZATION OF MEDICAL TREATMENT UNDER CURRENT CONDITIONS

Healthcare is one of the socially oriented systems and is under the influence of socio-political environment, legislature and legal norms, while market has a direct influence on the production activities and procurement of resources (Blokhin A.B., 2003; Artukhov I.P., Morozova T., 2009). It is well-known that in the last decade Russian Federation experienced difficult socio-economical, political and demographic changes. The difficulties that emerged have considerably affected functioning of the healthcare system, federal and local management bodies, each medical institution in particular (Shlyahto E.V., Shevchenko I.A., 2004). Thus, an urgent need to reform the system taking into account the new conditions in the country has emerged.

The Russian Government has developed a model of possible changes and the future state of healthcare. The task is defined – creation of a completely new technological, efficient model of healthcare, that will adequately manage the state of public health and rationally use the resources that are directed to these purposes (Blokhin A.B., 2003; Martynchik S.A., 2010; Shabunova A.A., 2010).

This has led to a widespread adoption of economic methods of management in the country's healthcare system, increased independence of healthcare institutions' managers, increased responsibility of managers and staff of medical institutions for the final result and quality. Also, a deep analysis of work results of Day and Out-patient treatment segments of healthcare is being conducted and means of their further improvement are being developed (Ziyatdinov K.S., 2000).

The first aim of reforming the Day-treatment medical help was the decrease of length of hospital rehabilitation stage of the treatment (Aleksandrov V.L., 2001). A.I. Vyalkov (2001) notes, that the length of hospital time under the Day-treatment model is one of the most important measures of efficiency and quality of medical services. Several authors use the average time spent by the patient on a hospital bed to evaluate the efficiency of using the hospital beds. Also, average time spent by patients on a hospital bed is used as one of factors in determining the labor guidelines, as well as one of the medico-statistical measures in managing the hospitals and as one of socio-economic criteria in evaluating various medical treatment procedures (Alekseev N.A., 2001, 2004).

It is established that the length of time that patient is required to be in the Day-hospital is influenced by many factors, among which following are highlighted: availability of modern medical equipment, ratio of hospital-beds to population size, the use of out-patient treatment in hospitals, good coordination across different medical institutions and others (Andreeva O.V., 2001; Gayvoronskiy V.S., 2001).

The literature convincingly establishes the opportunity of decreasing the time spent by patients in hospitals by introducing progressive methods of treatment into
the process, because right from the very beginning, these methods are aimed at improving the treatment, which will inevitably facilitate the quality of medical help and thus, will create conditions for a faster and higher quality health improvement (Galkin R.A., 1996; Kalininskaya A.A., Shapekina O.V., Slyafer S.I., Dementyeva N.D., 2000; Kulagina E.N., Vvedenskaya I.I., 2005). V.L. Aleksandrov (2001) has a similar view on the problem, and also thinks that average time spent on a hospital-bed is directly dependent on the level of adopted technologies of treatment.

Another approach aimed at decreasing the time spent by the patient at the hospital-bed is standardization of treatment-diagnostic process. It allows determining the cost characteristics of medical treatment and defining the end result of medical staff's efforts (Hisamutdinov R.A., 1999). For this to happen, as argued by A.A. Gilmanov (2003), the standardization of the diagnostic-treatment process should be based on expert evaluation of efficiency of introducing new protocols of diagnostic and treatment of patients, primarily, in light of their effect on decreasing the length of rehabilitation period and costs of treatment. Treatment protocols and drug forms that are used in the standardization process facilitate the provision of a constant level of quality of treatment to all patients and considerable decrease of time required for in-hospital rehabilitation (Vardosanidze S.L., 2000).

Relation between supply of drugs and amount of time spent by the patient on the hospital-bed has a special significance. Thus, when surveying doctors, it was established that in 63.8% of cases complete supply of drugs could have decreased amount of in-hospital treatment time and in 48.1% this time could be cut by introducing the new means of treatment (Ziyatdinov K.S., 2000).

A serious restructuring of hospitals is proposed to increase their efficiency and decrease resources-intensity (Kulagina E.N., Vvedenskaya I.I., 2005). One of the new organizational forms of all-day-hospitals is introduction of methods such as wards for day-only patient treatment (Order of the Ministry of Healthcare of Russian Federation from 09.12.1999 No 438 "Regarding the organization of day hospital's operations"). The essence of such a form of operation is to provide diagnostic, treatment and rehabilitation services in in-patient environment to patients who have previously required hospitalization.

Day-only treatment is primarily aimed at patients suffering from chronic deceases, who require a use of modern medical technologies, but do not need a 24-hour attention of medical staff and their needs are met by a medical examination and treatment correction one in 24 hours. These patients can successfully receive the required amount of medical help in day-only hospitals (Pavlov V.P. et al., 2003).

As V.I. Tretiak et al. (2002) and E.U. Ludupova (2002) argue the main aim of developing such forms of organization of medical treatment is decreasing number of hospitalization into 24-hour hospitals and huts, decreasing the costs of the healthcare system keeping the quality and accessibility of medical help constant.

Many authors note the advantages of this system. So, in N.N. Boltenko and A.G. Labzovkaya (1999) research, in comparison of total costs of treating one patient in 24-hour hospital and day-only hospital it is found that savings per one patient can reach up to 50-70%.
K.S. Ziyatdinov et al. (2000), V.I. Starodubov et. al. (2001) emphasize the fact that introducing this system into practice leads to shorter period of treatment and allows for a more rational use of bed-fund in hospitals, which in turn improves the availability of 24-hour service for the public.

A.A. Kalininskaya et. al. (2000) has conducted an in-depth study of an economic effect of day-only department (DOD) operation in a hospital. Analysis led to the following conclusions: cutting the night shifts has decreased the manpower of doctors and other medical workers. Due to savings on payroll, total costs in day-only department have become almost half of what is in 24-hour hospital. Furthermore, costs of furnishing and utilities (due to savings on required area and electricity savings). Spending on drugs has almost doubled in a day-only department. This is due to the fact that in a day-only department patients are treated with newer, next generation drugs, usually including intravenous and stream droppers. Medical efficiency of such a department is confirmed by patient surveys. All surveyed patients have indicated their satisfaction with this form of operation and considered it to be more convenient from a social point of view.

According to N.A. Alekseev et al. (2004), the cost of treating a patient in a day-only department (DOD) is 30-44.7% lower than in a 24-hour hospital. Authors have concluded that nowadays there is a need in developing new approaches in changing the decision making on whether 24-hour treatment is required, intensify the operations of highly technological, expensive 24-hour beds and decrease the cost of treatment by timely transferring patients to DOD treatment. Moreover, diagnostic and treatment technologies should be expanded on DOD stage as well.

Another direction of improving the organization of medical help is an integration of General Practitioner (Family) Doctor (GPD) into the healthcare system. According to "Basis of Russian Federation legislature about public health safety" (1993), the order of the Ministry of Healthcare of Russian Federation from 26.08.1992 No. 237 "About gradual switch to organizing of initial medical assistance through general practitioner doctor (family doctor)" and "The concept of healthcare and medical science development in Russian Federation", initial medical assistance should be provided by a general practitioner (family) doctor (Galkin R.A., Pavlov V.V., Kuznetsov S.I., 2000; Golovskoy et al., 2004, 2006).

In this case, the matter is about a reorganization of a system of initial medical assistance – about a gradual transformation of district-based service into a service that is concerned with treating a wide variety of deceases. The urgency of this question is quite pressing, since today a district doctor is performing an increasingly coordinating role, managing the distribution of patients across stringent specialists, every one of which is only concerned with treating only deceases that he or she specializes in. This violates one of the main principles of treating the patience, but not the decease (Kadirov F.N., 1998, Schepin O.P., Ovcharov V.K., 2005).

According to S.A. Suslin and R.A. Galkin (2006), the existence of general practitioner can increase the availability of medical care for the people, he takes care of all first contacts with him, timely seek the advice of more qualified, better-equipped professionals of the second level, directs the patient in the hospital when it
is necessary. The authors believe that at present the most profitable to enter general medical practice (GP) in distant and thinly populated areas, countryside, as well as in economically prosperous areas with a solvent population as a paid medical service for certain categories of citizens. So they found that the introduction of the institute GP in rural areas of the Chuvash Republic is accompanied with large economic effect. Even on the first stage of implementation, noticed the decreasing of the level of hospitalization by 5-10% on the areas with such specialists.

These authors are also offer to pay attention on the nursing services. This seems as the most cost-effective way to deliver services in primary health care. Nursing services can be represented as a reserve for regional economy and the municipal health care: the qualified nurse able to perform many of the duties performed by the doctor today. This way the stuff is successfully practicing in European countries.

In general, using hospital-substitution technologies (for example, day hospital), the reference to the services of a general practitioner or the creation of nursing care for patients can encourage to decrease the duration of staying in hospitals (Kakorina E.P., 2000; Saltman R.B., 2000; Ektov V.N., 2000, Lisitsyn Y.P., 2009).

Thereby, in the situation of progressive financial instability in the country, expensive and inefficient nature of the organizational structure of health care becomes more obvious. Because of this, one of the most important parts of improving the industry is the introduction of new advanced technologies and forms of organization of medical care. The solution to this actual urgent problem will provide a large integrated medical, social and economic effect through the lowest cost (Kadyrov F.N., 1998).

1.2. ECONOMIC ASPECTS OF HEALTH CARE

Last years, the elements of a market economy are actively developing in national health care system. Today, the importance of economic efficiency of the industry has priority, when the comparison the results with the costs providing it receipt realize with evaluation of the real volume of funds, rather than theoretical, as it was in pre-perestroika period. That is now economic effectiveness analysis becomes the part of comprehensive analysis of health care institutions. Also the search for the most economically advantageous institutional, medical technologies based on examination of the results of their introduction into the practice becomes urgent as never before (Ortendal K., 2000, Alekseev N.A., 2004).

Numerous researchers noticed the problem of interpretation of organization of medical care as a purely medical activity that doesn’t connected with economic interests. Till now, the administrative methods are continue to be the main form of management, economic leverages for stimulating the introduction of advanced methods of medical care are not used. However, now it is obvious that meeting the needs of the population in high-quality care requires the development and
introduction of progressive forms and methods of work organization of community-acquired and hospital health care facilities, as well as rational using of available material resources and human capacity (Zyyatdinov K.S., 2000; Kadyrov F.N., 1998).

Many authors offer different methods for calculation the economic and medical efficiency, but at the same time there is a lack of common approaches to the question of assessing the effectiveness.

The term of efficiency in health care has different meanings and depends on the object of research, evaluation criteria, and the system of completing the indicators.

According to Bushueva G.A. and the co-authors (2000), economic efficiency is the comparison of a useful result (effect, gain, profit, income) with the costs, with the price of which it can be achieved. In other words, economic efficiency is a quantitative assessment of the extension of the planned indicators of the object of research with the optimal cost (Gabueva L.A., 2002).

Practically all events, actions, technologies in health care can be assessed from the economic efficiency position. Economic evaluation of health interventions complex, services, which lead to improvement or patient’s recovery, allows us to analyze the effectiveness of medical care (Alekseev N.A., 2004).

The determination of the degree of economic efficiency in health care is a difficult task, because there is no obvious indicator that could be used to identify the effect (Vasilyeva L.N., 1998). Some authors believe that the economic benefits in healthcare is the consequence of the positive medical effect and consists of the reduction of loss in connection with the morbidity, disability, premature mortality (Kulagin E.N., 1998). Others believe that economic efficiency is determined by the costs and finally quantitatively expressed in the universal index such as money equivalent (Alekseev N.A., 2004).

At present, different methods are applying for assessment the economic parameters of health care. For example, one of them is the Kadyrov’s method (Kadyrov F.N., 1997). According to him, the expenditure can be reduced by lowering hospitalization (lowering the number of days spending on hospital bed). A.A. Gilmanov (2003) agrees with him. Gilmanov used in his research study the figures of the average length of staying the patient in hospital for the economic impact evaluation.

Thereby, some authors suggest defining the assessment of the useful results achieved by reducing the duration of treatment in physical terms or in cash (Kulagin E.N., 1998; Bushueva G.A., 2000). This allows us to calculate and estimate the economic benefits getting from reducing the average duration of hospital treatment of the disease.

In accordance with the method of formation of the federal government guarantee program patient received as a unit volume of medical care bed-day (Gilmanov A.A., 2003).

According to various researchers, the average tariff rate of one bed-day in the twenty-four-hour hospital includes the following major categories of hospitalization costs: the whole set of fixed costs associated with staying in bed, operating costs or the cost of utility services, the cost of diagnosis and treatment, staff costs and the
price of patients’s meal (Vartanjan F.E., 1991; Bagnenko S.F., 2002, Korotkov A., 2002). Thus, calculating the actual figures of the average length of staying the patient in hospital and comparing them with the standard, we can accurately define the efficiency of hospitals.

Besides the analysis of average length of staying the patient in hospital there is the traditional approach to assessing the effectiveness of health care such as study of expectation of diseases with temporary disability (Gilmanov A.A., 2003).

Able-bodied population’s state of health is the one of determining factors of the productive capacity of the country. For effective health management it is necessary to have reliable and timely information with detailed analysis of morbidity with temporary disability (Molodtsov S.A. and co-authors, 2006).

The high intensity of labor and improvement of its productivity makes high and qualitatively new demands of state of health of the population employed in social production. Index of morbidity with temporary disability extends and objectifies our understanding of the problems, connected with health care. It is a decisive condition for improving the organization and management of medical and prophylactic care, it is also the illustration of the effectiveness of the whole ongoing medical and social measures complex, aimed at protecting and promoting the health of people, working in any industry (Zyyatdinov K.S., 2001; Gilmanov A.A., 2003).

In the volumes of the economic damage caused by the incidence of the adult working population, its main components are the damages associated with a decrease in productivity (from 2.0% to 15% - depending on the type of production, decreasing the tax base at the same time), the temporary disability compensation, the care cost (Ortendal K., 2000).

In some studies the morbidity with temporary disability (MTO) can be recommended as the indicator, the analysis of which can help to optimize control of the reducing losses in the economy (Kleinman N.L., Cifaldi M.A., Smeeding J.E., et al., 2013).

Recently there has been a tendency to decrease the number of calls for medical assistance due to temporary disability while increasing the average length of stay on the sick list. This can be explained with the underemployment and unemployment, as well as the increase in the general structure the proportion and frequency of chronic diseases (Kiriakoff V.A., 1996; Ovcharov V.K., 1998; Skvirskaya G.P., 1998).

In addition, studies established the dependence of the duration of the IMTO on the health care providing. Therefore it is proved that the average duration of the morbidity with temporary disability treatment in the day hospital for 3-4 days less than its duration in the policlinic (Ladnyi A., 1990) and for 4-6 days shorter than treatment of similar diseases in the hospital (Kalinin A.A., 2000).

In view of the aforesaid we conclude that at the present point in time the main direction of medical care improvement is the creation of a qualitatively new model of health care, positively influencing on the health of the population and effectively using financial resources directed towards this purpose.

1.3. REASONS, POPULARITY AND OPPORTUNITIES APPLICATION OF SOFT CONTACT LENSES
FOR REHABILITATION OF PATIENTS WITH PATHOLOGY OF CORNEA

1.3.1. REASONS AND PREVALENCE OF DISEASES OF CORNEA

Diseases of the cornea is one of the most common types of ocular pathology, in this case frequently becoming the cause of the visual impairment or complete loss of vision, and even the death of the eye in sever case (Maychuk Yu.F., 2000; Farooq A.V., Shukla D., 2012). Among the eye diseases their share is for 25% of cases, and in the nosological structure of disability in sight they occupy about 20% (A.A. Kasparov, 1985, Libman E.S., 1986; Ferfilfayn I.L., 1986). According to the World Health Organization in 61.7% of blindness, caused as the result of destruction of the cornea, is one of the leading causes of loss of vision in the population (Maychuk Yu.F., 1990; WHO Library Cataloguing-in-Publication Data, Global Initiative for the Elimination of Avoidable Blindness: action plan 2006-2011).


Since 70-ies of the twentieth century in some developed countries, first of all in the United States, was registered a sharp rise in the number of people who become ill with acute and recurrent forms of herpetic virus disease (Maychuk Yu.F., 1998; Adhin M.R., Grunberg M.G., Labadie-Bracho M., 2012; Boto-de-Los-Bueis A. et al., 2013; Galvis V. et al., 2013).

Herpetic lesion of the cornea is one of the most common and disabling disease of this part of eye: it takes from 20 to 75% of the total number of inflammatory diseases of the cornea, and more than 60% of cases of corneal blindness associated with the formation of scars on its surface (Katsnelson A.B., 1969; Akberova S.I., 1997; Maychuk Yu.F., 2000; H. Ghiasi, S. Cais, S. Slanina, 1997; Steiner I., Benninger F., 2013; Farooq A.V., Shukla D., 2012).

Every year in the USA the number of patients with ocular herpes approaches to 500 000 (Grutzmacher R.D., Henderson D., McCanald P.J., Coster D.J., 1983). According to statistics, in Russia the figure is 250,000 - 300,000 people per year (Kasparov A.A., 2004; Maychuk Yu.F., 2011). Social significance of eye-herpes are frequent recurrent. According to Liesergang T.J. (1989) – from 22.9% to 63.2% of cases recur, so taking into account the recurrence of the disease, the total number of
patients with ocular herpes every year accounts several million people. This greatly increases the morbidity with temporary disability in working-age population.

Pathogenesis of ocular herpes includes biological balance of the latent state of herpes simplex virus in the host’s cell supported by the immune system of organism (antibodies, interferon, etc.). Ocular herpes relapses occur because of disequilibrium of this balance as a result of stress (Kasparov A.A., 1994; Farooq A.V., Shukla D., 2012).

For different authors various stress factors mean diseases and conditions accompanied by fever, including influenza and ARDS (Katznelson A.B., 1969); the processes associated with decreased production of interferon in the organism that is the most important factor in nonspecific antiviral resistance of organism. This can be caused by exposure to cold, raised doses of ultraviolet irradiation of the body, trauma, adrenaline, serotonin, alcohol intoxication, stress (Soloviev V.D., Bektemirov T.A., 1981; Shtein R.M., Stahl R.M., Saxe S.J., Mian S.I., 2007; Khalili M.R., Mehdizadeh M., Mehryar M. 2009; Jain V., Pineda R. 2009; Patell N.N., Teng C.C., Sperber L.T., Dodick J.M. 2009; Natandeli N., Chai J.S., Donnenfeld E.D., Perry H.D., 2013).

Unquestionable role in the exacerbation of herpetic keratitis, A.A. Kasparov (1994) devotes to micro traumas of cornea with the introduction or without it the small foreign bodies. In this study he found that among this group of patients people whose profession is associated with a high probability to injure the cornea (turners, fitters, drivers) were met much more often. In this study also enumerates other stress factors that provoke exacerbation of herpetic keratitis. They are treatment with corticosteroids, odontogenic infection, changes in endocrine system of women (menstruation, abortion), allergies and combination of several factors.

G.A. Loganovska (1999) also adds to these factors such causes as ARDS, pyelonephritis, psycho-emotional stress and sunstroke.

Suppurative inflammations in cornea are also in the list of the difficult and dangerous diseases. They differ in severity and always cause alarm about the fate of the eyeball (Chambers W.A., Belin M.W., Parenti D.M., Stimon G.L., 1988; Mondino B.J., 1988; Wiens J.J., Jackson W.B., 1988). The modern flora became more aggressive and resistant to many antibiotics, so in this case the severity of purulent process in the cornea is exacerbated (Malov V.M., 2003).

Factors caused suppurrative processes in the cornea are different: micro traumas of cornea (22.9% - 94%), soft contact lenses (3% - 34%), herpes simplex virus (20% - 24%), chronic diseases of the conjunctiva (27% - 51.5%), purulent meibomitis (25.8%), various surgical procedures (19% - 21%), keratopathy (18% - 24%), purulent dacryocystitis (4.7% - 17.6%) , epithelial - endothelial corneal dystrophy (1.5%), photorefractive keratectomy (0.2%) (Kasparov A.A., Sadykov, A.K., Moloven S.A., 1987; Shaimova V.A., 1999; Clinch T.E., 1994; Amayem A., Ali A.T., Waring G.O., Ibrahim O., 1996; Moshirfar M., 2007).

One of the most common present ways of vision correction with the help of soft contact lenses has disadvantages. First of all, this connected with the fact that many bacteria and some viruses have the ability to adhere to the lens surface. The scrutiny of microbial contamination of contact lenses used by patients allows to establish that
bacteria account for 95% and mushrooms account for 11% (Serbulov S.I., 1997). In addition, the soft contact lenses wearing reduces the effectiveness of natural protective systems of the eye, which makes the eye susceptible to viral and bacterial diseases (Avetisov S.E., 1990; Tervo T., Van Sertent G.B., Andersson R. et. al., 1989; Bui T.H., Cavanagh H.D., Robertson D.M., 2010; Hickson-Curran S., Chalmers R.L., Riley C., 2011).

Dart (1988) studied the factors that predispose to the development of microbial keratitis. 53 patients with microbial keratitis were examined. It turned out that the half of the patients (22 people) had in their anamnesis’s various diseases of the cornea such as herpetic keratitis, bullous keratopathy, state after keratoplasty, cataract extraction and etc., and the others (21 people) had wore contact lenses (Dart J.K., Radford C.F., Minassian D. et al., 2008).

Schein (1989) evaluated the risk of ulcerative keratitis (corneal ulcer) when using soft contact lenses. 471 people (61 - in the clinic, 420 - patient) were examined. Corneal ulcer was diagnosed in 86 patients. Individuals who used the soft contact lenses for the constant wear and do not removed them at night, the risk of corneal ulcer was higher above 10-15 times in comparison with people who used the soft contact lenses every day and removed them at night. It was pointed out that when the continuous wearing soft contact lenses during the whole day the risk reaches till 46%.

Yu.F. Maychuk (2000, 2005, 2006) in his research clearly concluded that there are two main groups of exogenous factors of the development of bacterial keratitis:

- traumatic injuries of the cornea, including the micro trauma occurring when wearing contact lenses and violation of hygiene, especially among those who don’t removed the lens at night (Stapleton F., Keay L., Edwards K. et al., 2008; Musa F., Tailor R., Gao A. et al., 2010; Wu Y.T., Zhu H., Harmis N.Y. et al., 2010; Evans DJ, Fleiszig SM., 2013).

- long duration of herpetic keratitis and corneal dystrophies when the irrational use of medicaments (corticosteroids, antiviral agents, antibiotics, anesthetics).

Every year in the United States are registering 30,000 bacterial corneal ulcers (McDonnell P.J. et al., 1992). Domestic data describing the prevalence of suppurative corneal ulcer among all the diseases of the cornea are contradictory. Some authors put suppurative corneal ulcer in the second place after viral lesions of the cornea (Maychuk Yu.F., 1990), while others assign them to the third place, after the virus (25%) and posttraumatic keratitis (20%) (Sharma S., Taneja M., Gupta R. et al., 2007; Narsani A.K., Jatoi S.M., Khanzada M.A., Lohana M.K., 2010; Shah V.M., Tandon R., Satpathy G. et al., 2010).

There should be added the diabetic ulcers of the cornea, number of those is steadily increasing at the same time with an increase in morbidity from diabetes (Groden L.R., Brinser J.H., 1986; Brodovsky S.C., Snibson G.R., 1997).

Meanwhile the intensification of ophthalmic surgery contributes to the increase in the number of cases of corneal lesions: during surgical procedures, intraocular lenses implantation, the introduction of medicaments into the anterior chamber and etc. endothelial injury goes on (Egorova E.V., 1985).

According to S. Fedorov’s and E.V. Egorov’s to research the frequency of
postoperative bullous keratopathy is about 11%. It is significant that that in 60%
bullous keratopathy occurs in the able-bodied age, 50% of patients relapse and
provides a large number of total disability days (from 20 to 190), requiring at the
average 73 bed-days of hospital treatment (Machekhin V.N., 1982).

The frequency of traumatic injury of eyes has been steadily increasing
throughout the world. It caused by the continuous processes of industrialization of
society, sports activities, increase traffic, aircraft accidents, everyday accidents, wars,
terrorist acts, etc. (Shangicheva I.V., 1964; Hart A., 1997; Pieramici D.J.,

From the beginning of 1990 in Russia the trauma entered of first place in the
structure of causes of visually disability, making up 22.8% of the primary disability.
The Intensive index of disability due to eye injuries steadily increasing: from 0.45 to
10 thousand adults in 1993 to 0.59 in 1995, that indicates that the ocular trauma

Eye burns account for 6.1 - 38.4% of all eye injuries. Among the eye burns
chemicals are more common - from 69 to 74% (Gogina N.D., 1981), and alkali burns
are the most severe (Lazarenko V.I., Sychev G.S., Gaidukova E.A., Lubanets E.B.,
occur in form of melting or perforation of the cornea, which accounts for 23% of
cases, in form of recurrent erosions (90%) and as the formation of coarse
vascularized leukomas the cornea, leading to complete loss of vision (Puchkovskaya
N.A., 1973; Chentsova E., 1996; Chechin P.P., 1985; Shirzadeh E., 2013). As a result,
40% of victims, mainly young the able-bodied age people become visually
handicapped with I-II degree of disability (Chentsova E., 1996).

1.3.2. POSSIBILITIES OF APPLYING SOFT CONTACT LENSES
FOR MEDICAL AID TO PATIENTS WITH DISEASES OF CORNEA

Treatment of eye diseases refers to the earliest section of somatic medicine and
it was known to ancient Indian and Arab healers, sooner to the doctors of the ancient
world and the Renaissance. According to herbals and manuals, for the treatment of
various eye diseases originally used herbs and plants with anti-inflammatory,
decongestive, disinfectant action (Alimardinova S.S., Efendiev, N.M., 1976; Madekin
A.S., 1998.)

Since the description of the first contact lenses in 1508 by Leonardo da Vinci,
their development prospects are associated with the general level of scientific and
practical advances in medicine. Great advances in diagnostic equipment, ophthalmic
optics (including contact and intraocular lenses), therapeutic and surgical
ophthalmology, organizational principles of prevention and clinical examination in
ophthalmology are the results of scientific-technical revolution in medicine in recent
decades.
Today, as is known, contact lenses are used in ophthalmology for two purposes: for vision correction and treatment.

First mass production of glass lenses was organized by the company “K. Zeiss (Jena)” in 1920. However, glass lenses in spite of the excellent optical properties, had several disadvantages of materials and construction, they were very hard and put pressure on the anterior eye.

In the 30th years of XX century, the Hungarian ophthalmologist Giorffi and an American Femblom (1955), working independently, as the material of contact lenses used organic glass or plastic – polymethylmethacrylate (PMMA), first made by the British physician Hill in 1931. Because of the simple fabrication method the lens made of PMMA had wide distribution. The first batch of lenses were corneal-scleral, until in 1948 Tuochy offered corneal, which are smaller than scleral and have no bearing scleral part and kept on eye surface by capillary forces. The advantages of PMMA lenses are transparency that is not less than the transparency of organic glass, mechanical strength and inertness to the tissues of the cornea, light weight and easy handling. However, PMMA has an important drawback such as low permeability for oxygen and metabolic products of the cornea.
In our country developed and promoted hard contact lenses made of silicate glass and then the organic glass (Belostotskiy E.M., 1956; E.M. Orlova, 1959, 1961). Subsequently, clinical experience has shown that contact lenses made of PMMA have disadvantages such as the difficulty of adapting to them and intolerance due to low oxygen permeability (Alyushin M.T., 1985).

According to M.G. Keshelava and S.H. Fiedler (1989) criteria for the suitability of polymeric materials for the soft contact lenses is the totality of the following properties: optical transparency, elasticity, mechanical and chemical stability, biological inertness, wettability, high oxygen permeability. Single-stage combination of these properties in one material is a theoretically and practically difficult task.

In the early 60-ies of the XX century O. Wichterle and D. Lim (1960) synthesized a new material - a hydrogel by copolymerizing 2-oxyethyl-methacrylate with ethylene glycol dimethacrylate, which has good optical properties and a high oxygen permeability as well as good wettability, that minimizing the discomfort of the lens as from a foreign body and making it more comfortable when wearing it. Apparently, heeding these positive qualities, M. Dreifus (1976) applied the hydrogel as a material for contact lenses.
In the Russia first appeared soft contact lenses made of HEMA – the material with 38% moisture content produced by «Spofa - lens» (Czechoslovakia). After that have been created the similar materials such as "Gipolan" and "Gipolan - 2" with 38% moisture content. The Strain-optical plant in Izium began to produce domestic soft contact lenses from these materials (Keshelava M.G., Fiedler S.H., 1989).

According to most researchers, from the standpoint of physical properties and physiological tolerance contact lenses divided on the lens with a low (water content 38-45%) and high (45-85%) hydration capacity. There is a close relationship between water content and oxygen permeability of hydrogels - the permeability of oxygen through the transparent hydrogel membrane is proportional to the water content, and is dependent on the structure of the polymer in the hydrogel and the thickness of the lens (Chen B.Y., Bower L., 1982; Parrisch S.T., Larks J.R., 1982; Stein R.M., Clinch Th.E., Cohen E.J. et. al., 1988; Young G., Bowers R., Hall B., 1997).

In the first place it is reflected in the duration of wearing the soft contact lenses, which is to a considerable extent, depend on its permeability to oxygen needed to maintain normal levels of oxygenation of the cornea. In common conditions it falls into the cornea from the surrounding air, and when wearing contact lenses from the lacrimation fluid washing the anterior eye. In the coating surface of the cornea - the epithelium - water contained in a small quantity and its presence counterpoises the balance of the intraocular fluid coming in the back layer of the cornea - the
endothelium. This limits the tendency of the stroma to swell and is necessary for the maintenance of corneal transparency (Tuft S.J., Coster D.J., 1990).

Srofa-Lens, Brucerlenses, Weicon, Vedidel-38, Hoya Soft, Flexicon, Hydron, Hydrocurve, Soflens, Hydrolens, Hydroflex and several other companies’ lenses are rather popular today. They made of hydroxyethyl methacrylate and copolymers of vinylpyrrolidone with HEMA, and have moisture content in the evenly swollen state in saline 38-45% (Thoft R.A., 1986; Wasserman E.L., 1989; Carney F.P., Morris C.A., Milthorpe B., Flanagan J.L., Willcox M.D., 2009). They belong to the lenses with a low hydration capacity. They do not let oxygen, because of what such lenses can be wearing no more than 10-12 hours.

Soft contact lenses with high water content in comparison with lenses with low water content have the following advantages: they are more comfortable for the eyes, have a short period of adaptation to the lens, rarely cause corneal edema and vessels tumor. However, there are some drawbacks: the lenses with high water content are easily damaged, dehydrated with a change in the parameters, various deposits on them appear more often and faster, after prolonged wearing there are surface epithelial arcuate damages on the cornea. For the prevention of peripheral lesions of the cornea lenses peripheral fenestration is recommended (Jones L., 1988). Other methods of improvement the tolerance stipulate using of so-called ultra-thin (the thickness at the center in the range 0, 04-0, 07 mm) contact lenses, contact lenses with hyperbolic inner surface (Churkina, M.N., 1983).

Nowadays it is known more than 50 types of polymers tested in the clinic as a material for the manufacture of lenses. Well-chosen soft contact lens is practically not felt by the eye. These lenses, thanks to its flexibility, hydrophilicity and permeability of the material, greatly simplified the process of adapting them to the patient (Hayashi K., Hayashi H., Nakao F., 1997; Kaye D.B., Hayashi M., Schenken J.B., 1988).

Improvement of the geometrical parameters of contact lenses also improves their portability. In recent years, researcher’s attention is focused on methods of studying the topography of the anterior corneal surface, on the definition according obtained data the optimal design of contact lenses, on the improvement of manufacturing methods and control lenses (Kivayev A.A. 1983; Binder P.S., 1980; W. Douthwaite, S. Pardhan, 1997).

The main purpose for the doctor in the treatment of the cornea is a readjustment of the conjunctival cavity, the suppression of the inflammatory response, the cessation of progressive ulceration, increasing regeneration and repair processes, which aims to the enlightenment of the cornea and restore vision (Lois N., Cohen E.J., Rapuano P.R., 1997).

Recovery of the integrity and transparency of the cornea after injury, burns and infectious lesions is an important task of modern ophthalmology (Kozlova T.V., 1990). Modern treatment methods should be based on the study of the pathophysiology of healing and repair processes in the cornea and the ways of their purposeful regulation (Sosulina N.E., 1991, Prokofieva G.L., 1994, Maximov I.B.,

The period of searching more effective than instillation of eye drops and an introduction to the conjunctival sac of ointments of various compositions preceded application of contact lenses for therapeutic purposes.

The value of medicinal treatment of eye diseases is increasing more and more around the world, often displacing the surgical methods of treatment. However, used in modern times, eye preparations, mainly in the form of eye drops and ointments as well as periocular injections do not meet modern standards of clinical practice: precise dosing when the introduction of an ointment or drops is not possible, which leads to their frequent introduction and an increased consumption of medicament; their duration is shorter than is needed to relieve existing pathology, due to the medicament with the lacrimal fluid wash off. Moreover, being used many times during the day, this dosage forms are easily contaminated by bacteria, viruses, fungi (Malanova N.L., Murzin A.A., 1991; Martinenas J.V., 1992; Svetlichko I. Shusterovskaya-Maritin E., Nawrocki, E., Kopchinskaya K., 1992; Assil K.K., Massry G., Lehnmann R., 1997).

Many authors have attempted to develop new dosage forms and methods of introduction of medicinal substance into the eye, permitting to eliminate indicated defects, however, eye tablets, capsules, insoluble plate or film, membrane systems because of basic defects of dosage forms are not received clinical recognition (Slusser T.G., Lowther G.E., 1998). Applying phonophoresis that prolongs medicaments action (Najem A., 1997) or sorbents (Sakowicz, V.N., 1991) also wasn’t very effective.

This causes the problem of optimal methods of introduction of medicaments to patients with various lesions of the cornea (Vorontsova T.K., 1991; Yuzhakov A.M., 1991). Yu.F. Maychuk (1994, 1995) cites data that on the application of ointments and drops about 80% of the active medicament comes on the eyelids or the tear path is already at the first blinking reflex and frequent movements, and only about 20% of the medicament absorbed. This medicament quantification was laid by the author in the developed by him ocular drug films. This polymer film, which has the ability to completely dissolve into the conjunctival sac and provide the prolonged effect, which is so necessary for the creation and maintenance of stable therapeutic effect, which keeps for 24-28 hours. These properties allow entering the medicament once a day (Maychuk Yu.F., 1991). Therefore, the created dosage form is not only rather accurate dosing the medicament, but in 5-10 times reduces the consumption of the medicament.


Collagen coatings, caps, plates, etc. using in the treatment and prevention of diseases and injuries of the cornea, with the acceleration of epithelialization of the cornea as the main mechanism become widespread especially in foreign practice.

Dorigo and co-authors (1995) conducted tests on rabbits and corroborated the suitability of using the collagen caps impregnated with antibiotic netilmicin for 10 minutes in a standard concentration of 3 mg / ml for the treatment of the corneal lesions.

In experiments on rabbits showed high effectiveness of collagen caps in the treatment of the central corneal wounds (Simsek N.A., Ay G.M., Tugal-Tutkun I. et. al., 1996).

Kuster and co-authors (1998) investigated the issue of drug (Trifluridine) introduction in the cornea with its various diseases with collagen cap, concludes that this technique has high efficiency. The authors found that collagen caps do not increase the flow of the drug in a healthy cornea, but in the diseased cornea its concentration increased. Therefore, they decided to continue this kind of research to determine the role of collagen in the treatment of herpetic keratitis. Unfortunately, the exorbitant price of treatment limits its spread (Marmer R.H., 1988; Ruffini J.J., Aquavella J.V., Lo Cascio J.A., 1989). Initially, soft contact lenses were used as a protective means for the damaged cornea as “an artificial bands” (Aquavella J.V., 1971, 1974; Gasset A.R., 1070, 1971, 1976; Kaufman H.E., 1984; Krejci L., 1967, 1971, 1972, 1973, 1974; Leibowitz H., 1975, 1976). Analysis of the results of clinical application of soft contact lenses for therapeutic purposes in the treatment of bullous keratopathy demonstrated their high efficiency on the assumption of the right selection and determining the schedule of wearing lenses. 89% of patients of able-bodied age were able to return to work. The researches carried out by author allowed to develop a unified scientifically grounded method of using soft contact lenses for the cure of extremely severe pathology of the vision, where their using is often the method of choice (Kasparov A.A., Kasyanov N.S., Oganesyants V.A., 1979).
In their report Srur and co-authors (1997) describe the use of therapeutic soft contact lens of the «Acuvue» brand in 33 patients with non-infected lesions of the cornea. After treatment in the period from 1 day up to 2-3 months was set a positive effect in 79% of patients, 21% of the treatment was interrupted because of intolerance and complications. Nevertheless, the authors recommend this type of soft CL for the treatment of non-infected diseases of the cornea.

Despite the fact that the application of soft contact lenses with a bandage to become a practice of ophthalmologists, many of the issues related to the method of selection and adaptation of lenses, the therapeutic approach, are still elucidated in the literature insufficiently (Gupta K., Arova R., Dass-Sota L., Kumar M., 1998).


It was found that the material for the soft contact lenses can accumulate in certain quantities of water-soluble drugs and thus created the possibility of supporting stable therapeutic concentrations of drugs in the structures of the eye for a long time.


However, because of the difficulty of studying the pharmacokinetics of drugs caused by the heterogeneity of their chemical structure and the lack of a universal method, the dosage of medicaments in the lens is chosen mostly empirically, that is not always ensure their optimal therapeutic effect, making the clinical application of soft contact lenses saturated with drugs difficult. This is due to the fact that the development of a single universal methodology for use of soft contact lenses saturated with drugs remains quite difficult task because of the variety of drugs used in ophthalmology and the heterogeneity of their chemical structure (Bouchard C.S., Meyer M.A., Donnatell J.F., 1996).


- bullous keratopathy (epithelial-endothelial corneal dystrophy);
- non-healing corneal ulcers and erosion of various origins (including after laser ablation of cornea when photorefractive keratectomy);
- fresh chemical and thermo-chemical eye burns;
- state after keratoplasty (illness or the threat of transplant rejection);
- penetrating wounds of the cornea;
- dry eye syndrome of various origins;
- neuroparalytic keratitis, lagophthalmos;
- some forms of glaucoma.

The presented literature data convincingly demonstrate the availability of therapeutic application of soft contact lenses for the treatment of a wide range of eye diseases; they are able to solve many problems of modern ophthalmology.

But despite the achievements in this field, in the practical public health methods of use the soft contact lenses with curative intent has not found wide application due to the lack of the feasibility study of this procedure, well thought-out system of medical care in their use and the disinformation of heads of medical institution and most ophthalmologists about its effectiveness in the treatment of diseases of the cornea.

All of this testifies to the relevance, scientific and practical significance of research and subsequent organizational activities aimed at improving health care for patients with diseases of the cornea by applying the soft contact lenses, in view of current and future health needs.

1.4. SOCIO-HYGIENIC AND ECONOMIC ASPECTS OF APPLYING OF SOFT CONTACT LENSES FOR THE TREATMENT OF DISEASES OF THE EYES

The number of persons using contact lenses in the world is constantly growing. For example, Hayes in 1981 noticed that in the USA for eight years, the number of people corrected with soft contact lenses increased more than six times: in 1980 their share of the total number of patients using contact lenses was 62% to 10% - in 1972.

Hamano and co-authors (1982) found that among corrected with contact lenses in Japan in 1973, 10% of the total number of patients with refractive errors used the soft contact lenses, and in 1980 - already 39.4%.

In view of the increased demand for contact lenses among older generation (over 40), especially those who wore them in his youth and used to them, have been developed bifocal soft contact lenses, that allows to correct presbyopia (Avetisov S.E., Rybakova E.G., Egorova G.B. et al, 2003).

Thus, today in Europe and in the United States number more than 26 million carriers of contact lenses. However, there are also complications caused by wearing them. They number in the millions and struggle with them requires a huge effort (Donshik P., Long B., Dillehay S.M., 2007; Morgan P., 2007; Yung A.M. et al., 2007; Willcox M.D., 2013).
According to Poggio and co-authors (1989), 18.7 million of Americans use contact lenses, of which 4 million - for a permanent and 9.1 million - for everyday wear. At the same time with a sharp increase of soft contact lenses users over the past 10 years, noticed an increase in the number of messages about the origin of ulcerative keratitis. For a comparative evaluation of the frequency of serious complications depending on the type of soft contact lenses was carrying out the research in five American states. 612 practicing ophthalmologists have provided the information for the 4 months about all cases of ulcerative keratitis in patients who use soft contact lenses (195 cases). In a randomized telephone survey of 4178 people was determined the frequency of use a particular type of soft contact lenses. Statistical analysis showed that the annual risk of ulcerative keratitis caused by using soft contact lenses for daily wear is 4.1 per 10 000 population, and the application of soft contact lenses for continuous wear - 20.9 per 10 000 population. An ophthalmologists and contact lenses user should be informed about the advantages of different types of soft contact lenses and side effects caused by wearing them (Santodomingo-Rubido J., Wolffsohn J., Gilmartin B., 2008).

Unfortunately, there are no such statistics in Russia. However, Y.S. Astakhov (1998) indicates that the number of carriers of contact lenses in our country is growing every year, the quality of contact lenses improves and their range expands. According to the author, now in our market there are the means of contact correction from the world's leading companies with good reputation - "CIBA Vision", "Bausch & Lomb", «ALLERGAN», "Johnson & Johnson", "Essilor", "Hydron", "MJS ", "SCORUS " and etc. The choice of contact lenses is very wide, hard contact lenses, including hard gas permeable and soft lenses with low (typically 38%) or high (above 50%) moisture content. Each of this group has its own features and its customers. In St. Petersburg, Moscow and other cities patients with refractive disorders, as well as around the world, prefer to use soft contact lenses.

According to the Kivayev A.A. and Shapiro Ye.I. (2000), in our country is constantly expanding the network of specialized laboratories and rooms, improved methods of selection and manufacturing of contact lenses, have expanded the indications for use, designed the lens of the new polymer materials. Highly increased the number of patients who use contact lenses, but the therapeutic possibilities of contact lenses and long-term consequences of this progressive form of treatment of diseases of the eye are still not explored.

In considering the application of soft contact lenses in opthalmic practice, we should dwell on the issue of disinfection – the essential condition of their successful application for a long time.

At this moment the whole system of care for the soft contact lenses was created. It requires certain skills and time. To simplify it, leading firms seek to create a multi-purpose solution and improve treatment means. But anyway there can stay protein deposits, stuck some cleaning enzymes because of the good permeability of the lenses material. Accumulating, they can provoke the development of various diseases of the conjunctiva and cornea. With the lapse of time it was concluded that it is easier for patients to use disposable soft contact lenses with high moisture content: «Focus»
In recent years the company «CIBA Vision» brought to the markets of Russia production of "CIBA VISION", which gives the advantageous such as the ability to easily manipulate with lenses, making them accessible for all strata and age groups. In view of the branched structure, "CIBA VISION" solutions are successfully differ from competitors solutions. Like this, solutions SOLO - CARE production of "CIBA VISION" characterized by a high removal (43%) from the surface of contact lenses of protein deposits that exceed about 1.5 times the activities of such common for the Russian consumer solution as a solution AOSEPT. It is a discontinuous innovation, because it allows using the peroxide that is the most effective one-step processing contact lenses treatment. Previously it was absolutely impossible (Serbulov S.I., 1997).

The analysis showed that the economically sound to change the lens from time to time than to clean and disinfect them with chemicals. This why contact lenses of short time wearing (2-4 weeks) are using more often (Ivins P., 1989).

In recent years, along with an optical purpose some authors have started to use soft contact lenses with curative intent. This way in the 70-80th of the last century in our country and abroad research in the clinical application of soft contact lenses for the treatment of bullous keratopathy were carrying out. Thanks to the correct selection and definition of lens wear schedule, 89% of patients of able-bodied age were able to return to work. The researches carrid out by author allowed to develop a unified scientifically grounded methods of using soft contact lenses for the cure of extremely severe pathology of the vision, where their useing is often the method of choice (Kasparov A.A., Kasyanov N.S., Oganesyants V.A., 1979).

Gendelin and co-authors (1994) have shown the favorable effect of soft contact lenses made on the basis of a combination of vinyl-pyrrolidone with methacrylate in the treatment of keratopathy. In 82% (71 eyes) achieved healing of the cornea. The authors conclude that this type of material is acceptable for the treatment of keratopathy with soft contact lenses (Gulsen D., Chauhan A., 2003).

The results of the application of soft contact lenses with curative intent obtained by several authors, has shown that wearing therapeutic lenses in pathological processes in the cornea greatly facilitates the patient’s state, increases the efficiency of therapy and this way provides speedy recovery. In addition, early use of contact lenses in the treatment of diseases of the cornea contributes to higher visual outcomes due to tender scarring of the affected area (Zelenskaya M.V., 1987; Novikov S.A., 1993; Rybakova E.G., 1999).

This way, the literature data indicates the widespread and the social significance of the cornea diseases and attempts to separate use of soft contact lenses in treatment of these diseases. Hence follows the necessity of scientific justification of the possibility of organizing ophthalmologic aid to the population of the Republic of Tatarstan in diseases of the cornea by applying the soft contact lenses in view of current trends in the health care system in the country.
CHAPTER 2

MATERIALS, VOLUMES, METHODS OF RESEARCH

2.1. THE STAGES AND THE VOLUME OF OBSERVATIONS

In the process of work the following materials were collected and processed (Table 2.1.):

- report documentation of medical institutions for ophthalmologic aid to the population (form № 30) in ten districts of the Republic of Tatarstan in which: a) ophthalmologists supply is satisfactory (Baltasinsky, Rybno-Slobodsky, Drozhzhansky, Aktanyshsky, Sarmanovskiy districts), and b) ophthalmologists supply is absent - Novosheshminsky, Spassky, Cheremshansky, Tyulyachinsky and Apastovskiy districts;
  - 2900 statistical coupons for the registration of the final (qualified) diagnoses;
  - 560 case histories of the patients from Tyulyachinsky’s and Apastovskiy’s central district hospitals and polyclinic, seeking ophthalmological help because of herpetic keratitis (mechanically selected every fifth case of visiting the doctor);
  - 141 medical cards of in-patients (form № 0031 / Y) with pathology of cornea, treated in the traditional way;
  - 128 medical cards of in-patients (form № 0031 / Y) with disease of cornea, treated with using soft contact lenses;
  - 128 medical cards of patients left the hospital (form № 066y), treated with using soft contact lenses;
  - 141 medical cards of patients who left the hospital (form № 066y), treated in the traditional way;
  - according to lists of temporary disability of 141 patients, treated in the traditional way and 128 – treated with using soft contact lenses, determined the average duration of morbidity with temporary disability in nosology of cornea diseases.
## The stages, methods and volumes of researches

<table>
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<th>Research stages</th>
<th>Research methods</th>
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<tr>
<td>1. Assessment of ophthalmologic service organizations in the Republic of Tatarstan. 2. Clinically-statistical analysis of prevalence and primary incidence (eye diseases, including the cornea).</td>
<td>The method of mechanical selection of case histories, continuous monitoring during exacerbations of herpetic keratitis, the method of the main array, monographic method, correlation analysis.</td>
<td>Reported medical documentation of medical prophylactic institutions of 10 districts of the Republic of Tatarstan. The reports of the ministry of public health of the Republic of Tatarstan about the state of ophthalmic services for 5 years. 2900 statistical coupons of the final (qualified) diagnoses.</td>
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<td>3. The study of the influence of medical and biological factors on the occurrence of cornea diseases.</td>
<td>Correlation analysis, ranked analysis, randomized study, a method of continuous observation.</td>
<td>560 case histories of the patients seeking ophthalmological help because of herpetic keratitis; 282 case histories of the patients with exacerbation of herpetic keratitis; 269 cards of in-patients with diseases of the cornea and 269 statistical cards of patients who left the hospital</td>
</tr>
<tr>
<td>4. Evaluation of medical effectiveness of the results of medical aid for patients with diseases of the cornea applying the traditional method based on the soft contact lenses in the hospital.</td>
<td>The clinical observation, clinical and laboratory research (made plating of microorganisms of the conjunctiva and the surface of the ulcers in the cornea with the definition of sensitivity to antibiotics of 50 patients from main group and 55 patients from the control group).</td>
<td>During 2 years 128 patients with diseases of the cornea was cured with using soft contact lenses (main group) and 141 patients (control group) - used the traditional approach to treatment.</td>
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5. Comparative evaluation of the economical effectiveness of treating patients with diseases of the cornea using the soft contact lenses and in the treatment of the traditional way.

Clinical supervision, expert assessment of the quality of care.

The average lengths of hospital stay of 128 patients who received treatment with soft contact lenses.
The average length of hospital stays of 141 patients who received treatment in the traditional way.
The morbidity with temporary disability of 128 patients (the main group) - in cases in days.
The morbidity with temporary disability of 141 patients (control group) - in cases in days.

2.2. METHODICAL APPROACHES, USED FOR MEDICAL AID TO THE PATIENTS WITH DESEASES OF THE CORNEA

Technologies of applying eye medicaments, mainly drops and ointments, are not adequate to modern requirements of clinical practice. It is known that 80% of the active drug substance with first wink reflexes comes on the eyelids only about 20% of the drug absorbed by the tissues of the eyeball. To obtain a therapeutic effect it has repeatedly introduce drugs into the eye throughout the day that leads to a large consumption of medication and tiring for patients and staff. Besides, being used during the day, the dosage form is easily contaminated by bacteria, viruses, fungi.

An attempt to solve the described problems seems in developing the ways to prolong the action of drugs on the eye. Many methods are known today, and among them - the soft contact lenses saturated with soluble medicinal substances.

Soft contact lenses with different water content have their own distinctive features. The amount of water in the material is an important physical property: the higher is the score, the more oxygen is delivered to the cornea that means that the risk of hypoxic complications will be less.

Soft contact lenses with low water content (35-45%) are compatible with all methods of contact lens care, including thermal treatment, treatment with hydrogen peroxide, chemical disinfectants. They consume little protein, so this prolongs their life. They have high tensile strength, and therefore more durable than contact lenses made of a material with high water content - 65% or more. They are also notable for good stability and compatible with most storage methods.

Soft contact lenses with high water content (over 65%) have a higher oxygen
permeability, but for simplification of using them, they are usually thicker, that affects the oxygen permeability. Because of the presence of significant amount of water, the lenses of these materials have a lower tensile strength in comparison with materials with lower water content, so they are more fragile. It must be pointed out that some materials with high water content, while on the eye, become dehydrated: the lens, contains 70% in the morning, during the day this figure could drop to 60%, it corresponds to the reduction of oxygen to the eye by 15%. And in this case the physiological stress is possible.

These materials are also distinguished by poor compatibility with disinfectants. Thermal disinfection is contraindicated because it causes severe redness of the eyes and discoloration of the lens. In addition, the soft contact lenses with high water content can not undergo the enzymatic treatment for a long time. Means of enzyme purification get combined with the lenses material matrix, and then get into the eye, causing irritation. This is a significant disadvantage, because the materials of contact lenses with high water content inclined to absorb protein. In combination with poor compatibility with enzyme cleaners this promotes decrease of the life duration of such lenses.

Lenses with average water content (45-60%) are an attempt to combine the advantages of materials with low water content and materials with high water content. The disadvantage of these materials is that they have increased absorption of protein. In addition, they can not undergo to thermal disinfection [140].

In view of the fact that we used the soft contact lenses for treatment, including infectious diseases of the eye, the material for these lenses should absorb bacteria and viruses as well as their decay products of the minimum extent, and moreover be resistant to chemical and thermal disinfection. As it follows from the review of the literature, such properties increasingly have the soft contact lenses with 38% water content. This type of lens was used in our studies.

We decided to increase the staying of the drug on the surface of the cornea, using the soft contact lenses as a reservoir for the drug. The drug was placed in the lens in ointment or gel form, and on the eye were worn ointment-type applications.

To keep the drug in contact lens for patients were chosen soft contact lenses in dome-shaped form. The base radius of such lens is steeper than the radius of curvature of the front surface of patient’s cornea. This favored the formation of a cavity where placed the drug. As a therapeutic lenses used standard contact lenses by "Lensy" (Yoshkar-Ola) and the company "Concor" (Vologda), made of the material "Gipolan-2", and lenses made of the same material by turning in the laboratory of contact correction of the Republican clinical ophthalmology hospital of the Ministry of public health of the Republic of Tatarstan. The main parameters of the lens: 38% of the moisture content, the diameter from 13.5 to 14.5 mm, the base radius – from 7.6 to 8.7 mm, the thickness of the lens in the center - 0.08 mm. Soft contact lenses put on the patient's eyes every morning immediately after the conjunctival cavity toilet or in 30 minutes after subconjunctival injection. In process of adaptation to the lens, carrying out in the first days in 30-60-120 minutes, they were left on the eye for 6 hours (during working day, when the patient was under the supervision of medical
staff). Extra instillation of essential drugs was carried out directly on the surface of the soft contact lenses. Lens disinfection was carried out by chemical and thermal methods.

This approach to treatment used for ophthalmic aid to patients with viral and bacterial keratitis and keratouveitis, accompanied by ulceration, purulent ulcer of the cornea, dystrophic keratitis, corneal burns, traumatic keratitis, corneal nonpenetrating injuries. The clinical group consisted of 269 persons (269 eyes): 128 patients (main group) were treated with soft contact lenses, 141 patients (control group) received the standard treatment. Age and sex structure of patients, the form and severity of disease in both groups were similar.

The patient’s admitted to hospital had complete ophthalmologic check-up, included: visometry, ophthalmometry, biomicroscopy with fluorescein-stain test, determination the sensitivity of the cornea, the direct and indirect ophthalmoscopy, planting and taking the smear from the surface of the conjunctiva and infiltrates to determine the causative agent and antibiotic susceptibility.

Treatment in the main and control group of patients was carried out in the usual way. Disinfectants and antibacterial (with herpetic lesions - antiviral) drugs assign locally. In the control group of patients, instillation of drugs produced 6-8 times a day, in the main group in view of the therapeutic effect of the lens, the number of instillations reduced to 3-4 times a day. Depending on the etiology of deep keratitis and keratouveitis antibiotics or antiviral agents were additionally entered under the conjunctiva to the patients in both groups. In case of the bacterial infection used 1% Tetracycline (1% Erythromycin) eye ointment 3 times a day, with eye herpes - 3% eye ointment "Zovirax" in the standard dosage - a strip of 10 mm 5 times a day. In the main group the ointment was introduced into the soft contact lenses once per day. In the case of viral infection after epithelialization, carefully, added to the treatment corticosteroids under the guise of antibiotics. In the case of traumatic injuries, burns and bullous keratopathy we used keratoplastic drug - 20% gel of Solcoseryl. According to indications (in the case of severe protracted process), there was a general treatment, including antibacterial and antiviral ("Zovirax» pills reception per os when herpetic keratouveitis) drugs, anti-inflammatory, desensitizing and immunostimulating drugs. In the process of care according to this method, the results of implementation was assessed by the corneas healing time, the rate of absorption of the infiltrate, and the dynamics of visual acuity at the time of admission and at the time of discharge.

2.3. DETERMINATION OF THE VOLUME OF REQUIRED OBSERVATIONS, STATISTICAL METHODS OF RESEARCH

In the majority of socio-hygienic studies determination of the required number of observations or of the volume of sample ascertains by one character of the
investigated phenomenon. Due to the fact that in our study we had to deal with multitude observation units, namely the number of patients with pathology of the cornea, received ophthalmic medical aid by the traditional scheme, developed in accordance with the organizational model, the average duration of their stay in hospital and the medical certificate, the cost in rubles per bed-day and one day morbidity with temporary disability, the cost of one bed-day and day of the morbidity with temporary disability, cost of soft contact lenses, ophthalmologist provision, material and technical equipment of ophthalmologic services of medical institutions of the Republic of Tatarstan and etc., determination of the required volume of observations presented considerable difficulties. The technique proposed by N.A. Plokhinskiy (1970), K.A. Otdelnova (1980), Y.P. Lisitcin (1998) helps to resolve these difficulties in identifying the main resultant feature and doubts about its accuracy (confidence interval) for the study of such sets.

Variability and confidence interval are not determined here (table 2.2) in advance. It is taken the approximate ratio, designated as K – the coefficient of accuracy, which level is chosen by researcher (from 0,5 to 0,1). In this case, the required number of observation units for obtaining a stable result with a minimum accuracy (K = 0.4: 0.5) and reliability (P = 0.95) is 16 - 25 observations. The mentioned number of observations (table 2.1.) used at various stages of our research covers the types of medium precision researches (P=0,98).

Table 2.2.

The required sample size

<table>
<thead>
<tr>
<th>Type of study</th>
<th>The desired accuracy of the study</th>
<th>p = 0,95</th>
<th>p = 0,98</th>
<th>t = 3,0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Position-finding acquaintance</td>
<td>K= Δ / σ t = 2</td>
<td>0,5</td>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0,4</td>
<td>25</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0,3</td>
<td>44</td>
<td>69</td>
</tr>
<tr>
<td>2. The average accuracy research</td>
<td></td>
<td>0,2</td>
<td>100</td>
<td>156</td>
</tr>
</tbody>
</table>
3. The extra accuracy research

<table>
<thead>
<tr>
<th></th>
<th>0,1</th>
<th>400</th>
<th>625</th>
<th>900</th>
</tr>
</thead>
</table>

In addition the main group (128 patients, who received treatment with soft contact lenses) and the control group (141 patients who received treatment in the traditional way) according to main features (the place of abode, the age-sex composition, structure of nosology of cornea diseases) were identical.

For statistical analysis of a study we used several methods: calculation of the average values and other parameters of the variational series \((M \pm m)\), extensive and intensive coefficients \((P \pm m)\), the estimation of reliability of the difference between the results of the study:

- Student t-test according to the formulas:

\[
t = \frac{M_1 - M_2}{\sqrt{m_1^2 + m_2^2}}
\]

\[
t = \frac{P_1 - P_2}{\sqrt{m_1^2 + m_2^2}}
\]

Also, we used the correlation coefficient calculated by the formula:

\[
rx,y = \frac{\sum d_x d_y}{\sqrt{\sum d_x^2 \cdot d_y^2}}, \text{ where}
\]

\(r_{xy}\) is the correlation coefficient,

\(d_x \cdot d_y\) is the departure from the average variant of \(x \) and \(y\) series.

The reliability of the correlation coefficient was estimated by the calculating of the average error \(m\) by the formula:

\[
m = \frac{1 - r^2}{\sqrt{n}}, \text{ where}
\]
is the average error of the correlation coefficient,

\( r^2 \) is the squared values of the correlation coefficient,

\( n \) is the number of observations.

The value of correlation coefficient \((r_s)\) considered reliable, if it exceeds it’s average error \((m)\) no less than 3 times.

Cost-effectiveness of organizing of introducing a new recovery method for patients with diseases of the cornea by applying the soft contact lenses defined by the formula:

\[
E_{eff} = (E_{rd} + E_t) - C_{cl}, \text{ where,}
\]

\( E_{eff} \) is the amount of economic effect from the use of soft contact lenses in the treatment of one case the cornea diseases;

\( E_{rd} \) – economic efficiency of reducing the average duration of hospitalization;

\( E_t \) – economic efficiency of one case of morbidity with temporary disability;

\( C_{cl} \) – the cost of one soft contact lens.
CHAPTER 3
THE CONDITION OF OPHTHALMIC SERVICE AND MORBIDITY OF EYE AND ITS APPENDAGES DISEASES IN THE REPUBLIC OF TATARSTAN

3.1. PROVISION OF MEDICAL-PREVENTIVE ESTABLISHMENTS WITH OPHTHALMOLOGISTS; OPHTHALMOLOGIC PREVALENCE OF THE POPULATION

The inpatient ophthalmology services in the Republic of Tatarstan is presented in five interdistrict ophthalmology centers in the cities: Almetyevsk, Yelabuga, Zelenodolsk, Nizhnekamsk, Chistopol and in ten ocular divisions of medical-preventive establishments (MPE) in some cities and districts of the republic: Aznakevskaya CRH, Agryzkaya CRH, Bugulinskaya CRH, Leninogorskaya NFM, Mendeleevskaya CRH, Octyabrskaya CRH, CRH Zainskaya, Republican Ophthalmological Clinical Hospital (ROCH), Emergency Care Hospital of Naberezhnye Chelny, and the Children's Republican Clinical Hospital.

According to statistics (Farrakhov A.Z., Gilmanov A.A., Sherputovsky V.G et al., 2012), the number of ophthalmologists, working in the field of MPE, subordinated to the Ministry of Health of the Republic of Tatarstan in the years 2011-2012 was 276. Among these ophthalmologists 82 (29, 7 %) were working for the national medical institutions, 56 (20, 3 %) were working for the MPE of Kazan, 27 (9, 8 %) were working for the MPE of Naberezhnye Chelny, remaining 111 (40, 2%) were working in districts with urban and rural population. During this period (years 2011-2012), there were no ophthalmologists at all in thirteen rural areas, such as Atninsky, Verheneuslonsky, Kamsko-Ustyinsky, Laishevsky, Mendeleevsky, Muslyumovsky, Rybnoslobodsky, Sarmanovsky, Spassky, Tetyushsky, Tyulyachinsky, Yutazinsky, Cheremshansky and eye care was provided by doctors of other specialties.

During these years 137 ophthalmologists (58,5%) were working in Kazan 28 (12,1%) - in Naberezhnye Chelny, 7 (2,1%) - in North-West Region, 22 (9,4%) - in North-East Region and in South-East Region - 25 (10,7%); in Zakamsky Region - 8 (3,4%), in Predkamsky - 5 (2,1%), in Predvolzhsky - 4 (1,7%).

The provision of the regions of the Republic of Tatarstan by ophthalmologist also was irregular (Table 3.1). The availability indexes of doctors were especially low in the regions where the population mainly were rural, such as Zakamsky Region – 0,29, Predkamsky – 0,25, Predvolzhsky – 0,2 per 10 000 population.

The average indexes of availability of ophthalmologists, observed in regions with settlements and cities of republican subordination, during the years, named above, were the following: in the North-East – 0,37 (in the cities Agryz, Yelabuga, Zainsk, Menzelinsk, Nizhnekamsk), in the South East – 0,47
(in the cities Aznakaev, Almetyevsk, Bavly, Bugulma, Leninogorsk), in the North-West – 0.26 (in Zelenodolsk) per 10 000 population. Is a logical high index of availability of ophthalmologists in large cities, for example, in the Naberezhnye Chelny - 0.63 per 10 thousand population, while the level of availability in Kazan declined in recent years and is only 0.43 for 10 thousand population, unlike 0.71 - in 2001.

While analyzing the relationship between the indexes of availability of ophthalmologists in the regions of the Republic of Tatarstan and the ophthalmologic morbidity, the prevalence of the among the population, it became clear that there is a regularity such as: the higher the availability indexes are the higher are the prevalence of eye and it’s appendages diseases. For example, the index of availability of ophthalmologists in Zakamsky Region is 0, 25 per 10 000 population, the morbidity – 19, 6, the prevalence – 77, 7 per 1,000 population, and in Kazan – 0, 43, 31, 4 and 146, 9 respectively (Table 3.1).

<table>
<thead>
<tr>
<th>Regions of the Republic of Tatarstan</th>
<th>Provision by doctors per 10 000 population</th>
<th>Per 10 000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Morbidity</td>
</tr>
<tr>
<td>Kazan</td>
<td>0,71-0,43</td>
<td>42,0-31,4</td>
</tr>
<tr>
<td>Naberezhnye Chelny</td>
<td>0,70-0,63</td>
<td>40,5-44,2</td>
</tr>
<tr>
<td>North-West</td>
<td>0,41-0,26</td>
<td>27,2-23,7</td>
</tr>
<tr>
<td>North-East</td>
<td>0,54-0,37</td>
<td>30,2-28,3</td>
</tr>
<tr>
<td>South East</td>
<td>0,47-0,47</td>
<td>25,3-24,7</td>
</tr>
<tr>
<td>Zakamsky</td>
<td>0,27-0,25</td>
<td>15,3-19,6</td>
</tr>
<tr>
<td>Predkamsky</td>
<td>0,30-0,15</td>
<td>18,7-13,3</td>
</tr>
<tr>
<td>Predvolzhsky</td>
<td>0,31-0,20</td>
<td>26,6-26,3</td>
</tr>
<tr>
<td>In the Republic of Tatarstan</td>
<td>0,46-0,73</td>
<td>28,2-29,0</td>
</tr>
</tbody>
</table>

We found that there is a strong positive correlation – \( r_{xy} = 0.73 \pm 0.15 \) between
the provision by ophthalmologist and morbidity of the eye and it’s appendages diseases; between the provision by ophthalmologist and the prevalence of the same type of diseases – the same strong positive correlation – \( r_{xy} = 0.71 \pm 0.12 \).

As mentioned above, there were absolutely no ophthalmologists in some medical-preventive establishments of some rural areas during the years 2001-2011. This very circumstance led to low levels of morbidity and the prevalence of the eye and it’s appendages diseases among the population of these regions (Table 3.2).

To compare the morbidity and the prevalence indexes of the eye and its appendages diseases we have analyzed these incidences among the rural population of the republic, where the provision by ophthalmologists was fair (Table 3.3).

**Table 3.2**

<table>
<thead>
<tr>
<th>Rural areas</th>
<th>Provision by doctors per 10 000 population</th>
<th>Per 10 000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Morbidity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prevalence</td>
</tr>
<tr>
<td>Spassky</td>
<td>–</td>
<td>11,0-15,8</td>
</tr>
<tr>
<td>Cheremshansky</td>
<td>–</td>
<td>9,5-27,7</td>
</tr>
<tr>
<td>Tyulyachinsky</td>
<td>–</td>
<td>12,7-11,0</td>
</tr>
<tr>
<td>Apastovskiy</td>
<td>–</td>
<td>6,1</td>
</tr>
<tr>
<td>IN TOTAL</td>
<td>–</td>
<td>10,4-20,1</td>
</tr>
</tbody>
</table>

As shown in Table 3.2., the morbidity of the eye and its appendages among the rural population of the republic, where there were no ophthalmologists, is 10,4 - 20,1 (in average, 15,2) per 1000. The same index for the areas, where there were ophthalmologists is equal to 28,8 - 29,0, i.e. 1,9 times higher. The same tendency when comparing the prevalence of the eye diseases and its appendages – 77,5: 28,7 = 2.7.

We have also found a strong positive correlation between the provision by ophthalmologist and the morbidity of the eye and its appendages diseases among the population - \( r_{xy} = 0,73 \pm 0,24 \).
Table 3.3

The morbidity and the prevalence indexes of the eye and its appendages diseases in rural areas of the Republic of Tatarstan, where the provision by ophthalmologists was fair (in average during the years 1997-2011)

<table>
<thead>
<tr>
<th>Rural areas</th>
<th>Provision by doctors per 10 000 population</th>
<th>Per 10 000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Morbidity</td>
</tr>
<tr>
<td>Baltasinsky</td>
<td>0,32-0,30</td>
<td>24,5-4,80</td>
</tr>
<tr>
<td>Rybnoslobodsky</td>
<td>0,33-0,00</td>
<td>23,3-17,8</td>
</tr>
<tr>
<td>Drozhzhanovsky</td>
<td>0,37-0,38</td>
<td>29,0-47,8</td>
</tr>
<tr>
<td>Aktanyshsky</td>
<td>0,37-0,31</td>
<td>37,5-27,0</td>
</tr>
<tr>
<td>Sarmanovsky</td>
<td>0,42-0,00</td>
<td>30,0-14,7</td>
</tr>
<tr>
<td>IN TOTAL</td>
<td>0,36-0,18</td>
<td>28,8-22,4</td>
</tr>
</tbody>
</table>

When analyzing the ratio of the eye diseases and its appendages, the morbidity of the population and the prevalence, we found that it is noticeable that, the second index is in average three times as high then the first. This indicates, that the part of chronic diseases is much bigger, than with acute cases. That confirms even the structure of the eye and its appendages disease’ nozology of the rural residents, turned for help to the outpatient department of the Republican Clinical Hospital.

Analysis showed that the 30,6 % of the rural residents of the Republic of Tatarstan (in average during the years 2003-2008), turned for help to the outpatient department of the Republican Clinical Hospital with the eye and its appendages diseases were age-related cataract, 15,4% - glaucoma, 10,2% - diseases of the retina, 7,5% - aphakia, 8,5% - refractive error, 4,4% - corneal diseases, 2,6% - juvenile cataracts, 2,9% diabetic angioretinopathy, 2,8% - retinal detachment, 15,1% - other diseases. Most of these diseases are chronic.

Low levels of provision of rural areas by ophthalmologists, as well as total shortage of them in medical-preventive establishments in some areas, lead to the fact, that a significant number of patients (11,6%) sends without a diagnosis and with diagnosis discrepancy (29,9%) (Fig. 3.1.).
We found, that in the rural areas where there were no ophthalmologists, 11.6% of patients were remitted to the Republican Clinical Hospital without diagnoses, diagnosis discrepancy was found in 29.9% of cases. Only 5.4% of patients from the areas, where there were ophthalmologists, had no diagnosis, diagnosis discrepancy occurs in 16.5% and in 78.1% of cases diagnoses were the same. However, as we know, an effective treatment is not possible without proper diagnostic. That means, that the duration of treatment could be delayed and can effect the length of hospital stay and a sick-list (R.I. Salyakhov, 2000; E. Lushnikov, 2001).

Since the purpose of our study is to evaluate the effectiveness of traditional treatment and with contact lenses, a morbidity of the population with eye diseases and its appendages was studied. Therewith we followed the same sequence as for analysis of morbidity of the eye and it’s appendages: based on the proportion of corneal disease among all eye diseases of patient, who turned to the outpatient department of the Republican Clinical Hospital, that was equal to 4, 4%, we did
calculate the number of patients by regions and by rural areas of the republic, whose medical-preventive establishments had and had no ophthalmologists (Table 3.4).

As in the study of the morbidity of the adult population of the republic in the eye diseases and its appendages diseases, there is the fact, that the higher the provision of medical-preventive establishments by ophthalmologists is, the higher is morbidity and prevalence of corneal diseases. There is a strong positive correlation between provision of the population by ophthalmologists and the morbidity and prevalence indexes \( r_{xy} = 0, 76\pm0, 16 \) и \( r_{xy} = 0, 69\pm0, 14 \).

The morbidity and prevalence rate ratio by regions was equal to \( 4,22 : 1,44 = 2,93 \), by rural areas, whose medical-preventive establishments had ophthalmologists \( 2,75 : 1,26 = 2,18 \), by areas, where there were no ophthalmologists \( 1,26 : 0,45=2,80 \), that indicates a lot of cases of corneal diseases with chronicity.

**Table 3.4.**

The morbidity and the prevalence indexes of the corneal diseases among the population of some regions and rural areas related to the provision of the medical-preventive establishments by ophthalmologists (in average during the years 1997-2011)

<table>
<thead>
<tr>
<th>Regions and districts (areas)</th>
<th>Provision by doctors per 10 000 population</th>
<th>Per 10 000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Morbidity</td>
</tr>
<tr>
<td><strong>Regions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kazan</td>
<td>0,71-0,49</td>
<td>1,84-1,61</td>
</tr>
<tr>
<td>Naberezhnye Chelny</td>
<td>0,70-0,53</td>
<td>1,78-1,86</td>
</tr>
<tr>
<td>North-west</td>
<td>0,41-0,20</td>
<td>1,19-1,12</td>
</tr>
<tr>
<td>North-east</td>
<td>0,54-0,33</td>
<td>1,32-1,28</td>
</tr>
<tr>
<td>South-east</td>
<td>0,47-0,42</td>
<td>1,11-1,10</td>
</tr>
<tr>
<td>Zakamsky</td>
<td>0,27-0,22</td>
<td>0,67-0,77</td>
</tr>
<tr>
<td>Predkamsky</td>
<td>0,30-0,15</td>
<td>0,82-0,70</td>
</tr>
<tr>
<td>Predvolzhsky</td>
<td>0,35-0,20</td>
<td>1,17-1,16</td>
</tr>
<tr>
<td><strong>IN TOTAL</strong></td>
<td>0,69-0,33</td>
<td>1,44-1,35</td>
</tr>
<tr>
<td><strong>Rural areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baltasinsky</td>
<td>0,32-0,30</td>
<td>1,07-0,64</td>
</tr>
<tr>
<td>Rybnoslobodsky</td>
<td>0,33-0,00</td>
<td>1,27-0,90</td>
</tr>
<tr>
<td>Drozhzhanovsky</td>
<td>0,37-0,38</td>
<td>1,27-1,68</td>
</tr>
<tr>
<td>Aktanyshsky</td>
<td>0,37-0,31</td>
<td>1,65-1,42</td>
</tr>
</tbody>
</table>
### 3.2. THE MATERIAL AND TECHNICAL EQUIPMENT OF OPHTHALMIC SERVICES IN THE REPUBLIC OF TATARSTAN

The material and technical equipment of ophthalmologic surgeries, especially in rural areas, is insufficient. In some areas, where there were no ophthalmologist, ophthalmologic surgeries had only a minimum set of tools and medicines, that allow to render first aid only to ophthalmic patients, to prescribe glasses and tentatively identify ocular pathology, while a detailed diagnosis with help of the same equipment is impossible in principle. The equipment is old and often breaks down. Lack of trial spectacle lenses and lacrimal probes in different size is common. District ophthalmologic surgeries are equipped with:

1. desk lamp;
2. mirror ophthalmoscope;
3. Golovin–Sivtsev’s Test-chart for determining the visual acuity;
4. chart for testing of near vision;
5. trial lens and frame set;
6. Eye Care First Aid Kit;

In the presence of ophthalmologist an examination room’s facilities includes a much broader range of instruments:

1. desk lamp;
2. mirror ophthalmoscope;
3. direct ophthalmoscope;
4. Golovin–Sivtsev Test for determining the visual acuity;
5. chart for near vision testing;
6. trial lens;
7. slit-lamp;
8. Maklakov’s tonometer;
9. perimeter;
10. Rabkin charts;
11. lacrimal Irrigation Set;
12. medications, instruments and bandages to provide emergency aid (Eye Care First Aid Kit).

This analysis clearly represents, that there is a lack of equipment of the eye examination rooms in rural areas, a sharp contrast to the modern requirements for the material and technical supply of medical-preventive establishments (MPE).

3.3. MEDICAL AND BIOLOGICAL RISK FACTORS, AFFECTED THE EMERGENCE OF CORNEAL DISEASE

In our research we did study the reasons of corneal diseases and of other pathological conditions of the cornea at the inhabitants of the Republic of Tatarstan. Biological materials for analysis were taken in the Central Republican Hospital (CRH) of Apastovo and Tyulyachinsky districts of the Republic of Tatarstan, as well as in the outpatient department of the Republican Clinical Hospital (RCH). Table 3.5 shows the factors, contributing to the development and exacerbation of herpetic keratitis, established in random sample from 842 patients, turned to ophthalmologists of the outpatient department of the CRH and the RCH during the last 5 years. The data were ranked by importance.

Table 3.5 shows, that in the structure of main disease emergence, as well as exacerbation of herpetic keratitis, catarrhal disease were of the first rank disease emergence – 35,0% and 31,6%, respectively, supercooling of the body was of the second rank disease emergence - 20,0 % and 15,6%, respectively. The third rank disease emergence in the structure of main disease emergence was the combination of several factors – 12, 7 %, microtrauma were the third rank disease emergence of exacerbation - 12, 4%. Of unidentified factors occupies the fourth place – 11, 0%, in case with exacerbation - a combination of several factors –11, 3%. Stress factors occupy the fifth place in the structure of main disease emergence - 7, 0%, unidentified factors - 9, 9% - as the causes of an exacerbation.

Among the rest causes the share of other factors did not exceed by more than 5,0%, in cases with exacerbation -a fairly significant part belong to odontogenic infection – 5,7% and stressful situations – 5,4%. The obtained, in general, coincides with data of some other researchers (Kasparov A.A., 1994; Loganovsky G.A., Valkova I.V., Feldmane G.Y., 1999).
### Table 3.5.
The structure of the factors, causing appearances and exacerbations of herpetic keratitis (in %)

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Appearances</th>
<th></th>
<th>Exacerbations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of patients</td>
<td>%</td>
<td>Rank</td>
<td>Number of patients</td>
</tr>
<tr>
<td>Influenza, ARI</td>
<td>194</td>
<td>35,0</td>
<td>1</td>
<td>89</td>
</tr>
<tr>
<td>Supercooling</td>
<td>112</td>
<td>20,0</td>
<td>2</td>
<td>44</td>
</tr>
<tr>
<td>Tonsillitis</td>
<td>18</td>
<td>3,2</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Pyelonephritis</td>
<td>6</td>
<td>1,0</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Microtrauma</td>
<td>17</td>
<td>3,0</td>
<td>8</td>
<td>35</td>
</tr>
<tr>
<td>Stressful situations</td>
<td>38</td>
<td>7,0</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Odontogenic infection</td>
<td>19</td>
<td>3,4</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Continuous insolation</td>
<td>14</td>
<td>2,5</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Allergic conditions</td>
<td>10</td>
<td>1,8</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Combination of several factors</td>
<td>71</td>
<td>12,7</td>
<td>3</td>
<td>32</td>
</tr>
<tr>
<td>The reason is not established</td>
<td>61</td>
<td>11,0</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td><strong>IN TOTAL</strong></td>
<td><strong>560</strong></td>
<td><strong>100,0</strong></td>
<td><strong>282</strong></td>
<td><strong>100,0</strong></td>
</tr>
</tbody>
</table>

As shown in Section 4.1, the two groups of patients, we’ve selected who underwent traditional treatment of diseases of the cornea and with contact lenses, were identical in nosology and gender. We could not reach the same identity in age composition. Apparently for the reason, that some diseases of the cornea, such as purulent corneal ulcer and bullous corneal dystrophy, which are more characterized in relatively older patients - from 50 yr. or older, while injuries and burns of the cornea - for relatively young patients. The study of middle-aged patients with diseases of the cornea did confirm the assumption we named above (Fig.3.3).

Fig. 3.3. shows the characteristics of patients with diseases of the cornea by age.
Thus, 50-year-old threshold is exceeded by patients with herpetic keratouveitis - 51,1 ± 3,6 y., by bacterial keratouveitis - 50,2 ± 3,5 y., by purulent corneal ulcer - 59,0 ± 4,0 y., by bullous keratopathy - 66,1 ± 4,2 y.. The patients with superficial herpetic keratitis are related to the age period 40-49 years - 42,5 ± 2,5y., with herpetic stromal keratitis - 45,3 ± 2,7 y., bacterial keratitis - 47,1 ± 2,8 y., traumatic keratitis - 46,1 ± 2,7 y. The patients with non-penetrating injuries of the cornea are related the age of 40 y. - 33,3 ± 1,9 y., corneal and with first-degree burn of the cornea - 39,7 ± 2,2 y.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>42,5±2,5</td>
<td>superficial herpetic keratitis</td>
</tr>
<tr>
<td>45,3±2,7</td>
<td>herpetic stromal keratitis</td>
</tr>
<tr>
<td>51,1±3,6</td>
<td>herpetic keratouveitis</td>
</tr>
<tr>
<td>47,1±2,8</td>
<td>bacterial keratitis</td>
</tr>
<tr>
<td>50,2±3,5</td>
<td>bacterial keratouveitis</td>
</tr>
<tr>
<td>59,0±4,0</td>
<td>purulent corneal ulcer</td>
</tr>
<tr>
<td>66,1±4,2</td>
<td>bullous keratopathy</td>
</tr>
<tr>
<td>39,7±2,2</td>
<td>first-degree corneal burn</td>
</tr>
</tbody>
</table>
There is a clear regularity in the data above, that the patients with more severe corneal disease are more common in older age, such as bacterial and herpetic keratouveitis, corneal ulcer and bullous keratopathy.

As described in Chapter 4, soft contact lenses are more effective in treatment of patients with diseases of the cornea, compared with conventional methods. Looking ahead, we should note what we have established: as it turned out, that the application of SCL, the age, and as a medical-biological factor, has no significant effect on the duration of the healing process.

We have determined the degree and direction of the correlation between age and duration of hospitalization of patients with diseases of the cornea with the traditional approach to health care and approach, based on new organizational model with SCL.

Calculations showed, there is a strong positive correlation – $r_{xy} = 0,70\pm0,13$ between the age of the patients with herpetic keratitis and the average duration of treatment according to the traditional scheme, while there is a medium positive correlation – $r_{xy} = 0,33\pm0,09$ in case with application of SCL. The correlation coefficients are statistically significant ($P <0, 05$).

There is a similar relationship in the treatment of patients with herpetic stromal keratitis in a traditional way - $r_{xy} = 0, 79 \pm 0, 10$ and with soft contact lenses - $r_{xy} = 0, 36 \pm 0, 09$ ($P <0, 01$). There are some significant differences in the values of the coefficients of correlation between the age of patients and the average duration of the treatment with the traditional approach to the organization of health care and with SCL, in patients with keratouveitis, bacterial keratitis, bacterial keratouveitis, purulent corneal ulcer, first-degree corneal burn, traumatic keratitis, non-penetrating injuries of the cornea. False distinction between the two groups of patients, whose convalescence is organized in different ways, takes a place in cases of bullous keratopathy and second-degree corneal burn.
4.1 INTEGRATION OF ORGANIZATIONAL MODEL OF OPTIMIZATION OF PROVIDING OPHTHALMIC HELP PATIENTS USING SOFT CONTACT LENSES IN THE ACTIVITY OF MEDICAL-PREVENTIVE ESTABLISHMENTS

In purpose to optimize medical care for patients with diseases of cornea in common research were developed measures to integrate methods of using SCL in ophthalmic practice. Integration of organizational model was carried out in two stages.

At first stage technical design, development and manufacturing for healing cornea was provided.

At next stage with participation of members of the Department of eye diseases KSMU, doctors of the first and second Ophthalmology departments of RCH and Eye department of district MPE MHC RT wide integration of SCL for treating patients with diseases of cornea and subsequent performance evaluation.

During this research were selected district eye units with following requirements:

1. High morbidity and prevalence of eye diseases, including cornea in the district area.

2. The presence in the ophthalmology departments, which were the base for scientific research, highly qualified medical staff and modern material and technical equipment in order to avoid errors when using this relatively new for most ophthalmologists method of treating patients.

First requirement matched following regions and cities of Tatarstan:

а) North-East region of RT: morbidity of eye diseases in 30,2 per 1000 population, diseases of cornea - 1,32 per 1000 population. The prevalence of eye diseases - 74,1 per 1000 population, diseases of the cornea - 3,26 per 1000 population.

б) North-West region in RT: morbidity of eye diseases in 27,2 per 1000 population, diseases of cornea - 1,19 per 1000 population. The prevalence of eye diseases - 75,7 per 1000 population, diseases of the cornea - 3,33 per 1000 population.

в) Naberezhnye Chelny, were morbidity of eye diseases in 40,5 per 1000 population, diseases of cornea - 1,78 per 1000 population. The prevalence of eye diseases - 121,3 per 1000 population, diseases of the cornea - 5,33 per 1000 population.

Bases for scientific research in these areas were Emergency Hospital in
Naberezhnye Chelny, Hospital №2, Nizhnekamsk (North-East region os RT) and Hospital №2, Zelenodolsk (North-West region of RT).

During the period 2001-2005 years medical assistance with SCL was provided for 128 patients with diseases of cornea. Each ophthalmology department was supplied with these SCL using own funds of authors, as in the estimates of costs of MPE for purchase of SCL is not included. Wholesale purchase was carried out in the laboratory of contact vision correction of ROCH MHC RT (prices at RUR 65,65 per lens).

For solving question about permanent provision of all medical establishments that provide eye care, with therapeutic SCL, a structured organization model for care of patients with disorders of the cornea on the basis of their (SCL) using were developed (pic. 4.1). During constructing this model we followed the principle objective display of the relations between elements and characteristics of medical practice, that it has its essence and logic, and was capable to functioning (Togunov I.A., 1998).

Basic link in this model serves ophthalmologist or in his absence (in rural MPE) a general practitioner, who have undergone specialization courses in ophthalmology at workplace. According to this scheme in the first stage a physician establishes the diagnosis. Determine the necessity and possibility of using SCL in treating patients.

At second stage a decision about the venues of treatment is taken and depending on circumstances these can be the relevant units of MPE-departments of ophthalmology, day patient department, in-patient department CPH in which ophthalmic beds.

At next stage patient’s ensuring with SCL is providing, which can be done in different ways: patient buys SCL using his personal funds or through sponsorship and charitable aid, or through budget of medical establishment. For constant provision of patients who are in need of therapeutic SCL, Head of the ophthalmology departments recommended, with specific time interval, for example, semi-annual, submit to the commission of the purchase (which is available in each MPE) request with approximate number of lenses that are required for following period.
The required number of lenses is determined based on the data provided by the organizational and methodological department of own MPE (Form №30). Next, this commission, which include chief physician, supply chief, medical equipment chief and chief nurse, signs contract for the purchase of therapeutic SCL with contact vision correction laboratory of ROCH MHC of the RT.

At the final stage patient being treated with use of SCL in MPE. In this process may be involved appropriately trained personnel with secondary medical education, which will significantly reduce time that required for specialist to care of patients.
In 128 patients with diseases of cornea were treated on the basic of using SCL (main group) and 141 patients with same disease were treated using traditional method (control group).

The structure of two groups of patients according to nosology is presented in Table 4.1.

Contingents of patients in both group were organized in such a way that their structure, the share of nosology of diseases were not dramatically different. The differences were in the range of 0,2 to 1,6%

By the same principle we have formed two groups of patients according to gender structure (Table 4.2)

Table 4.1.

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Traditional treatment</th>
<th>Using SCL</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Abs.</td>
<td>%</td>
<td>Abs.</td>
</tr>
<tr>
<td>1. Herpetic keratouveitis</td>
<td>14</td>
<td>9,9</td>
<td>13</td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>13</td>
<td>9,2</td>
<td>12</td>
</tr>
<tr>
<td>3. Herpetic superficial keratitis</td>
<td>17</td>
<td>12,0</td>
<td>16</td>
</tr>
<tr>
<td>4. Bacterial keratouveitis</td>
<td>16</td>
<td>11,3</td>
<td>14</td>
</tr>
<tr>
<td>5. Bacterial keratitis</td>
<td>13</td>
<td>9,2</td>
<td>11</td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>14</td>
<td>9,9</td>
<td>12</td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>15</td>
<td>10,9</td>
<td>14</td>
</tr>
<tr>
<td>8. Corneal burns</td>
<td>14</td>
<td>9,9</td>
<td>12</td>
</tr>
<tr>
<td>9. Traumatic keratitis</td>
<td>12</td>
<td>8,5</td>
<td>13</td>
</tr>
<tr>
<td>10. Nonpenetrating corneal injury</td>
<td>13</td>
<td>9,2</td>
<td>11</td>
</tr>
<tr>
<td>IN TOTAL</td>
<td>141</td>
<td>100,0</td>
<td>128</td>
</tr>
</tbody>
</table>
Table 4.2.

**Gender structure of patients with various forms of diseases and injuries of the cornea, patients which had received a medical care in the conditions of a hospital (in % to total)**

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Treatment using SCL</th>
<th>Traditional treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>W</td>
</tr>
<tr>
<td>1. Herpetic keratouveitis</td>
<td>46,1</td>
<td>53,9</td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>50,0</td>
<td>50,8</td>
</tr>
<tr>
<td>3. Herpetic superficial keratitis</td>
<td>43,7</td>
<td>56,3</td>
</tr>
<tr>
<td>4. Bacterial keratouveitis</td>
<td>57,1</td>
<td>42,9</td>
</tr>
<tr>
<td>5. Bacterial keratitis</td>
<td>56,3</td>
<td>43,7</td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>50,0</td>
<td>50,0</td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>57,2</td>
<td>42,8</td>
</tr>
<tr>
<td>8. Corneal burns</td>
<td>50,0</td>
<td>50,0</td>
</tr>
<tr>
<td>9. Traumatic keratitis</td>
<td>53,9</td>
<td>46,1</td>
</tr>
<tr>
<td>10. Nonpenetrating corneal injury</td>
<td>45,4</td>
<td>54,6</td>
</tr>
<tr>
<td>IN TOTAL</td>
<td>50,9</td>
<td>49,1</td>
</tr>
</tbody>
</table>

As seen in Table 4.2, for each nosology, the proportion of men and women in the structure of patients groups we have choose differed from each other by no more than 5.0%.
The above means that the groups of patients with diseases and injuries of the cornea, received eye care according to the traditional method of recovery and on the basis of the new method, the structure of nosology of diseases and gender, were identical. This eliminates the impact of differences in disease nosology and gender the commitments we obtain two groups, the results of treatment.

As it is said in Chapter 2, we have treated 269 patients with diseases and injuries of the cornea. Necessary to note that in both groups (basic and control), used same medications, but the principles of the method to provide health care were different.

For the treatment of patients of the main group we have used SCL made of "Gipolan-2" material with 38% moisture content by "Lance" (Yoshkar-Ola), and by "Concor" (Vologda), and lenses made by sharpening in laboratory contact vision correction Republican eye Hospital Ministry of Health of Republic of Tatarstan from the same material. Every day after the removal of lenses was carried their cleaning and disinfection (chemical - in 3% hydrogen peroxide solution for 1 min., then heat-boiling the "water bath" for 10 min).

In herpes lesions of the cornea medical care provided under the traditional scheme, including ophthalmoherpes basic therapy: chemotherapy, specific and non-specific antiviral treatment. Basic chemotherapy drug - 3% eye ointment "Zovirax" was introduced into the main group 1 per day in a soft contact lens, and in the control group to apply in the ointment in the conjunctival sac of the standard dose - a strip of 10 mm x 5 times a day. Lens worn on the eye every morning right after the toilet of conjunctival cavity or the 30 minutes after subconjunctival injection in the case of deep forms of herpetic keratitis and keratoiridocyclitis and left eye for 6-8 hours. Instillation of the above preparations was soft contact lenses.

In the treatment of patients with bacterial keratitis, corneal ulcers, posttraumatic keratitis and corneal burns primarily conducted infection control. The choice of antibiotic depended on the outcome of bacterial microflora sowing conjunctiva or ulcers in the cornea and determine susceptibility of bacteria to antibiotics. In this antibacterial unguent - 1% Tetracycline or 1% Eritromycine laid over the lower lid patients from the main group 1 time per day in therapeutic soft contact lenses, as described above, and in the control group - 3-4 times a day.

In treatment of patients with degenerative keratitis main attention was focused on improving nutrition of the cornea, acceleration time that need to its epithelialization. Basic group’s patients was treated using 20% gel of Solcoseryl in therapeutic contact lens 1-2 times per day, and the control group - were buried in the eye 4 times a day.

Also, locally appointed disinfectants and drugs to protect eyes vascular tract from inflammation.

If necessary, patients received antibiotics, antisense and anti-inflammatory drugs as well as vitamins and biogenic stimulants.

Clinical efficacy of treatment of patients with diseases and traumatic injuries of the cornea by developed organizational model of optimization ophthalmic help was evaluated by timing of the pathological process in the cornea disappearance (the
healing and epithelialization of its surface) and resorption of the inflammatory zone and dynamics of vision acuity at the time of admission and at discharge.

Ophthalmic help was provided to 85 patients (41 patients in the first group and 44 patients in the second) with various forms of herpetic keratitis and keratouveitis with ulceration, 105 patients with bacterial corneal (50 patients in the intervention group and 55 - in the control), traumatic corneal damage had place in 50 patients treated by us (23 people in the first group and 27 - in the second), degenerative lesions of the cornea - in 29 patients (15 patients in the intervention group and 14 - in the control).

Studying time for completion epithelialization of the cornea (pic. 4.2) in providing medical care to patients with traditional method and using SCL showed that the second method is more efficient. So, in all forms of diseases and injuries of the cornea, using SCL, the completion of epithelialization occurs significantly earlier than the traditional approach to recovery. It should be noted that in severe forms of herpetic keratitis - stromal and keratouveitis, the effect is less pronounced, the process of epithelization in applying SCL terminated by 4.3 - 4.5 days earlier than those without them, while in herpetic keratitis surface, the difference is 5, 3 days. In patients with bacterial keratouveitis - 2.8, purulent corneal ulcer - 3.8, dystrophic keratitis - 4.5 days early epithelization is completed by treatment with SCL than traditional.

<table>
<thead>
<tr>
<th>Disease Type</th>
<th>M ± m</th>
<th>P&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial herpetic keratitis</td>
<td>14,3±1,4</td>
<td>0,05</td>
</tr>
<tr>
<td></td>
<td>10,0±1,2</td>
<td></td>
</tr>
<tr>
<td>Stromal herpetic keratitis with ulceration</td>
<td>26,8±2,2</td>
<td>0,05</td>
</tr>
<tr>
<td></td>
<td>22,0±1,9</td>
<td></td>
</tr>
<tr>
<td>Herpetic keratouveitis with ulceration</td>
<td>29,0±1,2</td>
<td>0,05</td>
</tr>
<tr>
<td></td>
<td>25,4±1,1</td>
<td></td>
</tr>
<tr>
<td>Bacterial keratitis</td>
<td>11,8±1,1</td>
<td>0,05</td>
</tr>
<tr>
<td></td>
<td>9,2±0,8</td>
<td></td>
</tr>
<tr>
<td>Bacterial keratouveitis with ulceration</td>
<td>22,9±2,0</td>
<td>0,05</td>
</tr>
<tr>
<td></td>
<td>18,1±1,2</td>
<td></td>
</tr>
<tr>
<td>Purulent ulcer of cornea</td>
<td>17,4±1,6</td>
<td>0,01</td>
</tr>
<tr>
<td></td>
<td>8,2±0,9</td>
<td></td>
</tr>
<tr>
<td>Bullous keratopathy</td>
<td>16,6±1,5</td>
<td>0,01</td>
</tr>
</tbody>
</table>
First-degree corneal burns

Second-degree corneal burns

Traumatic keratitis

Nonpenetrating corneal injures

Traditional treatment

Treatment using SCL

Pic.4.2. Time for completion epithelialization of the cornea in days at treatment of diseases of anterior eye segment using traditional method and with SCL

Studying time for completion resorption of infiltrate in patients with diseases of the cornea received ophthalmic help by the new organizational model and the traditional method of treatment showed that SCL significantly accelerate the regenerative processes, restore the integrity and transparency of the cornea. This technology is especially effective for the treatment of herpes infections - superficial stromal keratitis with ulceration and keratouveitis - completion accelerated resorption of infiltration by 4.4 - 6.2 days (Table 4.3.).

Table 4.3.

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Traditional treatment M±m</th>
<th>Treatment using SCL M±m</th>
<th>P&lt;</th>
<th>Time of resorption reduce (in days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Herpetic superficial keratitis</td>
<td>18,6±1,8</td>
<td>12,4±1,1</td>
<td>0,05</td>
<td>6,2</td>
</tr>
<tr>
<td>2.Herpetic stromal keratitis with ulceration</td>
<td>29,2±2,3</td>
<td>24,8±2,0</td>
<td>0,05</td>
<td>4,4</td>
</tr>
<tr>
<td>3.Herpetic keratouveitis with ulceration</td>
<td>27,3±2,1</td>
<td>22,3±2,0</td>
<td>0,05</td>
<td>5,0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----------------</td>
<td>--------</td>
<td>--------</td>
<td>----</td>
</tr>
<tr>
<td>4.</td>
<td>Bacterial keratitis</td>
<td>11,7±1,4</td>
<td>8,8±1,0</td>
<td>0,05</td>
</tr>
<tr>
<td>5.</td>
<td>Bacterial keratouveitis with ulceration</td>
<td>19,4±1,3</td>
<td>16,9±1,0</td>
<td>0,05</td>
</tr>
<tr>
<td>6.</td>
<td>Purulent ulcer of cornea</td>
<td>27,2±1,8</td>
<td>24,3±1,1</td>
<td>0,05</td>
</tr>
<tr>
<td>7.</td>
<td>Traumatic keratitis</td>
<td>8,1±0,9</td>
<td>4,6±0,8</td>
<td>0,05</td>
</tr>
</tbody>
</table>

Pic. 4.3 presents the results of studying the dynamics of visual acuity in the traditional method to health care and using new embedded mode.

On admission to hospital, the visual acuity of patients in both comparison groups had no significant differences (P> 0.05). At discharge, patients with attention to our clinical entity of diseases and injuries of the cornea in basic and control group, showed obvious difference between the P <0.05 and P <0.001 (Figure 4.3). In outcome the vision acuity of patients in the basic group is significantly higher than in control group.

Thus, in this research, we optimized health care according to social diseases of cornea and growth of these diseases among the population and developed measures to improve it. To do this, in the Republic of Tatarstan has implemented a new technology treatment of diseases of the cornea with the SCL and the results obtained, indicating high clinical effectiveness of this technique. To ensure that all medical institutions that provide eye care, therapeutic SCL, a scheme for the organizational model of care for patients with disorders of the cornea, based on their application. This will increase the level of eye care provided to patients suffering from diseases of the cornea.
5.1 THE ECONOMIC EFFICIENCY OF REDUCING THE AVERAGE LENGTH OF HOSPITALIZATION

Medical efficiency of the method of using SCL with curative goal was recognized in the previous chapter. In accordance with the objectives set in the present study, we estimated the economic efficiency of ophthalmic medical care organization for patients with corneal diseases on the basis of using SCL.

Factual data for the calculation of economic benefit were inpatients cards (form № 0031/U) with traumatic injuries and inflammation of the cornea of viral and bacterial etiology who received treatment according to the method of application of SCL (128 cards) and the traditional treatment (141 cards).

As a result, on account of the using of therapeutic lenses, we got a significant acceleration of corneal defect epithelialization and decreased the amount of time required to resorb an infiltration. Objectively, this is impacted the reduction of the length of hospitalization (table 5.1).

As seen from table 5.1 in herpetic superficial keratitis cases length of treatment was reduced by 5,5 days, in herpetic keratouveitis cases – by 5,0 day, in herpetic stromal keratitis cases with ulceration and bullous keratopathy – by 4,0 day, in bacterial keratitis cases – by 2,6 days, in bacterial keratouveitis cases with ulceration – by 2,4 days, in purulent corneal ulcer cases – by 3,0 days, thus, in average for specified diseases – by 3,2 days.

With the cost of one hospitalization day in the ophthalmology department of RCH MHC RT 263,80 rubles, the treatment with SCL for patients with herpetic superficial keratitis provides financial savings in the amount of 2465,43 rub., for patients with herpetic stromal keratitis – 1793,04 rub., with herpetic keratouveitis – 2241,30 rub., with bacterial keratitis – 1165,47 rub., with bacterial keratouveitis – 1075,82 rub., with purulent corneal ulcer – 1344,78 rub., with bullous keratopathy – 1793,04 rub., with first-degree corneal burn - 493,08 rub., with second-degree corneal burn - 1344,78 rub., with traumatic keratitis - 986,17 rub., with non-penetrating corneal trauma - 1255,12 rub., thus, in average for specified corneal diseases – 1434,43 rub. per day (table 5.2).
Table 5.1.

The average length of hospitalization for patients with corneal diseases in hospital using traditional methods and SCL in treatment (M±m)

<table>
<thead>
<tr>
<th>Nosology</th>
<th>M±m</th>
<th>P&lt;</th>
<th>Reduction of bed-days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Herpetic superficial keratitis</td>
<td>20,8±1,4</td>
<td>0,05</td>
<td>5,5</td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>32,0±1,7</td>
<td>0,05</td>
<td>4,0</td>
</tr>
<tr>
<td>3. Herpetic keratouveitis</td>
<td>30,0±2,2</td>
<td>0,05</td>
<td>5,0</td>
</tr>
<tr>
<td>4. Bacterial keratitis</td>
<td>12,2±1,2</td>
<td>0,05</td>
<td>2,6</td>
</tr>
<tr>
<td>5. Bacterial keratouveitis</td>
<td>23,0±1,4</td>
<td>0,05</td>
<td>2,4</td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>28,7±1,7</td>
<td>0,05</td>
<td>3,0</td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>24,0±1,4</td>
<td>0,05</td>
<td>4,0</td>
</tr>
<tr>
<td>8. First-degree corneal burn</td>
<td>6,5±0,9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Second-degree corneal burn</td>
<td>13,0±1,3</td>
<td>0,05</td>
<td>3,0</td>
</tr>
<tr>
<td>10. Traumatic keratitis</td>
<td>9,6±1,0</td>
<td>0,05</td>
<td>2,2</td>
</tr>
<tr>
<td>11. Non-penetrating corneal trauma</td>
<td>7,1±0,7</td>
<td>0,05</td>
<td>2,8</td>
</tr>
<tr>
<td><strong>IN TOTAL</strong></td>
<td>18,8±0,6</td>
<td>0,01</td>
<td>3,2</td>
</tr>
<tr>
<td>Nosology</td>
<td>Cost of the treatment</td>
<td>Difference in cost</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------------------</td>
<td>--------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Traditional treatment</td>
<td>SCL</td>
<td></td>
</tr>
<tr>
<td>1. Herpetic superficial keratitis</td>
<td>5487,04</td>
<td>4036,14</td>
<td>1450,90</td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>8441,60</td>
<td>7386,40</td>
<td>1055,20</td>
</tr>
<tr>
<td>3. Herpetic keratouveitis</td>
<td>7914,00</td>
<td>6595,00</td>
<td>1319,00</td>
</tr>
<tr>
<td>4. Bacterial keratitis</td>
<td>3218,36</td>
<td>2532,48</td>
<td>685,88</td>
</tr>
<tr>
<td>5. Bacterial keratouveitis</td>
<td>6067,40</td>
<td>5434,28</td>
<td>633,12</td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>7571,06</td>
<td>6779,66</td>
<td>791,40</td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>6331,20</td>
<td>5276,00</td>
<td>1055,20</td>
</tr>
<tr>
<td>8. First-degree corneal burn</td>
<td>1714,70</td>
<td>1424,52</td>
<td>290,18</td>
</tr>
<tr>
<td>9. Second-degree corneal burn</td>
<td>3429,40</td>
<td>2638,00</td>
<td>791,40</td>
</tr>
<tr>
<td>10. Traumatic keratitis</td>
<td>2532,48</td>
<td>1952,12</td>
<td>580,36</td>
</tr>
<tr>
<td>11. Non-penetrating corneal trauma</td>
<td>1872,98</td>
<td>1134,34</td>
<td>738,64</td>
</tr>
<tr>
<td><strong>IN TOTAL</strong></td>
<td><strong>4961,83</strong></td>
<td><strong>4108,08</strong></td>
<td><strong>853,75</strong></td>
</tr>
</tbody>
</table>
The cost of treatment and one bed-day in the hospital for patients selected for studying the economic efficiency of using SCL are presented in the Table 5.3.

As seen from the Table 5.1 the cost of bed-day and treatment in the hospital for 14 patients with superficial herpetic keratitis using traditional treatment amounted 76818,56 rub and for 13 patients received treatment with SCL – 52469,92 rub. In this case we cannot compare the cost of treatment for patients who had traditional treatment and patients who used SCL, because the number of patients is different. If the number of traditionally treated patients would also be 13, as the number of patients treated with SCL, the cost of treatment for one day will be 71,331.52 rubles, however for the same number of patients who used SCL – 52469, 82 rubles. The difference will be 71331,52 – 52469,82 = 18861,70 rubles.

Thus, to calculate the economic efficiency of treatment with the use of soft contact lenses in one day we can offer formula:

\[ E_{eff.} = (C_1 \times K_1 \times n_1) - (C_2 \times K_2 \times n_1) \]

\( E_{eff.} \) – the amount of the economic efficiency,
\( C_1 \) – the average length of hospitalization using traditional treatment,
\( K_1 \) – the cost of one bed-day, \( n_1 \) – the amount of traditionally treated patients,
\( C_2 \times K_2 \times n_1 \) – the amount of patients treated with the use of SCL.

The economic efficiency of the treatment of patients with herpetic stromal keratitis calculated by the formula will be \( E_{eff.} = (32,0 \times 263,8 \times 12) - (28,0 \times 263,8 \times 12) = 101299,2 - 88636,8 = 12662,40 \) rub.

Similarly we calculated the economic efficiency of a single day of maintenance and treatment for patients from two our groups suffering from other diseases. Thus, as can be seen from the Table 5.3., the greatest economic benefit can be achieved using SCL with such diseases of the cornea as herpetic superficial keratitis, herpetic stromal keratitis, herpetic keratouveitis and bullous keratopathy.

Also we can count reduction of bed-days in treatment with SCL.

We estimated reduced number of bed-days in the hospital for patients with various diseases of the cornea treated with SCL by dividing the amount of economic benefit - \( E_{eff.} \) - at the cost per bed-day - \( K_2 \), i.e.:

\[ K_{ec.} = E_{eff.} / K_2. \]

For example number of reduced bed-days for patients with herpetic superficial will be \( K_{ec.} = 1886170 \) rub. /263, 8 rub. = 71,5 bed-days for 13 patients, or 71,5 / 13 = 5,5 days - per one patient.
Similarly we calculated reduction of bad-days for certain number of patients with other types of keratopathy. We found that for treatment of 12 patients with herpetic stromal keratitis 48.0 bed-days are saved, 16 patients with herpetic keratouveitis – 80.0 bed-days, 14 patients with bacterial keratitis – 36.4 days, 11 patients with bacterial keratouveitis – 26.4 days, 12 patients with purulent corneal ulcer – 36.0 bed-days, 14 patients with bullous keratopathy – 56.0 bed-days, 12 patients with corneal burn – 24.6 bed-days, 13 patients with traumatic keratitis – 28.6 bed-days, 11 patients with non-penetrating corneal trauma – 30.8 bed-days.

Table 5.3.

The cost of one day hospitalization and treatment for selected patients treated with traditional methods and with the use of SCL (in rubles)

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Traditional treatment</th>
<th>SCL</th>
<th>E\text{ eff.}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount of patients</td>
<td>The cost in rub.</td>
<td>Amount of patients</td>
</tr>
<tr>
<td>1. Herpetic superficial keratitis</td>
<td>14</td>
<td>76818,56</td>
<td>13</td>
</tr>
<tr>
<td>3. Herpetic stromal keratitis</td>
<td>13</td>
<td>109740,80</td>
<td>12</td>
</tr>
<tr>
<td>3. Herpetic keratouveitis</td>
<td>17</td>
<td>134538,00</td>
<td>16</td>
</tr>
<tr>
<td>4. Bacterial keratitis</td>
<td>16</td>
<td>51493,76</td>
<td>14</td>
</tr>
<tr>
<td>5. Bacterial keratouveitis</td>
<td>13</td>
<td>78876,20</td>
<td>11</td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>14</td>
<td>105994,84</td>
<td>12</td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>15</td>
<td>94968,00</td>
<td>14</td>
</tr>
<tr>
<td>8. Corneal burn</td>
<td>14</td>
<td>36008,70</td>
<td>12</td>
</tr>
<tr>
<td>9. Traumatic keratitis</td>
<td>12</td>
<td>30389,76</td>
<td>13</td>
</tr>
<tr>
<td>10. Non-penetrating corneal trauma</td>
<td>13</td>
<td>24348,74</td>
<td>11</td>
</tr>
<tr>
<td>IN TOTAL</td>
<td>141</td>
<td>699281,04</td>
<td>128</td>
</tr>
</tbody>
</table>
Table 5.4.

The cost of one day hospitalization and treatment for patients from our selected groups treated with SCL (in rubles)

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Amount of patients</th>
<th>The economic efficiency of saved amount (in rub.)</th>
<th>K ec. Amount of reduced bed-days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Herpetic superficial keratitis</td>
<td>13</td>
<td>18861,70</td>
<td>71,5</td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>12</td>
<td>12662,40</td>
<td>48,0</td>
</tr>
<tr>
<td>3. Herpetic keratouveitis</td>
<td>16</td>
<td>21104,00</td>
<td>80,0</td>
</tr>
<tr>
<td>4. Bacterial keratitis</td>
<td>14</td>
<td>9602,08</td>
<td>36,4</td>
</tr>
<tr>
<td>5. Bacterial keratouveitis</td>
<td>11</td>
<td>6964,32</td>
<td>26,4</td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>12</td>
<td>9496,80</td>
<td>36,0</td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>14</td>
<td>14772,80</td>
<td>56,0</td>
</tr>
<tr>
<td>8. Corneal burn</td>
<td>12</td>
<td>6489,48</td>
<td>24,6</td>
</tr>
<tr>
<td>9. Traumatic keratitis</td>
<td>13</td>
<td>7544,68</td>
<td>28,6</td>
</tr>
<tr>
<td>10. Non-penetrating corneal trauma</td>
<td>11</td>
<td>8125,04</td>
<td>30,8</td>
</tr>
<tr>
<td>IN TOTAL</td>
<td>128</td>
<td>115624,02</td>
<td>438,3</td>
</tr>
</tbody>
</table>

In total 438,3 bed-days are saved using treatment with SCL in 128 patients with different corneal diseases (Table 5.4).

Using data from official statistics and our research we have determined by extrapolating the annual number of patients with diseases of the cornea who required hospitalization.

We found that the morbidity of eye diseases in the urban population in average is 43,0 per 1000, in the rural population – 20,0 per 1000. Using these levels of morbidity the number of cases with eyes and its appendages diseases will be - 119836 cases among the urban population, 19526 cases among rural population; in the population respectively - 2786900 and 976300 people (the average population of

According to our research percentage of keratopathy among all applications of patients from rural areas in RCH MHC RT polyclinic is 4, 4%. On the assumption of this data and the number of all eye diseases and its appendages (19526) the number of such patients is approximately 859 people.

By calculation we have found that during 2002 on average 19,0% (or 163 patients) of patients from rural areas with keratopathy who came to RCH MHC RT polyclinic were hospitalized. For the same approach to urban population 1002 patients annually will need hospitalization (Table 5.5).

The structure of average number of patients hospitalized to RCH with diseases of the cornea during the period 2002 is represented in Table 5.6. With this distribution the number of patients with herpetic superficial keratitis who require hospitalization will be 156 among urban residents and 25 among rural population per year. For patients with herpetic stromal keratitis the number of annually hospitalization will be 62 for urban patients and 10 for patients from rural areas, for patients with herpetic keratouveitis respectively – 94 and 15, with bacterial keratitis – 101 and 16, with purulent corneal ulcer – 109 and 18, with bullous keratopathy – 70 and 12, with non-penetrating corneal trauma – 90 and 14, in total for patients with corneal diseases – 1002 and 163.
Extrapolation of evaluation the number of patients with corneal diseases from urban and rural areas who need hospitalization in current levels of morbidity and population

<table>
<thead>
<tr>
<th>Levels of extrapolation</th>
<th>Urban population</th>
<th>Rural population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Morbidity of eyes and its appendages among population</td>
<td>43 на 1000</td>
<td>20,0 на 1000</td>
</tr>
<tr>
<td>2. Number of population</td>
<td>2786900</td>
<td>976300</td>
</tr>
<tr>
<td>3. Number of eyes and its appendages diseases cases for certain level of morbidity among population</td>
<td>119836</td>
<td>19526</td>
</tr>
<tr>
<td>4. Percentage of keratopathy among all diseases of eyes and its appendages</td>
<td>4,4 %</td>
<td>4,4 %</td>
</tr>
<tr>
<td>5. Number of keratopathy cases</td>
<td>5273</td>
<td>859</td>
</tr>
<tr>
<td>6. Percentage of hospitalized patients among all served patients with keratopathy</td>
<td>19,0 %</td>
<td>19,0 %</td>
</tr>
<tr>
<td>7. Number of hospitalized patients</td>
<td>1002</td>
<td>163</td>
</tr>
</tbody>
</table>
The average data of the structure of corneal disease’s nosology of patients hospitalized to RCH in and the annually expected number of urban and rural residents who require hospitalization

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Structure of hospitalization</th>
<th>Number of requiring hospitalization</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Urban population</td>
<td>Rural population</td>
<td></td>
</tr>
<tr>
<td>1. Herpetic superficial keratitis</td>
<td>15,6</td>
<td>156</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>6,2</td>
<td>62</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3. Herpetic keratouveitis</td>
<td>9,4</td>
<td>94</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>4. Bacterial keratitis</td>
<td>10,1</td>
<td>101</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>5. Bacterial keratouveitis</td>
<td>7,8</td>
<td>78</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>10,9</td>
<td>109</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>7,0</td>
<td>70</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>8. Corneal burn</td>
<td>17,2</td>
<td>172</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>9. Traumatic keratitis</td>
<td>7,0</td>
<td>70</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>10. Non-penetrating corneal trauma</td>
<td>8,8</td>
<td>90</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td><strong>IN TOTAL</strong></td>
<td><strong>100,0</strong></td>
<td><strong>1002</strong></td>
<td><strong>163</strong></td>
<td></td>
</tr>
</tbody>
</table>

We have proved that the treatment of corneal diseases using SCL has a significant economic benefit. However as seen from the previous data the scope of economic benefit was determined among the limited number of cases – 128 patients. Determination of the possible scope of financial savings on the scale of the republic including all hospitalized patients in ophthalmic department with the use of SCL in the treatment of the corneal diseases is required. Such calculations were made by us.

According to our calculations, we can reduce consumption of the budget using treatment with SCL for 156 urban patients with herpetic superficial keratitis and for 25 patients from rural areas (Table 5.6) by 226340,40 rubles and 36272,50 rubles, respectively, comparing to the conventional method of treatment.
Using SCL for treatment will give the possible scope of economic efficiency for urban patients with herpetic stromal keratitis by 65422,40 rubles, for patients from rural areas – 10552,00 rubles, for patients with herpetic keratouveitis respectively - 123986,00 rub. and 27699,00 rub., with bacterial keratitis - 69273,88 rub. and 10974,08 rub., with bacterial keratouveitis - 69273,88 rub. and 8230,56 rub., with purulent corneal ulcer - 49383,36 rub. and 14245,2 rub., with bullous keratopathy - 86262,6 rub. and 12662,4 rub., with corneal burn - 73864,0 rub. and 8125,04 rub., with traumatic keratitis - 40625,20 rub. and 9496,80 rub., with non-penetrating corneal trauma - 66477,6 rub. and 10340,96 rub.

In total using SCL in the treatment of hospitalized patients with corneal diseases may reduce the expenditure of funds for the urban residents in the amount of 851,018.90 rubles, for rural residents - 148,598.54 rubles.

5.2. SOCIAL INSURANCE SAVINGS DUE TO REDUCING AVERAGE DURATION OF THE MORBIDITY WITH TEMPORARY DISABILITY

The economic expediency of the treatment using SCL in patients from urban and rural areas with corneal diseases is not limited only by the amount of reduced funding for hospitalization. It should be noted that 56, 3% of the population of the Republic of Tatarstan are persons of working age: women aged 16 to 54 years, men - 16 to 59 years. Most of them work in various sectors of the national economy. The most negative effect on the formation and composition of the labor supplies bring losses due to diseases with a temporary disability. Nowadays many people of retirement age are forced to work as well; therefore, they will receive compensation for morbidity with temporary disability.

Among indexes of morbidity with temporary disability we used the average duration of morbidity with temporary disability in days.

As can be seen from Table 5.7, the average duration of morbidity with temporary disability was significantly different for inpatients with all diseases of the cornea (except first-degree burns) treated in the traditional way and using the SCL.

Using the treatment with SCL we can reduce the average length of stay on sick leave for all diseases of the cornea by 3,8 days, and for the nosology by 1,1 - 6,1 days.

According to the Social Insurance Committee of the Republic of Tatarstan the amount of compensation for one day of temporary incapacity for rural residents was 61,0 rubles, urban – 100,0 rubles in 2003. In this case the economic efficiency obtained by us for one case of temporary disability calculated by the formula:

\[ E_{in\ I} = Dr \times S, \]

\[ Dr \] – quantity of saved days in MTD (morbidity with temporal disability);
$S$ - compensation sum for one day of temporary disability;

$E$ in 1 - economic efficiency of reducing average duration of one case of morbidity with temporary disability.

Amount of Social Insurance savings per case of herpetic superficial keratitis will be $E$ in 1 = Dr × S = 6,1 × 61 = 372,10 rubles; of herpetic stromal keratitis - 329,40 rub.; herpetic keratouveitis - 329,40 rub.; bacterial keratitis - 183,00 rub.; bacterial keratouveitis - 176,90 rub.; purulent corneal ulcer - 311,10 rub.; bullous keratopathy - 341,60 rub.; fist-degree corneal burn - 67,10 rub.; second-degree corneal burn - 195,20 rub.; traumatic keratitis - 134,20 rub.; non-penetrating corneal trauma - 170,80 rub., of one keratopathy case on average - 231,80 rubles for rural residents and 380,00 rubles for urban residents.

**Table 5.7.**

The average duration of morbidity with temporary disability for patients with corneal diseases using traditional treatment and SCL (in days)

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Average duration of morbidity with temporary disability</th>
<th>P&lt;</th>
<th>Reduction of MTD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional treatment</td>
<td>SCL</td>
<td></td>
</tr>
<tr>
<td>1. Herpetic superficial keratitis</td>
<td>23,3±2,5</td>
<td>17,2±1,8</td>
<td>0,05</td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>46,5±2,0</td>
<td>42,1±1,9</td>
<td>0,05</td>
</tr>
<tr>
<td>3. Herpetic keratouveitis</td>
<td>44,7±2,1</td>
<td>39,3±1,7</td>
<td>0,05</td>
</tr>
<tr>
<td>4. Bacterial keratitis</td>
<td>14,4±1,0</td>
<td>11,4±0,9</td>
<td>0,05</td>
</tr>
<tr>
<td>5. Bacterial keratouveitis</td>
<td>30,9±1,2</td>
<td>28,0±1,1</td>
<td>0,05</td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>43,2±2,1</td>
<td>38,1±1,8</td>
<td>0,05</td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>29,6±2,0</td>
<td>24,0±1,9</td>
<td>0,05</td>
</tr>
<tr>
<td>8. First-degree corneal burn</td>
<td>9,5±0,7</td>
<td>8,4±0,6</td>
<td>-</td>
</tr>
</tbody>
</table>
The scope of economic efficiency in 128 patients and projected for 1002 urban and 163 rural residents in each nosology of corneal diseases by reducing the average duration of temporary disability calculated by the formula:

\[
Et = Dr \times S \times n,
\]

where

\( Et \) – economic efficiency of reducing the average duration of MTD;
\( Dr \) – quantity of saved days;
\( S \) - compensation sum for one day of temporary disability;
\( n \) – number of patients.

128 patients suffering from various corneal diseases were treated by SCL. Savings of social insurance were determined for each nosological form of the corneal diseases. Thus, the economic effect of reducing the average duration of temporary disability for herpetic superficial keratitis was:

\[
Et = Dr \times S \times n = 6,1 \times 61,0 \times 13 = 4837,3 \text{ rub.}
\]

Similarly we calculated the amount of the economic efficiency of reducing of the average duration of temporary disability for other corneal diseases (Table 5.8). The total amount of savings in the group of patients treated by SCL was 31292,60 rubles.

In the case of use SCL for treatment of corneal diseases in all patients from urban and rural areas we could have an economic benefit by reducing the average duration of morbidity with temporary disability, for example in cases of herpetic superficial keratitis saving will be 95160,00 rub and 9302,0 rub, respectively.

Amounts of economic efficiency regarding to other corneal diseases were calculated in the similar manner (Table 5.8.). The total amount of savings of social insurance could be 401830,00 rubles for urban and 43589,80 rubles for rural
population.

The scope of actual and expected savings of social insurance funds using SCL for the treatment of corneal diseases in case of morbidity with temporary disability (in rubles).

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Factual savings (128 patients in RCH)</th>
<th>Expected</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Urban residents (1002 people)</td>
<td>Rural residents (163 people)</td>
<td></td>
</tr>
<tr>
<td>1. Herpetic superficial keratitis</td>
<td>4837,3</td>
<td>95160,0</td>
<td>9302,5</td>
<td></td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>3220,8</td>
<td>27280,0</td>
<td>2684,0</td>
<td></td>
</tr>
<tr>
<td>3. Herpetic keratouveitis</td>
<td>5270,4</td>
<td>50760,0</td>
<td>8100,0</td>
<td></td>
</tr>
<tr>
<td>4. Bacterial keratitis</td>
<td>2562,0</td>
<td>30300,0</td>
<td>2745,0</td>
<td></td>
</tr>
<tr>
<td>5. Bacterial keratouveitis</td>
<td>1945,9</td>
<td>22620,0</td>
<td>2616,9</td>
<td></td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>3733,2</td>
<td>55990,0</td>
<td>5599,8</td>
<td></td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>4782,4</td>
<td>39200,0</td>
<td>4099,2</td>
<td></td>
</tr>
<tr>
<td>8. First-degree corneal burn</td>
<td>536,4</td>
<td>7920,0</td>
<td>536,8</td>
<td></td>
</tr>
<tr>
<td>9. Second-degree corneal burn</td>
<td>780,8</td>
<td>32000,0</td>
<td>3904,0</td>
<td></td>
</tr>
<tr>
<td>10. Traumatic keratitis</td>
<td>1744,6</td>
<td>15400,0</td>
<td>1610,4</td>
<td></td>
</tr>
<tr>
<td>11. Non-penetrating corneal trauma</td>
<td>1878,8</td>
<td>25200,0</td>
<td>2391,2</td>
<td></td>
</tr>
<tr>
<td><strong>IN TOTAL</strong></td>
<td><strong>31292,6</strong></td>
<td><strong>401830,0</strong></td>
<td><strong>43589,8</strong></td>
<td></td>
</tr>
</tbody>
</table>

The official purchase of SCL for the treatment of patients with corneal diseases was not possible as it is not taken into account in the estimates of hospital. The author of this research had to buy SCL himself.
Based on the analysis of the costs of treatment of patients with diseases of the cornea with the use of SCL, we came to the conclusion that the economic efficiency of the use of SCL for one case will be determined by the formula:

$$E_{eff} = (E_{rd} + E_t) - C_{cl},$$ where,

- $E_{eff}$ – the amount of economic efficiency using soft contact lenses in the treatment of a single case of corneal disease;
- $E_{rd}$ – economic efficiency of reducing the average duration of hospitalization;
- $E_t$ – economic efficiency of one case of morbidity with temporary disability;
- $C_{cl}$ – the cost of one soft contact lens.

Table 5.9 presents data on the cost-effectiveness of using SCL for the treatment of one corneal disease case for urban and rural residents, calculated using the formula above.

The table shows that the greatest economic benefit is achieved by using SCL in the treatment of herpetic superficial keratitis – 1763.00 rubles, herpetic keratouveitis – 1588.00 rubles, herpetic stromal keratitis – 1263.60 rubles, bullous keratopathy – 1336.80 rubles in rural residents.

In the treatment of urban residents from these diseases using contact lenses the economic effect will be 2002.90 rubles in cases of superficial herpetic keratitis, 1799.00 - herpetic keratouveitis, 1435.20 rubles - herpetic stromal keratitis and 1555.20 in cases of bullous keratopathy.
The economic efficiency of the treatment with SCL for one case of corneal disease (E\textsubscript{rd}-economic efficiency of reducing the average duration of hospitalization, E\textsubscript{t}-economic efficiency of one case of MTD, Ccl - the cost of one soft contact lens)

\[ E_{\text{eff}} = (E_{\text{rd}} + E_{\text{t}}) - C_{\text{cl}} \]

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Erd (in rub.)</th>
<th>Et (in rub.)</th>
<th>Ccl (in rub.)</th>
<th>E eff For urban residents</th>
<th>E eff For rural residents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>For urban residents</td>
<td>For rural residents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Herpetic superficial keratitis</td>
<td>1450,90</td>
<td>610,00</td>
<td>372,10</td>
<td>60,0</td>
<td>2000,90</td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>1055,20</td>
<td>440,00</td>
<td>268,40</td>
<td>60,0</td>
<td>1435,20</td>
</tr>
<tr>
<td>3. Herpetic keratouveitis</td>
<td>1319,00</td>
<td>540,00</td>
<td>329,40</td>
<td>60,0</td>
<td>1799,00</td>
</tr>
<tr>
<td>4. Bacterial keratitis</td>
<td>685,88</td>
<td>300,00</td>
<td>183,00</td>
<td>60,0</td>
<td>925,88</td>
</tr>
<tr>
<td>5. Bacterial keratouveitis</td>
<td>633,12</td>
<td>290,00</td>
<td>176,90</td>
<td>60,0</td>
<td>863,12</td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>791,40</td>
<td>510,00</td>
<td>311,10</td>
<td>60,0</td>
<td>1241,40</td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>1055,20</td>
<td>560,00</td>
<td>341,60</td>
<td>60,0</td>
<td>1555,2</td>
</tr>
<tr>
<td>8. First-degree corneal burn</td>
<td>290,18</td>
<td>110,00</td>
<td>67,10</td>
<td>60,0</td>
<td>340,18</td>
</tr>
<tr>
<td>9. Second-degree corneal burn</td>
<td>791,40</td>
<td>320,00</td>
<td>195,20</td>
<td>60,0</td>
<td>1051,4</td>
</tr>
<tr>
<td>10. Traumatic keratitis</td>
<td>580,36</td>
<td>220,00</td>
<td>134,20</td>
<td>60,0</td>
<td>740,36</td>
</tr>
<tr>
<td>11. Non-penetrating corneal trauma</td>
<td>738,64</td>
<td>280,00</td>
<td>170,80</td>
<td>60,0</td>
<td>958,64</td>
</tr>
<tr>
<td><strong>IN TOTAL</strong></td>
<td><strong>853,75</strong></td>
<td><strong>380,00</strong></td>
<td><strong>231,80</strong></td>
<td><strong>60,0</strong></td>
<td><strong>1173,75</strong></td>
</tr>
</tbody>
</table>
The expected annual economic efficiency of treatment of corneal diseases with SCL for urban and rural population (in rubles).

<table>
<thead>
<tr>
<th>Nosology</th>
<th>Urban residents</th>
<th>Rural residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Herpetic superficial keratitis</td>
<td>181105,00</td>
<td>25638,75</td>
</tr>
<tr>
<td>2. Herpetic stromal keratitis</td>
<td>72772,50</td>
<td>10255,50</td>
</tr>
<tr>
<td>3. Herpetic keratouveitis</td>
<td>110332,50</td>
<td>15383,25</td>
</tr>
<tr>
<td>4. Bacterial keratitis</td>
<td>118548,75</td>
<td>16408,80</td>
</tr>
<tr>
<td>5. Bacterial keratouveitis</td>
<td>91552,50</td>
<td>13332,15</td>
</tr>
<tr>
<td>6. Purulent corneal ulcer</td>
<td>127938,75</td>
<td>18459,90</td>
</tr>
<tr>
<td>7. Bullous keratopathy</td>
<td>82162,50</td>
<td>12306,60</td>
</tr>
<tr>
<td>8. First-degree corneal burn</td>
<td>51645,00</td>
<td>8204,40</td>
</tr>
<tr>
<td>9. Second-degree corneal burn</td>
<td>150240,00</td>
<td>20511,00</td>
</tr>
<tr>
<td>10. Traumatic keratitis</td>
<td>82162,50</td>
<td>12306,60</td>
</tr>
<tr>
<td>11. Non-penetrating corneal trauma</td>
<td>105637,50</td>
<td>14357,70</td>
</tr>
<tr>
<td><strong>IN TOTAL</strong></td>
<td>1176097,50</td>
<td>167164,65</td>
</tr>
</tbody>
</table>

On average the economic efficiency of using SCL for the treatment of a single case of the corneal disease is 1025,50 rubles for rural residents and 1173,75 rubles - for the urban residents.

The annual economic benefit of using SCL for the treatment of corneal diseases (Table 5.10) will be 117609, 50 rubles for urban residents, 167164,65 rubles for rural residents and 1343262,10 rubles generally for Republic of Tatarstan.

Thus the practical implementation of the new health care organizational models in order to optimize care for patients with diseases of the cornea through the application of SCL is one of the leading foundations of healing patients with these nosological forms and it provides a significant economic efficiency.


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