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# AGRICULTURAL SCIENCES

## PATHOLOGIES CAUSED BY FUNGI IN AZERBAIJAN AND THEIR RESEARCH

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### Abstract

The nature of the Republic of Azerbaijan is under the influence of the changing ecological conditions of the globalized world day by day, the quality change in the country's economy as a result of regaining independence of Azerbaijan in 1992 made it necessary to reconsider the measures implemented in relation to these phytopathological studies. Thus, as a result of changes such as the country's transition to a market economy, the transfer of land to private ownership, and the replacement of collective farms and state farms by private farms, a number of state organizations that are supposed to control the country's phytosanitary status have not been determined in time in the newly formed economic system, and their material and technical base has not been determined in time. the collapse of the established communication mechanism and the impossibility of creating a new one in a short period of time put those organizations in a de facto inactive state. All this greatly increased the probability of the spread of diseases and the emergence of new diseases. Among them, the diseases caused by fungi are of special importance due to both the distribution area and the danger.

**Keywords:** ecological conditions, mycological research, vegetation, mycobiota

Before proceeding to the analysis of the mycological research conducted in Azerbaijan, which has a rich vegetation[2] and forests occupy up to 11% of its territory,[4] it would be appropriate to dwell on one issue. In general, until the middle of the last century, the pathologies caused by fungi were studied in the context of mycological research and the obtained results were given together. However, over time, according to the level of development of science, researches began to be grouped according to their nature, so that similar cases did not pass by Azerbaijan, and researches in this direction were started from the middle of the second half of the last century. Although many of the earlier studies were episodic in nature, serious studies were also carried out towards the end of the last century. This can be clearly seen from the information given below.

From the results of the research conducted in this field, it can be said that rust, antimony, powdery mildew, trachymycosis, anthracosis, Dutch disease, cancer, necrosis, wilting (verticellosis), curling of leaves, etc. are common in Azerbaijan. The causative agents of diseases such as covers biotopes.

The mycobiota of dry subtropical plants such as figs, almonds, pistachios, figs and turnips were studied according to their taxonomic structure, frequency of occurrence, the pathologies they cause and their prevalence, as well as their phytotoxic activity. It was determined that the mycobiota of subtropical fruit plants, such as figs, oleanders, almonds, pistachios, and peanuts, includes 89 species, which, according to their taxonomic affiliation, belong to 4 subdivisions (Zygomycota, Ascomycota, Basidiomycota, and

Deuteromycota) of the true fungi division (Euomycota) of the fungi kingdom (Mycota) 5 belongs to 52 genera of the class, 15 orders, 21 chapters. 3 of the fungal species included in the mycobiota of the studied dry subtropical fruit plants (*Aspergillus versicolor* (Vuill.) Tiraboschi, *Ascochyta fagi* Woronich and *Coniofoera puteana*(Fr.)Karst) were recorded for the first time for the mycobiota characteristic of Azerbaijani nature [2].

Vegetables and melons cultivated in different zones of Azerbaijan were also analyzed according to the species composition of their mycobiota, as well as the transmission of pathologies by seeds, a description of many types of fungi spread in these plants was given, and the spread of new species for the mycobiota of Azerbaijan was discovered [5-6]. In addition, diseases caused by fungi in some agricultural plants cultivated in Azerbaijan were identified [5] and the dynamics of some of them were studied. In the studies carried out in the Mugan plain, the plants typical for the area, including cultivated ones, were purposefully studied according to the species composition of mycobiota, areal classification, and diseases caused by phytopathogens involved in the formation of mycobiota. It became clear that 172 species of fungi are involved in the formation of the overall mycobiota of the Mughan Plain, and among them *Aspergillus ustus*(Bain)Thom et Church, *A. sulphureus*(Fres) Thom et Church, *Aschophyta cytisi* Lib., *A. gladioli* Trav., *A. iridis* Oud. ., *Fusarium culmorum*(W.G.Sm.) Sacc., *Puccinia iridis*(DC.)Wallr. and *Thanatephorus cucumeris* (Frank) Donk. such species were recorded for the first time in the territory of the Republic of Azerbaijan. About 40 pathologies caused by the fungi

recorded in this area were also among the results obtained in the studies conducted in the Mughan plain[1].

From the research conducted in the area called "Sultanbud forest" of Aran Karabakh, it was clear that 137 species of true fungi are involved in the formation of the mycobiota of cultivated and growing plants there, of which 8 are (*Podosphaera clandestina* (Fr.) Leveille, *Sphaerotheca fuliginea* Poll., *Uromyces trifolii* -repentis (Cast.) Liro, *Meruliopsis taxicola* Fr., *Alternaria mali* Roberts, *Colletotrichum trifolii* Bond. et Truss and *Diplodina lycopersici* Hollos) were recorded for the first time in Azerbaijan. In addition, it became clear that the pathogenic representatives of the fungi registered in the studied areas were found to cause about 95 pathologies, and a 3-point system was proposed for evaluating their degree of danger[2].

As it is known, many species of fungi cause various diseases both in cultivated[3,4] and wild plants[5,6], as a result of which the biological productivity of plants decreases, and the product produced by them changes in quality and quantity, and in most cases this change is unambiguous. It is characterized negatively in terms of practical demand. One of such diseases and one of the most dangerous diseases of recent times is fusariosis, and this disease is found all over the world[2]. Fungi belonging to the genus *Fusarium* are involved in the occurrence of this disease. The dangerous aspect of the disease caused by these fungi is that it is most often found in cereal plants[4], and cereal plants are the main food source for humans and a number of other animals. On the other hand, as a result of this disease, not only the biological productivity of plants decreases, but at the same time, the product obtained from plants affected by this disease is also enriched with metabolites formed as a result of the life activity of fungi belonging to this genus. Such metabolites include mycotoxins (for example, deoxynivalenol-DON, diacetoxypyrenol-DAS and zearalenone-F-2, fumanisin B-1, etc.) that it is dangerous is one of the accepted realities of today. Research materials related to the study of this mushroom can be found in the research conducted in Azerbaijan. For example, in the studies conducted in the Mughan plain, it was determined that these fungi cause fusarium disease in the studied areas, and it was determined that 6 species of the genus *Fusarium* are involved in the occurrence of this disease [1]. In general, it has become clear that 9 species of fungi belonging to the genus *Fusarium* are widespread in Azerbaijan, and almost all of them are involved in the occurrence of fusarium disease in one or another combination[7]. For this reason, one of the results of the conducted research determined that the

determination of the permissible limit of the amount of fungi belonging to the genus *Fusarium* and the amount of mycotoxins they produce in cereals is important for ensuring the microbiological safety of cereal products. During the analysis of the results of some studies, it became clear that the phytopathogenic activity of fungi in cereals is related to various diseases caused by them, and the most common fungal diseases are root rot, fusarium, septarius, white rot, rust, powdery mildew, various types of spotting, wilting, etc. is determined to be. It has become clear that the situation of a number of agrophytocenoses currently used for the cultivation of agricultural plants in Azerbaijan is not so dangerous from the mycological point of view, but the characterization of the spread of a number of diseases as a rising line[1], the lack of advanced normative documents that allow for a comprehensive assessment of the dangerousness of fungi, make the situation worse. can make it inevitable to change at any moment.

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# ECONOMIC SCIENCES

## ENHANCING CONSUMER PROTECTION RESPONSIBILITY OF BUSINESS ORGANIZATIONS IN VIETNAM

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Faced with the enormous changes in the economic context under the impact of the 4.0 industrial revolution and deep integration into new-generation free trade agreements, it has required state management agencies to perfect legal documents to ensure the consistency of the legal system. In response to that requirement, the Party and the State have set out the task of amending and supplementing the Law on Consumer Rights Protection. In performing the assigned tasks, the Ministry of Industry and Trade has coordinated with localities, ministries, branches, domestic and foreign agencies to draft and submit to the Government and the National Assembly for approval the Law on Consumer Rights Protection in 2023.

On June 20, 2023, the National Assembly promulgated the Law on Consumer Rights Protection. The Law added many contents such as: i) supplementing regulations on the responsibility of business organizations and individuals in providing transparent information on the composition, functions, and distinct benefits of products, goods, and services provided specifically for each gender to ensure equal relations between men and women; ii) supplementing regulations on the responsibility to receive, resolve, and support the resolution of consumer feedback, requests, and complaints at business organizations and individuals, state management agencies on consumer rights protection, and social organizations participating in consumer rights protection to facilitate the exercise of consumers' right to complain and denounce; iii) Complete regulations to create special conditions for consumers and social organizations when filing lawsuits in court, such as: civil cases on consumer rights protection with a transaction value of less than 100 million VND will be resolved under simplified procedures without having to meet the conditions prescribed in the Civil Procedure Code; consumers file civil lawsuits to protect their legitimate rights and interests, social organizations participating in consumer rights protection representing consumers under authorization to file civil lawsuits on consumer rights protection do not have to pay advance court fees; and social organizations participating in consumer rights protection file civil lawsuits on consumer rights protection for the public interest do not have to pay advance court fees or pay court fees. Along with that, for the first time, the Law on Consumer Rights Protection 2023 has mentioned the role of consumers in shaping consumption trends, contributing and having an important impact on the country's economic development momentum through policies that identify consumer rights protection in conjunction with promoting respon-

sible business practices, diversifying modern distribution channels, and building an independent and self-reliant economy.

Retail organizations and individuals are one of the important entities that have many interactions with many consumers. Therefore, understanding the responsibilities and providing solutions to increase the law enforcement of retail organizations and individuals will contribute significantly to the results of protecting consumer rights in Vietnam.

### 1. Some basic issues about retail organizations and individuals

Distribution and retail channels for consumer goods often include: Manufacturers (who directly produce products and goods, sometimes the manufacturers are also the ones who sell products and goods to consumers without going through any intermediary distribution channels) and Intermediaries (who are involved in the process of distributing products and goods to consumers. Intermediaries can include brokers; wholesalers; retailers such as convenience stores, convenience stores, department stores, grocery stores, discount stores, specialty stores, company showrooms, consumer cooperatives; retail through traditional market systems, supermarkets, mini supermarkets, specialty supermarkets and general supermarkets, hypermarkets, shopping centers, etc.

Based on the nature of the retail distribution channel, retail systems can be divided into two types: traditional retail systems and modern retail systems. Modern retail systems have typical models such as convenience stores, mini-supermarkets, supermarkets, hypermarkets, department stores, regular department stores, hard discounters, commercial centers, shopping malls, etc. Thus, modern retail systems differ from traditional retail systems in terms of business management methods, store layout, and service style.

In addition, an important, central and decisive subject for the healthy operation and development of the retail market is the consumer. In the common understanding, the consumer is the last person who receives the goods for the purpose of consumption; according to the provisions of the Law on Consumer Protection 2023, the consumer is the person who buys and uses products, goods and services for the purpose of consumption, daily life of individuals, families, agencies, organizations and not for commercial purposes. We need to clearly define the differences and scope of consumers according to the law to ensure the application and use of the law is correct and effective.

### 2. Some basic responsibilities of retail business organizations in the 2023 consumer protection law

When conducting transactions with consumers at distribution and retail chains, organizations and individuals retailing products, goods and services need to fulfill the following basic responsibilities:

**2.1. Responsibility for ensuring safety, measurement, quantity, volume, quality, and uses of products, goods, and services sold and provided to consumers**

According to Article 14 of the Law on Consumer Protection 2023, business organizations and individuals are responsible for: - Ensuring the safety, measurement, quantity, volume, quality, and uses of products, goods, and services sold and provided to consumers in accordance with the contents registered, announced, announced, listed, advertised, introduced, contracted, committed, or as prescribed by law.

- Warning about products, goods, and services that are likely to cause insecurity, worryingly affecting the life, health, and property of consumers, and notifications about preventive measures as prescribed by law.

**2.2. Responsibility to protect consumer information**

In consumer transactions at different channels in the modern retail system, the responsibility to protect consumer information is considered one of the important responsibilities, especially in the context of strong development of consumer transactions in cyberspace as today.

Article 15 of the Law on Consumer Protection 2023 stipulates the responsibility to protect consumer information. Accordingly:

- Business organizations and individuals that collect, store, use, edit, update, or delete consumer information themselves or authorize or hire a third party to collect, store, use, edit, update, or delete consumer information must ensure the safety and security of consumer information in accordance with the provisions of this Law and other relevant legal provisions.

- In cases where business organizations and individuals authorize or hire a third party to collect, store, use, edit, update, or delete consumer information, they must obtain the consent of the consumer. Authorization or hiring of a third party must be made in writing, clearly stating the scope and responsibility of each party in protecting consumer information in accordance with the provisions of this Law and other relevant laws.

- In case consumers conduct transactions through a third party, the third party is responsible for protecting consumer information in accordance with the provisions of this Law and other relevant laws.

In addition, business organizations and individuals are responsible for developing rules for protecting consumer information. Specifically, unless otherwise provided by law, business organizations and individuals that collect, store, and use consumer information must develop rules for protecting information that are generally applicable to consumers with the following contents:

- Purpose of collecting information;
- Scope of information use;
- Duration of information storage;
- Measures to protect information and ensure consumer information security.

These rules must be made public in the form of posting in a visible location at the headquarters, business location and posted on the electronic information page, application software (if any), creating conditions for consumers to access before or at the time of information collection.

In addition, Articles 17, 18 and 19 of the Law on Consumer Protection 2023 also specifically stipulate the responsibilities for notification when collecting and using consumer information and the responsibility to ensure the safety and security of consumer information. Accordingly, business organizations and individuals must ensure the safety and security of consumer information that they collect, store, and use and take measures to prevent the following acts:

- Stealing or illegally accessing information;
- Using information illegally;
- Editing, updating, and deleting information illegally. In case of complaints, requests, and claims from consumers related to information being illegally collected or used for purposes other than those notified, business organizations and individuals must be responsible for receiving and resolving them.

**2.3. Responsibility for resolving consumer disputes**

Due to the nature of daily transactions, high frequency and related to all types of goods, products, services, consumer transactions in the distribution and retail system are transactions that have the potential to generate many risks of requests, feedback, and complaints from consumers. For this reason, organizations and individuals doing business in the retail industry need to pay special attention to the responsibility of resolving disputes with consumers.

According to the provisions of the Law on Consumer Protection 2023, in case a consumer sends a request for negotiation and related information and documents (if any), the receiving organization or individual must be responsible for receiving and conducting negotiations with the consumer within 07 working days from the date of receipt of the request and notify in writing the negotiation results to the state management agency on consumer rights protection, social organizations participating in consumer rights protection within 05 working days from the date of completion of the negotiation. In case of refusing a consumer's request for negotiation, within 07 working days from the date of receipt of the request for negotiation, the business organization or individual must respond in writing and state the reason.

**2.4. Responsibility for warranty of products, goods, components and accessories**

For products, goods, components, and accessories purchased in consumer transactions on distribution and retail channels, business organizations and individuals must perform the responsibility of warranty for products, goods, components, and accessories for consumers according to the agreement between the two parties or mandatory warranty according to the provisions of law.

In case of warranty, business organizations and individuals are responsible for:

- Publicly announcing the warranty policy. The warranty policy includes the following main contents: time, duration of application, content, scope, method of warranty implementation and cases of exclusion of warranty liability of business organizations and individuals;

- Accurately and fully perform the warranty responsibility for products, goods, components, and accessories provided by them;

- Provide consumers with a warranty acceptance document or other equivalent form of warranty acceptance, clearly stating the warranty implementation time. The warranty period is not included in the warranty period of products, goods, components and accessories.

In case the business organization or individual replaces components and accessories, the warranty period of those components and accessories shall be recalculated from the time of replacement of components and accessories.

In case the business organization or individual exchanges new products and goods, the warranty period of those products and goods shall be recalculated from the time of replacement of new products and goods;

- Provide consumers with similar products, goods, components and accessories for temporary use or have a suitable settlement form according to the agreement between the consumer and the business organization or individual during the warranty period;

- Exchange similar new products, goods, components, accessories or recall products, goods, components, accessories and refund money to consumers in case the warranty period expires without repair or error correction or in case the product, goods, components, accessories have been warranted 3 times or more within the warranty period but the error is still not corrected;

- Bear the cost of repairing and transporting products, goods, components, accessories from the consumer's residence or the place of use of the product, goods, components, accessories to the warranty location and from the warranty location to the consumer's residence or the place of use of the product, goods, components, accessories;

- Be responsible for the warranty of products, goods, components, accessories for consumers even in cases of authorizing or hiring other organizations or individuals to perform the warranty.

**2.5. In addition, business organizations and individuals must comply with the prohibitions prescribed by the Law on Consumer Protection 2023, specifically:**

According to Article 10 of the Law on Consumer Protection, in retail transactions, business organizations and individuals are strictly prohibited from performing a number of acts, including:

- Deceiving or confusing consumers by providing false, incomplete, or inaccurate information about one of the following contents: products, goods, and services that business organizations and individuals sell or provide;

- Harassing consumers through direct or indirect contact against the consumer's will to introduce prod-

ucts, goods, services, business organizations and individuals, proposing to enter into contracts or other acts that hinder the normal work and life of consumers;

- Forcing consumers to buy products, goods, and services against the consumer's will through using force, threatening to use force, or other acts of a similar nature;

- Forcing consumers to pay for products, goods and services provided without prior agreement with the consumer;

- Not compensating, refunding or exchanging products, goods and services for consumers due to mistakes made by business organizations and individuals;

- Not compensating, refunding or exchanging products, goods and services for consumers due to products, goods and services not being in accordance with the registration, notification, announcement, listing, advertisement, introduction, contract or commitment of business organizations and individuals;

- Swapping or defrauding products, goods and services when delivering or providing services to consumers;

- Preventing consumers from checking products, goods and services, except in cases where the law provides otherwise.

**3. Some recommendations to increase compliance with consumer rights protection laws by retail organizations and individuals**

(i). Tăng cường tuyên truyền, hướng dẫn nội dung của Luật Bảo vệ quyền lợi người tiêu dùng năm 2023 và các văn bản hướng dẫn cho các tổ chức cá nhân bán lẻ hiểu rõ trách nhiệm của mình để thực hiện cho đúng quy định.

(ii). Đối với hệ thống cơ quan quản lý nhà nước về bảo vệ quyền lợi người tiêu dùng, cần có sự chung tay cùng hành động của các bộ ngành ở Trung ương cũng như ở các địa phương. Công tác bảo vệ quyền lợi người tiêu dùng không phải là của ngành công thương mà là của tất cả các bộ ngành khác, cụ thể tại điều 75 quy định trách nhiệm của Bộ Công Thương với công tác bảo vệ quyền lợi người tiêu dùng, điều 76 quy định trách nhiệm của các bộ ngành có liên quan đến công tác bảo vệ quyền lợi người tiêu dùng.

(iii). Phát huy mạnh mẽ vai trò giám sát của Trung ương Mặt trận tổ quốc Việt Nam, các tổ chức chính trị xã hội đối với việc thực hiện nhiệm vụ bảo vệ quyền lợi người tiêu dùng của các cơ quan tổ chức, và các doanh nghiệp.

(iv). Cần phát huy hơn nữa chức năng thanh tra, kiểm tra nhằm làm lành mạnh thị trường, hạn chế đến mức tối thiểu việc vi phạm quyền lợi người tiêu dùng của các tổ chức, cá nhân bán lẻ.

(v). Cần kịp thời động viên, khen thưởng, nêu gương các cơ quan, tổ chức, cá nhân bán lẻ có thành tích tốt trong công tác bảo vệ quyền lợi người tiêu dùng đồng thời có các biện pháp xử phạt nghiêm minh tổ chức cá nhân bán lẻ cố tình vi phạm quyền lợi người tiêu dùng.

(vi). Bản thân các tổ chức, cá nhân bán lẻ cần nhận thức sâu sắc rằng việc tuân thủ tốt pháp luật bảo vệ quyền lợi người tiêu dùng là cách tốt nhất để bảo vệ quyền lợi người tiêu dùng, là cách thức nâng cao khả

năng cạnh tranh của doanh nghiệp một cách thiết thực nhất, bền vững nhất.

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# MEDICAL SCIENCES

## SPECIFICS OF HYGIENE DURING ORTHODONTIC TREATMENT OF PATIENTS WITH PERIODONTAL PATHOLOGY

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### Abstract

Numerous studies conducted in our country and abroad indicate that oral hygiene is of great importance in the prevention of dental caries and periodontal disease, especially in patients with periodontal disease undergoing orthodontic treatment. It is known that orthodontic equipment prevents complete teeth cleaning, as it creates additional retention points to retain dental plaque [2, 3].

**Keywords:** oral hygiene, periodontal diseases, retention points, dental plaque.

Inadequate oral hygiene leads to deterioration of periodontal health, which leads to loss of gingival attachment at the tooth site. In addition, regular supportive personal oral hygiene is the best guarantee of healthy teeth and periodontal tissues [1]. The presence of orthodontic structures in the oral cavity significantly increases the prevalence and intensity of periodontal diseases and dental caries [2]. After fixation of the orthodontic apparatus, the hygienic condition of the oral cavity deteriorates due to the retention features of orthodontic structures. The accumulation of dental plaque leads to a powerful bacterial effect in the oral cavity, which leads to functional and morphological changes in the dental system and a decrease in the factors of nonspecific antibacterial defense of the body [4]. Orthodontic treatment is a long process that lasts from several months to several years, and the patient has to return to the doctor quite often. It is important in the process of orthodontic treatment to effectively remove plaque, as well as control its growth in order to prevent caries and periodontal disease. The key point when planning orthodontic treatment is to eliminate or significantly reduce the accumulation of plaque and inflammation in periodontal tissues before, during and after orthodontic treatment. Oral hygiene products for patients with dentoalveolar anomalies and deformities during orthodontic treatment include: 1 toothbrushes, including orthodontic and mono-beam (mono-brush); 1 interdental products (brushes, flosses, flossesets, tooth-picks); 1 tongue scrapers and brushes; 1 toothpastes, gels; 1 dental elixirs, mouth rinses, deodorants for the oral cavity; 1 oral irrigators; 1 powders or tablets for the treatment of removable orthodontic appliances and dentures; 1 dyes for identifying dental plaque (tablets, solutions); 1 orthodontic wax; 1 whiteners for teeth and orthodontic equipment. The effectiveness of plaque removal during brushing depends on three main factors: the design of the toothbrush, the skill of the person using

the toothbrush, the use of additional hygiene products, the frequency and duration of their use. A correctly selected toothbrush, paste, interdental agents and others, individually for the patient and the method of their use, makes it possible to effectively control the growth of plaque. Therefore, the best toothbrush is one that is individually selected, and the ideal method of brushing teeth is one that allows you to remove dental plaque in a short time, without damaging tooth tissue and periodontal tissue. Nowadays, the use of a toothbrush and fluoride toothpaste is almost universal. The use of interdental products and rinses is less common among the population.

However, for patients with orthodontic appliances, the use of additional hygiene products, in addition to basic products, is mandatory and necessary. During orthodontic treatment, teeth should be brushed for 10 minutes after each meal. You should brush your teeth as you would normally brush your teeth using the standard method of brushing your teeth without braces. Next, teeth, braces, rings, arches, ligatures, springs and other elements of orthodontic equipment are cleaned with special-purpose hygiene products: orthodontic, mono-beam, brushes, floss, interdental brushes (Fig. 1). Regular toothbrushes treat all accessible dental surfaces, but orthodontic equipment must be cleaned with special orthodontic brushes. The design features of orthodontic brushes determine the specifics of their use. Some of them have a longitudinal V-shaped depression on the entire surface of the bristle field for the size of braces (Oral-B Orthodontic). In this case, horizontal movements of the brush on the braces should prevail. Using longer marginal tufts of bristles, plaque is removed in the direction from the gum to the arch, and from under the arch it is removed with long marginal bristles on the opposite side of the head. At the same time, shorter internal bristles allow you to clean the braces and orthodontic archwire. Other orthodontic brushes have a narrow brush head for sweeping vertical

movements when brushing over brackets and wires (TePe) (Figure 2). Mono-beam and small-beam brushes are used as aids and can complement orthodontic brushes. The self-cut Sulcus toothbrush has two rows of bristles, which are left on a regular brush, and are designed to clean the gingival groove, the narrow interdental spaces of the teeth. These brushes are recommended for hygiene measures in the presence of orthodontic structures, orthopedic structures and for crowded teeth. It is preferable to use single-tuft brushes in the form of a truncated cone with rounded bristle tips. They are indicated for cleaning fixed orthodontic and orthopedic structures, involving the furcation of multi-rooted teeth, the distal surface of the extreme tooth (usually a molar), implanted implants, and the oral and lingual surfaces of teeth with an atypical gingival margin (Fig. 3). New generation electric toothbrushes have shown greater efficiency in removing plaque on contact surfaces compared to conventional toothbrushes, as they use a combination of not only horizontal and vertical movements, but also rotational and vibration movements. Electric toothbrushes remove plaque from the surface of teeth per unit of time faster and more efficiently than manual ones. Moreover, the motivational impulse and interest of most people after purchasing an electric toothbrush encourages them to improve their oral hygiene. However, the popularity effect diminishes over time and the patient may return to using traditional manual toothbrushes. For patients with fixed orthodontic appliances in the oral cavity, it is necessary to use two-speed electric toothbrushes with vibrating torque. In this case, you should clean the braces at low speed to prevent the elements of orthodontic equipment from coming off.

Thus, electric toothbrushes may be particularly useful in persons undergoing orthodontic treatment, in poorly motivated patients, patients with periodontal disease, disabled or mentally retarded people, children over 6 years of age, hospitalized patients, nursing which are monitored by medical personnel. Electric toothbrushes can also be recommended in cases where the doctor considers it necessary for the patient to adjust the method of brushing the teeth; improve the motivationally-conscious effect. Contraindications for using an electric brush include peeling off of an orthodontic element, grade 3 tooth mobility, hyperplastic gingivitis, gum recession, stomatitis, condition after surgery on periodontal tissues, condition after surgery, including for oncological diseases of the oral cavity, abrasion and abrasion of teeth and dentin sensitivity. Interdental brushes (interdental or interproximal brushes) are intended for cleaning wide interdental spaces, fixed orthodontic elements and enamel around braces, rinsing parts of bridges, spaces between implanted implants, diastemas and threes, as well as exposed bifurcations and trifurcations of teeth and after periodontal surgery ( Fig. 4). In the presence of these situations in the oral cavity, brushes are a mandatory means of hygiene. They are made of nylon bristles fixed to a thin wire base. The shape of the working part of the brush can be conical or cylindrical. Brush brushes vary in size and stiffness of the bristles. The most convenient for cleaning bracket systems are

“strong” brushes with a larger working part and a more durable rod. Special probes have been developed to determine the required size of the brush in each specific case. The brushes can be mounted in a special holder, or mounted in a special lockable case. Cleaning the interdental spaces of plaque with dental floss is important for the prevention of caries and gingivitis in these areas, as well as for improving the overall level of oral hygiene (Fig. 5). Normally, the interdental spaces are small and located in the area of the contact point and directly below it. After tooth extraction for orthodontic reasons, when teeth are moved during orthodontic treatment and in patients with periodontal disease, the interdental spaces can increase, and the accumulation of plaque in these spaces increases, so the use of manual and electric toothbrushes is not enough. Flossing is the most universal method that removes up to 80% of plaque on contact surfaces. Even subgingival dental plaque can be removed by placing dental floss or tape 2.5 to 3 mm below the apex of the interdental papilla. There are disposable holders with a small piece of thread fixed on them - flossers (light flossing). However, no differences in their effectiveness were identified. The main condition for the effectiveness of dental floss is its daily use. It should be noted that flossing is difficult for people for whom brushing is not easy. This requires a certain skill and takes a lot of time, and there is also a danger of gum injury and abrasive damage to hard dental tissues due to the wrong choice or violation of the technique of using interdental hygiene products. To clean fixed elements of orthodontic devices (bracket systems), superfloss is specially used, consisting of three parts of different diameters, turning into one another. The first part is a solid fiber for passing the thread through the gingival part of the interdental space, the second part is thicker and looser. This section of the thread effectively cleans wide interdental spaces, spaces around fixed orthodontic elements and under orthodontic arches, as well as splinting structures, rinsing parts of bridges, between implanted implants, in the presence of intraoral traction, in addition, it is able to absorb exudate from the periodontal pocket in diseases periodontal The third part is regular floss. To clean the inner surface of the orthodontic arch, superfloss is inserted under the arch, and to clean the bracket along the perimeter and the adjacent part of the tooth enamel, which is especially susceptible to demineralization, superfloss is placed around the bracket and forward movements are made. Most therapeutic and prophylactic toothpastes presented on the Belarusian market contain strong antiseptics as active ingredients: chlorhexidine bigluconate and triclosan. These pastes have high antimicrobial activity and their use leads to the suppression of not only pathogenic, but also saprophytic microflora, which leads to dysbiosis and resistance of pathogenic strains to existing antimicrobial drugs, reducing the effectiveness of treatment. Long-term use of toothpastes with antiseptics can exacerbate the inflammatory process in the periodontium. Therefore, recently much attention has been paid to pastes based on herbal and plant extracts. Among their variety, Parodontax-F paste deserves special attention. Parodontax-F paste contains extracts of medicinal

herbs: chamomile - promotes epithelization, stimulates the removal of decay products and toxic substances, has an anti-inflammatory, antiseptic effect; myrrh - strengthens tissues and stops bleeding; ratania - prevents bleeding, has an anti-inflammatory effect, gives the gums firmness and elasticity; sage - has bactericidal, bacteriostatic and antiseptic activity, helps remove toxins from cells; Echinacea - has anti-inflammatory, immunocorrective and healing effects. In addition, it contains Na bicarbonate and Na fluoride, which enhances anti-inflammatory and cleansing properties. Increased sensitivity of hard dental tissues is one of the most pressing problems of modern dentistry. According to various authors, this condition causes discomfort in 45–60% of the entire adult population and in more than 85% of patients with periodontal pathology. One of the most modern developments of the Glaxo SmithKline company is Sensodyne Total Care toothpaste, recommended by dentists for symptoms of dentin hypersensitivity and periodontal disease. Along with the active ingredients "Sensodyne-F" (potassium chloride, sodium fluoride, zinc citrate), this toothpaste contains vitamins E and B5, which have an antioxidant, keratoplasty and strengthening effect on periodontal tissue, which is especially necessary to maintain oral health during orthodontic treatment. Mouth rinses or dental elixirs are additional hygiene products. Based on their main function, rinses are divided into deodorizing; reducing the formation of dental plaque and the degree of inflammation due to the antibacterial effect; and rinses containing various concentrations of fluoride compounds and can affect the mineralization of hard dental tissues. These rinses should not be used continuously, but are applied at certain intervals in courses depending on the concentration of fluoride ions and active antibacterial components. Corsodyl mouthwash contains 0.2% chlorhexidine bigluconate, hydrogenated castor oil, triclosan, sanguinarine and other components of plant origin (peppermint oil, tea tree oil, echinacea extract, wheat germ extract), vitamins (tocopherone, panthenol), allantoin, xylitol, zinc and potassium compounds. Sensodyne Mouthwash does not contain alcohol, sugar or dyes. This product contains potassium chloride, which is very effective as a way to quickly get rid of hypersensitivity. Other active ingredients are sodium fluoride, sorbitol, which is active against oral microbes, and glycerin and castor oil, which create an additional protective film and retain the active substances on the tooth surface. To carry out the most effective oral hygiene during orthodontic treatment, there is a need to use an irrigator - a device for removing plaque from interdental spaces, to improve blood circulation in periodontal tissues due to a constant or pulsating jet of liquid under pressure and the effect of hydromassage of the gums. Liquid medications (chlorhexidine, ethacridine lactate, romazulone, decoctions of calendula, chamomile, sage, corsodil, stomatophyte, etc.) can be added to the water supplied for irrigation. The procedure for irrigating the teeth and gums of one jaw for 3 minutes greatly helps prevent focal demineralization of enamel, gingivitis in the process of orthodontic treatment of fixed orthodontic equipment. Removing plaque from the back of the tongue with a tongue scraper and brush

is also an important hygienic procedure that reduces the contamination of oral microflora and eliminates bad breath (Fig. 6). Currently, two types of tongue cleaning products are proposed: scrapers of various shapes and brushes, mainly round or crescent-shaped. To clean the back of the tongue, regular brushes or brushes with additional devices for cleaning the tongue can be used, as well as electric brushes with special attachments for these purposes. It is recommended to use tongue cleaners twice a day in conjunction with an antiseptic rinse or antiseptic gel applied to the surface of the tongue after cleaning it. Orthodontic wax is used to protect the mucous membranes of the lips and cheeks from irritation and rubbing of braces, rings, arches and other orthodontic elements of a multibonding system. For erosion and ulceration of the mucous membranes of the lips and cheeks, the combined use of transparent orthodontic wax on the surface of the traumatic fixed orthodontic element and an epithelializing ointment or gel (solcoseryl, Actovegin, methyluracil, Reparef-2) applied to the wound surface of the mucous membrane is recommended. Dyes for detecting dental plaque (tablets, solutions) make it possible to detect the presence of dental plaque and the places where they accumulate when rinsing a solution or chewing a tablet. These substances are used both for individual control by the patient himself and to determine the level of oral hygiene by the doctor. Purpose and objectives of the study. The purpose of the study is to increase the effectiveness of treatment of patients with periodontal diseases and dentofacial anomalies and deformities by developing the scientific and methodological foundations of pathogenetically oriented hygienic measures before the installation of orthodontic equipment, during the process of orthodontic treatment, as well as during the period of maintenance therapy. The objectives of the study are to evaluate the impact of various hygienic measures on the course of periodontal diseases in patients with dentofacial deformities and periodontal pathology, as well as to prevent the development of periodontal diseases during orthodontic treatment in patients with dentofacial anomalies. Materials and methods of research. To solve the set tasks, a comprehensive treatment was carried out for 80 patients with periodontal pathology and dentofacial deformities and 30 patients with dentofacial anomalies, including various hygiene products at the stages of treatment. The preparatory (periodontal) stage of complex treatment consisted of hygienic measures with the elimination of iatrogenic factors in the oral cavity (low-quality fillings of classes II, V, IV, dentures with long crowns and a traumatic intermediate part of the prosthesis). Next, before orthodontic treatment, the patient was motivated, taught how to care for the oral cavity, and, if necessary, administered anti-inflammatory therapy. Orthodontic treatment began after the formation of a stable skill in caring for the oral cavity, as well as after eliminating inflammation in the periodontal tissues. During the orthodontic treatment, the level of oral hygiene was monitored every 3 months and, if necessary, professional teeth cleaning was carried out in conjunction with other therapeutic and preventive measures. After removal of the equipment, oral care

was adjusted in order to prevent habitual excessive efforts when brushing teeth with the inclusion of hygiene products that were recommended before the installation of orthodontic equipment. All patients were informed about the rational use of fluoride and reducing the frequency of carbohydrate intake. Before orthodontic treatment, all patients used individually selected hygiene products (therapeutic and prophylactic toothpastes, toothbrushes, rinses, mono-beam brushes, if necessary, floss, interdental brushes, tongue scrapers and dyes to identify plaque). After fixing the orthodontic equipment, patients in two groups were prescribed to use basic and auxiliary hygiene products (therapeutic toothpastes, basic toothbrushes, electric, orthodontic and mono-beam brushes, superflosses, interdental brushes, rinses, irrigators, tongue scrapers and dyes to identify plaque). An important role in reducing the accumulation of plaque in patients with periodontal disease was played by the correct choice of orthodontic equipment. In this regard, orthodontic equipment was chosen that was indifferent to periodontal tissues and at the same time aesthetic. Orthodontic technique was used without hooks, elastic ligatures and excess fixation material around the base of the bracket. Orthodontic treatment was carried out using self-ligating (ligature-free) passive type bracket systems (Damon System 2, 3 MX). The work used two protocols for dynamic observation of patients with periodontal pathology and dentofacial deformities. The first protocol consisted of using an optimal set of objective research methods with control calls every 2 weeks after the installation of orthodontic equipment in the first 3 months of orthodontic treatment and then every 3 months in order to prevent inflammation and develop a stable skill in caring for the oral cavity using basic and auxiliary means hygiene. If necessary, professional teeth cleaning was carried out together with other therapeutic and preventive measures at each visit. After removal of the orthodontic equipment, depending on the condition of the periodontal tissues, patients were divided into groups "A", "B" or "C" for dispensary observation. Group A for dynamic observation included patients with good hygiene skills and a compensated condition of periodontal tissues with a frequency of control visits 2 times a year (every 6 months). Group "B" of dynamic observation with a frequency of control examinations 3 times a year (every 4 months) included patients with minor deviations from the norm in the condition of periodontal tissues. Group "C" of dynamic observation included patients with significant deviations from the norm in the condition of periodontal tissues with a frequency of control visits 4 times a year (every 3 months). The second protocol included traditional research methods and traditional hygiene products. After removal of the orthodontic equipment, the patients were transferred to the usual routine follow-up (every 6 months). Based on the results obtained, the condition of periodontal tissues was assessed, as well as the effectiveness of the treatment. The results were considered as good, satisfactory and unsatisfactory. Thus, the effectiveness of the treatment was considered good if the patient had no complaints, and clinical data and objective tests were within

normal limits. Satisfactory treatment results were considered to be those in which the patients had no complaints, clinical data and objective test indicators had a slight deviation from the norm. The effectiveness of treatment was considered unsatisfactory in cases where patients continued to have complaints and the indicators of objective tests had significant deviations from the norm. The effectiveness of orthodontic treatment was assessed using 6 Andrews keys of normal occlusion [135]. To solve these problems, a comprehensive treatment was carried out for 60 patients with periodontal pathology and dentoalveolar deformities, including basic and additional hygiene products at the stages of treatment. All patients were divided into 2 groups. The first group consisted of 30 patients who underwent orthodontic treatment of dentoalveolar deformities with fixed orthodontic appliances using individually selected basic and additional hygiene products with dynamic observation according to the first protocol. The second group included 30 patients who underwent hygienic control and treatment and preventive measures according to the generally accepted method with dynamic observation according to the second protocol. Results and discussion. Based on the objective data obtained, the condition of the periodontal tissues of patients in two groups, as well as the effectiveness of the treatment, was assessed. In patients of the first group with periodontal diseases and dentoalveolar deformities, using individually selected basic and additional hygiene products with dynamic observation according to the first protocol throughout the entire period of orthodontic treatment, as well as after removal of the equipment, the condition of the periodontal tissues was similar to the indicators before orthodontic treatment. In the first group, 24 (80.0%) people had a good condition of periodontal tissues in the second week after fixation of the equipment, and 6 (20.0%) patients had a satisfactory condition of periodontal tissues. After 1 month in the first group, good condition of periodontal tissues was detected in 25 (83.33%) patients, and satisfactory – in 5 (16.67%). After removal of the equipment in patients of the first group, in 93.33% of cases, a good condition of periodontal tissues was revealed, which was also noted from 6 weeks and throughout the entire period of orthodontic treatment (GI -  $0.15 \pm 0.05$ ; PMA -  $2.62 \pm 0.13$ ; IPC -  $85.71 \pm 1.74$ ;  $03 \pm 0.01$ ), and only 2 (6.67%) patients had a satisfactory condition (GI -  $1.05 \pm 0.05$ ; RMA -  $11.31 \pm 1.79$ ; IPC -  $50 \pm 0$ ; GZDB -  $1.21 \pm 0.86$ ; ICH -  $1.3 \pm 0.02$ ; PI -  $0.22 \pm 0.11$ ; IR -  $0.13 \pm 0.01$ ), which indicates the therapeutic and prophylactic effect of the optimal complex. individually selected hygiene products and other therapeutic and preventive measures with dynamic observation according to the first protocol throughout the entire period of orthodontic treatment. In the second group of patients who followed the second protocol, only 11 (36.67%) patients had a good condition of periodontal tissues at the 3rd month of orthodontic treatment, and 19 (63.33%) patients had a satisfactory condition. After 6 months, good condition of periodontal tissues was found in 10 (33.33%) patients, and satisfactory – in 20 (66.66%). From 9 months until the end of complex treatment, the results on average corresponded to the

assessment after 6 months. After removal of the equipment, only 12 (40%) patients showed good condition of periodontal tissues, confirmed by gingival coefficients (GI -  $0.15 \pm 0.05$ ; PMA -  $2.62 \pm 0.13\%$ ; IPC -  $85.71 \pm 1.74\%$ ; GZDB -  $0.62 \pm 0.05$ ; ICH -  $0.46 \pm 0.05$ ; PI -  $0.07 \pm 0.01$ ; ) patients had a satisfactory condition (GI -  $1.05 \pm 0.05$ ; RMA -  $11.31 \pm 1.79\%$ ; IPC -  $50 \pm 0\%$ ; GZDB -  $1.21 \pm 0.86$ ; HPI -  $1.3 \pm 0.02$ ; PI -  $0.22 \pm 0.11$ ; IR -  $0.13 \pm 0.01$ ). The results of orthodontic treatment of patients in two groups showed that all patients, after removal of fixed orthodontic equipment, had a harmonious smile, profile, normal symmetrical shape, size, ratio of the dentition of the upper and lower jaws and multiple fissure-tubercle contacts between antagonist teeth. For stability of the result, after removal of the fixed equipment, fixed retainers made of a .0175" Tripleflex orthodontic arch and composite material were fixed to the upper and lower jaws.

#### Conclusion.

Thus, orthodontic treatment with modern orthodontic devices worsens the hygienic condition of the organs and tissues of the oral cavity and requires patients to undergo an optimal set of individually selected

hygiene products and other therapeutic and preventive measures with dynamic monitoring every 2 weeks after installation of orthodontic equipment in the first 3 months of orthodontic treatment and beyond. every 3 months using basic and auxiliary hygiene products. The effectiveness of hygienic measures in the oral cavity during orthodontic treatment of patients with periodontal pathology depends on the "doctor-patient match" and the doctor's responsibility in achieving the goal.

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**FIXATION OF REMOVABLE DENTURES ON TELESCOPIC CROWNS****Hasanova V.***Department of Orthopedic Dentistry assistant***Abdulazimova G.***Department of Orthopedic Dentistry Assistant***Rustamov E.***Doctor of Philosophy in Medicine, Assistant**Azerbaijan Medical University,**Baku, Azerbaijan*<https://doi.org/10.5281/zenodo.13863119>**Abstract**

Modern dentistry offers a large number of different types of prostheses for restoring damaged teeth - the doctor selects the necessary design for each patient. Many patients have heard about telescopic dentures, but do not quite understand what they are - in this article we will try to explain how telescopic dentures differ from conventional ones. There are removable and fixed (bridges, implants) dentures. Telescopic crowns are removable. Despite the fact that permanent structures, due to their name, may seem more durable, telescopic fastening of a denture in the oral cavity can last a very long time and provide a complete replacement of a lost tooth.

**Keywords:** removable dentures, telescopic crowns, diagnostic models, digital radiography.

Currently, information technologies are increasingly penetrating various areas of medicine, including dentistry. And we are not talking about the banal use of a computer as a typewriter. Computer power is actively used at the stages of diagnostics (scanned diagnostic models, digital radiography and photography) and prosthetics. To justify the use of various types of orthopedic structures, mathematical modeling methods are widely used. Their essence lies in predicting the results of medical intervention when calculating the stress-strain states of the organs of the dental system, dentures or crowns. In this work we will talk about telescopic crowns. The finite element method [1, 4] is a numerical method also intended for solving partial differential equations that arise when solving problems of mathematical physics. The method is widely used to solve problems in the mechanics of a deformable solid, as well as for problems of heat transfer, hydrodynamics and electrodynamics. As the name of the method suggests, its essence lies in finding a solution on a discretized area - dividing the original area into many subdomains (elements). For each element, the type of approximating function is selected (in the simplest case, a polynomial of the 1st degree). These functions are null outside the scope of their element. The matching conditions are also met - equality of the values of the approximating functions at the boundaries of the elements (at nodes). These matching conditions also make it possible to determine the coefficients of the approximating functions on their elements. A system of algebraic equations is compiled and solved. Since each function is limited to the domain of its element, the system is usually sparse, which makes it easier to solve.

The purpose of the study is to evaluate the cone retention force for the considered physical model of the crown. The holding force occurs when the crowns are pressed against each other; the inner cone fits like a wedge into the outer one. In this case, a significant pressure force appears on the surface of the cone, which is directed perpendicular to the surface - a normal force, which also determines the magnitude of the friction

force. The stronger the components of the crown are pressed against each other, the greater the holding force will be generated and the more securely the crown will be fixed.

**Material and methods.**

In the numerical experiment we will perform several variants of calculations: for different angles and for different loads. We will vary the angles from 40 to 120 in increments of 2. On average, the human jaw creates a load of about 108 Pa when chewing. All options for parameters of a numerical experiment are specified in the problem.xml parameter file. We will generate the area and perform calculations for each pair (angle-load) of a specific parameter value. To generate the area and mesh we will use the free-software package Gmsh. To carry out the calculations, we will use the open-source tool FEniCS [3], which is designed to solve problems described by partial differential equations using the finite element method. Results. For all loads and angles, the maximum values of the resulting holding force are presented. The magnitude of the inclination angle of the cone generatrix is inversely proportional to the magnitude of the resulting holding force. In practice, it is not recommended to use angles greater than 6° for telescopic conical crowns.

**Conclusion.** The main results of this work are as follows. To solve the boundary problem of elasticity theory in a domain of complex shape, a numerical method based on the finite element method was constructed. The design of telescopic cone-shaped crowns was modeled. A Python program was developed for the simulation. Based on modeling, the influence of the geometric parameters of the crown on the holding force was assessed. In general, it has been established that for cone-shaped crowns it is not worth choosing an angle greater than 6°, since for large angles the holding force decreases sharply.

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**IS DOMESTIC VIOLENCE FREQUENTLY ENCOUNTERED IN THE WORK OF MEDICS IN THE EMERGENCY MEDICAL CARE CENTER****Todorova D.***Assistant Professor, PhD, Doctor of Medicine  
Trakia University, Stara Zagora, Bulgaria***ДОМАШНО НАСИЛИЕ ЧЕСТО СРЕЩАНО ЛИ Е ПРИ РАБОТАТА НА МЕДИЦИТЕ В  
ЦЕНТЪР ЗА СПЕШНА МЕДИЦИНСКА ПОМОЩ****Тодорова Д.***Асистент, доктор по медицина  
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<https://doi.org/10.5281/zenodo.13863131>***Abstract**

Домашното насилие е цикъл от физическо, сексуално, словесно, емоционално или икономическо нахлуване, което се повтаря все по-често и обикновено се реализира срещу жена от нейния партньор (съпруг или интимен партньор) или друг роднина (пълнолетно дете и др.) с цел придобиване на власт, контрол и надмощие над пострадалата.

**Анотация**

Домашното насилие се счита за форма на дискриминация спрямо жените, тъй като засяга пропорционално повече жени, отколкото мъже. Освен това, домашното насилие трябва да бъде разглеждано в по-широк контекст от този на междуличностните отношения, тъй като насилствените отношения, от които основно жените страдат от мъже, не са основният проблем.

**Keywords:** domestic violence, medical personnel, victim**Ключови думи:** домашно насилие, медицински лица, жертва**ВЪВЕДЕНИЕ**

Домашното насилие е всеки акт на физическо, сексуално, психологическо, емоционално или икономическо насилие, както и опитът за такова насилие, принудителното ограничаване на личния живот, личната свобода и личните права, извършени спрямо лица, които се намират в родствена връзка, които са или са били в семейна връзка или във фактическо съпружеско съжителство. Актът се счита за домашно насилие независимо дали е извършен между настоящи или бивши съпрузи; настоящи партньори във фактическо съпружеско съжителство; роднини от първа степен (деца и родители); роднини от втора степен (внуци, баби и дядовци, сестри и братя); роднини по съребрена линия (чичовци, лели, племенници, племеннички, братовчеди); както и свекър, свекърва, тъст, тъща и зет или снаха; от настойник/приемен родител; от лице, което има общо дете с пострадалия, от възходящ или низходящ на лицето, с което пострадалият се намира във фактическо съжителство, от настоящ или бивш партньор в съжителство на родител и дали деецът споделя или е споделял с пострадалия общо (самостоятелно) домакинство.

Смята се, че домашното насилие се подкрепя и от други форми на дискриминация, с които жените се сблъскват на пазара на труда, в публичното пространство, в медиите и др.

Домашното насилие е цикъл от физическо, сексуално, словесно, емоционално или икономическо нахлуване, което се повтаря все по-често и обикновено се реализира срещу жена от нейния партньор (съпруг или интимен партньор)

или друг роднина (пълнолетно дете и др.) с цел придобиване на власт, контрол и надмощие над пострадалата.

Властта и контролът върху пострадалия от домашно насилие са особени характеристики на домашното насилие и го отличават от другите актове на насилие. Затова, за да се помогне на пострадалите от домашно насилие да излязат безопасно от връзката си, е необходимо не само да се разбере явлението домашно насилие, но и да се създават стратегии за безопасен изход и да се осигуряват държавно гарантирана защита и помощ на пострадалите.

Домашното насилие е всеки акт на насилие, независимо дали между настоящи или бивши съпрузи, настоящи или бивши партньори във фактическо съпружеско съжителство, роднини от първа степен (деца и родители), роднини от втора степен (внуци, баби и дядовци, сестри и братя), роднини от трета степен (чичовци, лели, племенници, племеннички, братовчеди), както и роднини по сватовство (зет и зет или снаха; зет и снаха; закон), от настойник/приемен родител или от лице, което има дете с пострадалия, от възходящ или низходящ на съжителстващия, от настоящ или бивш съжител на родител и независимо дали извършителят споделя или е споделил общо (несемейно) домакинство с пострадалия. Разграничават се три форми на домашно насилие – физическо насилие, съпротивително насилие и нефизическо насилие. И има четири вида домашно насилие - физическо, емоционално, сексуално и икономическо насилие.

Много хора не разпознават някои или всички форми или видове домашно насилие. Разбирането им за това какво е домашно насилие зависи от тяхното образование, житейски опит и общността, в която живеят. Пострадалите от домашно насилие обикновено разпознават само една част от насилствените отношения като насилие. Например, те открояват физическото насилие, но не смятат словесното или психологическото насилие за насилие.

Общото разбиране за домашното насилие е много важно за постигане на по-ефективна реакция от правоприлагащите институции на домашното насилие и за повишаване на осведомеността сред широката общественост, че всяка форма или вид домашно насилие не е приемлива и е незаконна.

Ясното послание към обществеността от органите на реда за споделено разбиране на домашното насилие и неговата незаконосъобразност ще насърчи много пострадали да се дистанцират от насилието и да потърсят помощ.

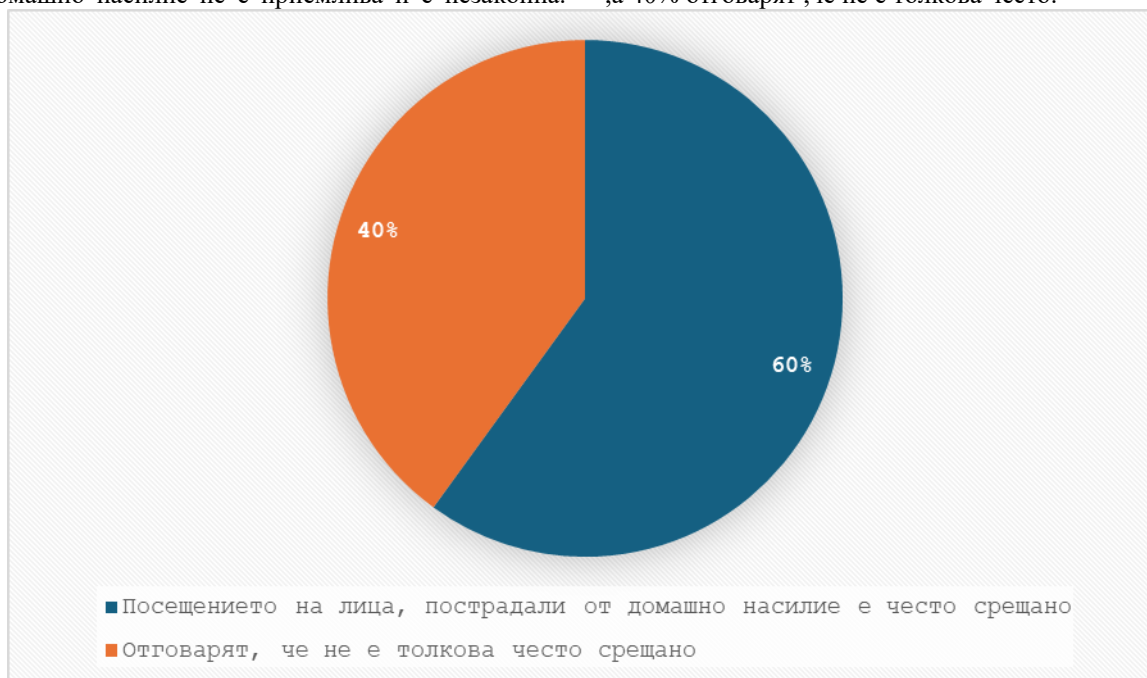
#### МАТЕРИАЛИ И МЕТОДИ

Проведено бе проучване чрез анкета и пряка анонимна анкета с 100 работещи в ЦСМП през м. март 2024г.

Резултатите са обработени с Microsoft Office Excel 2016.

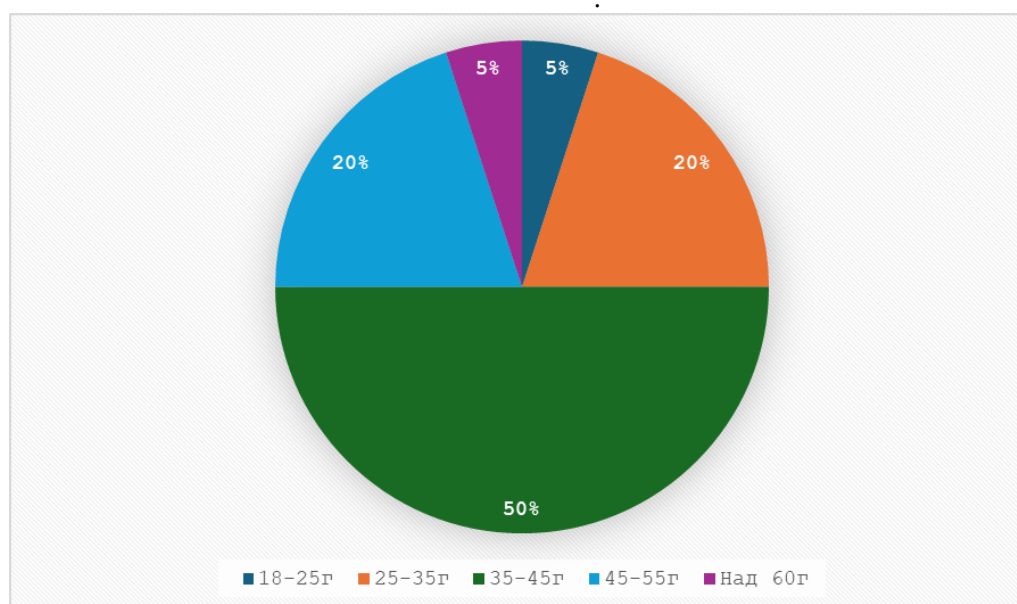
#### АНАЛИЗ НА РЕЗУЛТАТИТЕ

60% от анкетираните медицински лица отговарят че посещенията на лица пострадали от домашно насилие е често срещано в тяхната работа ,а 40% отговарят ,че не е толкова често.



На въпроса на каква възраст е най-често насилник 5% отговарят че са на възраст 18-25

години, 20% на възраст 25-35 год., 20% на 45-55 години, 50% на възраст 35-45, над 60 год. - 5%



От данните от анкетата се оказва, че най-често насилника е на възраст 35-45 години. На въпроса кой по-често е подложен на домашно насилие мъжете или жените анкетирани отговарят 95% жени и 5% мъже. На въпроса къде най-често се извършва насилието анкетирани медици отговарят 5% на работното място на жертвата, 5% на улицата, 90% отговарят в дома. На въпроса насилника дали е употребил алкохол опойващи наркотични вещества 95% отговарят че са употребили и само 5% отговарят че не са употребили. Оказва се от анкетата, че когато насилника напада жертвата си е под влияние на алкохол и опойващи наркотични вещества.

### ЗАКЛЮЧЕНИЕ

Домашно насилие представляват такива действия, когато един член на семейство, настоящ или бивш партньор се опитва да упражнява насилие или оказва психически тормоз върху другия партньор или член на семейството.

Домашното насилие се извършва от и спрямо лица, които се намират в родствена връзка или във фактическо съпружеско съжителство. Домашното насилие може да се отнася за насилие на един от съпрузите спрямо другия, когато се намират в брачна връзка, родител върху дете, но също и на партньор върху партньор, когато лицата нямат сключен брак. Домашно насилие може да се наблюдава и при лица, които споделят общ дом, например между съквартиранти.

Домашното насилие има различни форми на проява. Може да се изразява във физическо насилие, сексуално малтретиране, психическо малтретиране, заплашване, сплашване, икономическо лишаване, в това число и заплахи за насилие.

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**CLINICAL SYMPTOMS OF TRIGEMINAL NEURALGIA, DIFFERENTIATED SURGICAL TREATMENT OF PATIENTS AND ASSESSMENT OF QUALITY OF LIFE****Mirzaev A.**

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ORCID ID: <https://orcid.org/0009-0000-1986-136X><https://doi.org/10.5281/zenodo.13863146>**Abstract**

The article on the occurrence of trigeminal neuralgia, its surgical treatment, and the history of the development of other methods. Modern diagnostic methods, treatment tactics, determination of the effectiveness of treatment methods. Methods of assessing the quality of life, the impact of a particular treatment method on the quality of life of patients. The analysis of the effectiveness of treatment methods is given. Application of questionnaires and comparative analysis of the results to determine the quality of life before and after the treatment of trigeminal neuralgia.

**Keywords:** neuralgia, trigeminal nerve, neurosurgery, surgical treatment, quality of life, questionnaires.

**Relevance**

Attacks of sharp pain attacks in patients with trigeminal neuralgia primarily affect their psych emotional sphere, sharply worsening their quality of life. During the course of the disease, patients' quality of life will change under the influence of treatment: physical, emotional well-being and social adaptation will improve [1,2,5,8].

With a long-term recurrent course of trigeminal neuralgia, the resulting depressive disorders can lead to immune disorders in patients. In studies, depressive disorders can be observed in 18%-30% of patients with trigeminal neuralgia. It can be both a consequence and a cause of pain. It is assumed that the depressive state improves since it is the cause of increased pain sensitivity in patients with trigeminal neuralgia [1,2,5,8].

At the present stage of development of medicine and the variety of mechanisms of development of pain – the main symptom in the clinic of neuralgia of the trigeminal nerve predetermines various differentiated approaches in surgical treatment [1,2,5,8].

Analysis of literature shows that some authors recommend MVD for young healthy patients taking into account the absence of concomitant somatic pathologies of the body. Conducting mini-invasive through cutaneous neurolysis of the trigeminal nerve in the elderly and patients with concomitant diseases. In case of absence of effect from MVD, partial dissection of the trigeminal nerve can be considered [4,5,8,9].

Quality of life reflects the impact of the disease and treatment on the well-being of the patient and characterizes his physical, emotional and social well-being, which changes under the influence of the disease or its treatment, therefore, scientists of the world have increasingly begun to study [3,6,7,9].

Thus, at the present stage of development of medicine there is still not a single method of treatment leading to the final recovery of patients from neuralgia of the trigeminal nerve. This suggests that we need to work on the pathogenesis of the occurrence and a differentiated approach to the surgical treatment of trigeminal neuralgia. This proves the relevance of scientific research, the lack of consensus on the treatment of the trigeminal nerve makes it in demand.

**Purpose of the study:** Improving the treatment results for patients with trigeminal neuralgia through a differentiated approach, taking into account the severity of the course and assessing the quality of life.

**Material and methods**

The study is based on the results of observations of 168 patients with trigeminal neuralgia who were treated in the hospital of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department from 2019 to 2023.

To establish a diagnosis and choose a treatment method, all patients underwent a comprehensive examination, including clinical, neurological and instrumental research methods.

The quality of life of patients was assessed using the questionnaires "Assessment of the quality of life in trigeminal neuralgia" and "Assessment of pain syndrome in trigeminal neuralgia" developed by the Republican Specialized Scientific and Practical Medical Center for Neurosurgery.

**Results and discussion**

The results of observations of 168 patients with trigeminal neuralgia who were treated in the inpatient department of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department in the period from 2019 to 2023 were studied.

All patients upon admission to the hospital underwent clinical examinations, clinical and instrumental studies to clarify the diagnosis and treatment tactics.

All 168 patients were divided into three groups according to treatment methods, severity of trigeminal neuralgia and somatic status.

The first group included 54 (32.2%) patients who underwent Gasser's node blockade, exeresis of the branches of the trigeminal nerve.

The second group consisted of 56 (33.3%) patients who underwent microvascular decompression surgery using a modified approach proposed by the Republican Specialized Scientific and Practical Medical Center for Neurosurgery for Trigeminal Neuralgia (TN).

The third group consisted of 58 (34.5%) patients who underwent the existing method of microvascular decompression of the trigeminal nerve root.

By age, patients are distributed according to the WHO classification, which provides for the allocation of age groups: young age 14-19 years; younger middle age 20-44 years; older middle age 45-59 years; elderly age 60-74 years; old age 75-89 years.

Distribution of patients by age and gender showed that among the patients, women predominated - 101 (60.2%), there were 67 men (39.8%), which is 1.5 times less than women. The majority of patients 69 (41.5%) were older middle and old age, the maximum number of patients fell on the age group 60-74 years, 51 (30.4%), which is consistent with the data of world scientists.

When examining the somatic status, it was revealed that among 168 patients, 68 (40.5%) had somatic pathology, manifested as arterial hypertension in 52 (31.0%) patients, ischemic heart disease in 13 patients (7.8%). In 18 (11.2%) cases, diabetes mellitus was noted, in 4 (2.6%) patients, liver pathology, and in 1 (0.9%), renal failure. It should be noted that in one and the same patient, a combination of two or more somatic diseases was noted, this was especially characteristic of cardiovascular diseases.

Analysis of provoking factors based on the results of the study showed that almost all patients had: a provoking factor such as chewing and talking in more than 93% of cases, the second place is occupied by the factor of touch - 8% of observations, the rest are cold, brushing teeth, washing, shaving and opening the mouth in less than 5% of cases.

During examination of patients, the following symptoms were identified as the main criteria of trigeminal neuralgia: unilateral paroxysmal facial pain, the presence of a trigger zone in the examined 168 patients, the localization of trigger zones gave the following results, with a total of 32 (19.3%) observations, among 32 patients with the presence of trigger points by localization, the nasolabial triangle ranks first 15 (48.5), the mental area ranks second 8 (24.3%), the frontal-zygomatic region ranks third 2 (9.1%), the remaining zones are the oral cavity, cheek, parotid region, Vale points, neck in the area of the spinous processes of the III-IV cervical vertebrae from 3% to 6% of cases.

We also checked for symptoms of hypertonicity of the masticatory muscles, autonomic disorders, hypesthesia of the innervation zones of individual branches

or the entire half of the face. In this case, we were convinced that trigeminal neuralgia is characterized by the presence of short attacks (2-15 min), which can be repeated frequently (up to 30 times a day). The study of sensitivity disorders in the innervation zone of the trigeminal nerve branches gave the following results.

In our study, out of 168 patients in total, 90 (54%) had sensitivity disorders in the innervation zone of the trigeminal nerve branches: 52.2% of cases of hypesthesia, 40.2% of cases of paresthesia, 6.5% of cases of hyperesthesia, and 1 case of anesthesia as a result of previous surgical interventions. This case was observed among patients in the third group. As a result of multiple exeresis operations, sensitivity in the innervation zone was completely lost, and trophic changes in the facial muscles of the face on the side of the lesion of the trigeminal nerve branches occurred. This patient did not feel pain in the trigeminal nerve innervation zone after MVD, but sensitivity was not restored after destructive surgical interventions.

Vegetative disorders in our patients were observed in 17 (10.5%) cases, of which 50.1% were hyperemia, 33.3% were lacrimation %, salivation 16.6% if we consider by groups 55.6% in the third group, 27.7% in the second group and the least 16.7% in the first group, after treatment vegetative disorders were restored.

Analysis of the examined 168 patients, by the location of the affected branches of the trigeminal nerve showed the following results.

In 131 (78.4%) patients, trigeminal neuralgia was noted on the right, in 33 (19.8%) on the left and in 3 (1.8%) observations on both sides.

In the examined patients in our observations, the second (33.3%) and second + third branches (4.6%) were more often affected and, as noted above, in most cases right-sided neuralgia was noted, which proves its typicality.

Thus, in our observations, 2 branches were most often affected simultaneously 50.9% of patients. The defeat of all three branches was observed in 31.9% and one branch in 17.2%. Most often, the pain syndrome was on the right in 78.4%, on the left in 19.8% and on both sides in 1.8% of cases. The data we obtained from the study of patients are consistent with the literature data of world authors.

Positive results among the 168 patients studied were noted in 164 (97.5%), without changes in 4 (2.5%). The best indicators were in the second and third groups, all patients in these groups received positive results.

This proves the effectiveness of the surgical intervention method with a differentiated approach to the treatment of trigeminal neuralgia, taking into account the somatic status of the patient.

Analysis of the obtained data showed that 87.8% of patients in the second and third groups showed significant improvement, 12.2% showed improvement, no change, in the first group 9.3% showed significant improvement, 83.4% showed improvement, and 4 (7.3%) patients showed no improvement.

In our studies, microvascular decompression of the trigeminal nerve root turned out to be a more effective method of surgical intervention. Those operated on

with microvascular decompression using a modified approach proposed by the Republican Specialized Scientific and Practical Medical Center for Neurosurgery for Trigeminal Neuralgia, using the existing approach of microvascular decompression at the brainstem, since there were 87.8% of patients with significant improvements in the second and third groups out of a total of 168 treated patients.

The use of the questionnaire "Assessment of the quality of life in trigeminal neuralgia" showed that the quality of life in all the studied groups was similar: that is, before the operation, the quality of life, indicators in all groups were low.

After the treatment, the quality of life, indicators immediately began to improve in patients with trigeminal neuralgia, this was especially noticeable in the second and third groups, and positive results were also shown by the treatment in patients of the first group.

The use of the questionnaire "Assessment of pain syndrome in trigeminal neuralgia" showed that the parameters of pain syndrome in the preoperative period in the studied patients in all groups differed from each other with a difference in points.

High indicators were recorded in the first group before the operation, which corresponded to a severe degree of severity of the pain syndrome, and after the treatment in all groups, a decrease in it to an average degree was observed in both the first and second groups, which was noted by the data obtained as a result of using the questionnaires.

In our studies, questionnaires from the Republican Specialized Scientific and Practical Medical Center of Neurosurgery were used to assess the quality of life and pain syndrome in patients with trigeminal neuralgia.

According to the questionnaire "Assessment of pain syndrome in trigeminal neuralgia": a sum of up to 10 points - mild severity of trigeminal neuralgia, 11-21 points - moderate severity of trigeminal neuralgia, 22-32 points - severe severity of trigeminal neuralgia. Assessment of pain syndrome in trigeminal neuralgia according to the questionnaire made it possible to determine in 168 patients mild pain syndrome in 40 (24.4%), moderate pain in 119 (71.3%), severe pain in 9 (5.2%), and in the postoperative period - a complete absence of pain was noted in 164 (97.3%) and in 5 (2.9%) - mild pain syndrome.

According to the questionnaire "Assessment of the quality of life in trigeminal neuralgia": a sum of up to 10 points is a slight deterioration in the quality of life, 11-21 points is a moderate deterioration in the quality of life, 22-33 points is a significant deterioration in the quality of life. Assessment of the quality of life according to the questionnaire in 168 patients with trigeminal neuralgia showed a significant deterioration in the quality of life in the preoperative period in 128 (76.5%) patients, and a deterioration in the quality of life in 40 (24.4%). And in the postoperative period, patients with a significant improvement in the quality of life amounted to 17 (10.4%) and with an improvement - 143 (85.4%), a slight improvement in the quality of life was noted in 7 (4.3%) patients.

## Conclusions

1. The presence of a trigger zone in the examined 168 patients, the localization of trigger zones gave the following results, with a total of 32 (19.3%) observations, among 32 patients with the presence of trigger points by localization, the nasolabial triangle ranks first 15 (48.5), the mental region ranks second 8 (24.3%), the frontal-zygomatic region ranks third 2 (9.1%), the remaining zones are the oral cavity, cheek, parotid region, Vale points, neck in the area of the spinous processes of the III-IV cervical vertebrae from 3% to 6% of cases.

2. In our study, out of 168 patients, 90 (54%) had impaired sensitivity in the innervation zone of the trigeminal nerve branches: 52.2% of cases of hypoesthesia, 40.2% of cases of paresthesia, 6.5% of cases of hyperesthesia, and 1 case of anesthesia as a result of previous surgical interventions.

3. Autonomic disorders in our patients were observed in 17 (10.5%) cases, of which the most were hyperemia (50.1%), lacrimation (33.3%), and salivation (16.6%).

4. Positive results among the 168 patients studied were noted in 164 (97.5%), with no changes in 4 (2.5%). The best indicators were in the second and third groups; all patients in these groups received positive results.

5. Assessment of pain syndrome in trigeminal neuralgia using a questionnaire allowed us to determine mild pain syndrome in 40 (24.4%) patients, moderate pain syndrome in 119 (71.3%), severe pain syndrome in 9 (5.2%), and in the postoperative period, a complete absence of pain was noted in 164 (97.3%) and mild pain syndrome in 5 (2.9%).

6. Assessment of the quality of life using a questionnaire in 168 patients with trigeminal neuralgia showed a significant deterioration in the quality of life in 128 (76.5%) patients in the preoperative period, and a deterioration in the quality of life in 40 (24.4%). In the postoperative period, patients with a significant improvement in quality of life amounted to 17 (10.4%) and with improvement - 143 (85.4%), a slight improvement in quality of life was noted in 7 (4.3%) patients

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**CLINICAL MANIFESTATIONS AND ASSESSMENT OF QUALITY OF LIFE IN THE DIFFERENTIATED TREATMENT OF PATIENTS WITH TRIGEMINAL NEURALGIA****Mirzaev A.***Doctor of Medical Sciences, senior researcher, JSC "NMMC" MA "Kyzyl-Kum", Deputy Director for Personnel and Administrative Issues, Republic of Uzbekistan  
ORCID ID: <https://orcid.org/0000-0002-8216-54>***Boymuradov Sh.***Doctor of Medical Sciences, Professor Vice-Rector for Academic Affairs, Tashkent Medical Academy, Republic of Uzbekistan***Ernazarov O.***Head of the Department of Neurosurgery, Multidisciplinary Clinic, Tashkent Medical Academy, Republic of Uzbekistan*ORCID ID: <https://orcid.org/0009-0007-4465-7660><https://doi.org/10.5281/zenodo.13863222>**Abstract**

The article describes in detail the historical aspects of such a serious disease as trigeminal neuralgia, the dynamic development of methods and techniques of conservative and surgical treatment. In connection with the development of medicine and the emergence of modern diagnostic methods, an analysis and importance for determining the severity of trigeminal neuralgia are given. The advantages of methods for treating trigeminal neuralgia, the validity of a differentiated approach taking into account the severity of the disease is given. Studies of the quality of life of patients using questionnaires, based on the analysis of the data obtained, the choice of a method for treating trigeminal neuralgia and improving the results.

**Keywords:** trigeminal neuralgia, diagnostics, quality of life, differentiated approach, severity of neuralgia.

**Relevance**

Symptoms of trigeminal neuralgia were first described in more detail and its treatment was proposed by John Locke, an English philosopher, philosopher of consciousness, who studied Plato and Aristotle during the English ambassador's wife in 1677 with paroxysmal pain in the face on the right. In order to treat this disease, he prescribed laxatives, after using them for several weeks, he observed a significant reduction in neuralgia attacks [1,2,4,5,7,8,10,12,13].

Then, about a century later, Nicholas Andre in 1756 described the pain syndrome in trigeminal neuralgia and called it "tic doloieux". Andre thought that the occurrence of pain syndrome was associated with facial muscle contractions as a result of irritation of the branches of the trigeminal nerve, due to the production of fluids, based on his hypothesis, he used an alkali solution for local application with the aim of destroying the second branch through the suborbital opening for several days until the root was completely destroyed [1,2,7,8,10,11,13].

Currently, quality of life (QOL), based on the patient's subjective feelings, is an important, and in some situations one of the main criteria for assessing the effectiveness of treatment in clinical trials [3,6,9,13].

A differentiated approach to treating patients, taking into account the severity of trigeminal neuralgia, gives us the opportunity to improve treatment results and quality of life.

**Purpose of the study:** Improving the treatment results of patients with trigeminal neuralgia by a differentiated approach, taking into account the severity of the course and assessing the quality of life.

**Material and methods**

The study is based on the results of observations of 171 patients with trigeminal neuralgia who were treated in the inpatient department of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department in the period from 2019 to 2023.

To establish a diagnosis and choose a treatment method, all patients underwent a comprehensive examination, including clinical, neurological and instrumental research methods.

During the initial examination of patients, as the main criteria for trigeminal neuralgia (TN), attention was paid to the presence of the following symptoms - unilateral paroxysmal facial pain; the presence of a trigger zone; soreness of the Vale points (pressure on which causes an attack), increased pain when eating and talking; a positive effect from treatment with Finley psinom at the initial stages of the disease. The presence of such symptoms as hypertonicity of the masticatory muscles, autonomic disorders, hypesthesia of the innervation zones of individual branches or the entire half of the face were also checked. NTN is characterized by the presence of short attacks (2-15 min), which can be repeated frequently (up to 30 times a day).

We have given an important place in establishing the diagnosis and determining further treatment tactics to magnetic resonance imaging (MRI) data from 1.5 to 3.0 Tesla, by T2 (3D-FIESTA, DRIVE or CISS), time of flight magnetic resonance angiography (MRA) (3D-TOF), as well as contrast enhanced weighted by T1 mode to determine the neurovascular conflict.

In our studies, we used electroneuromyography (ENMG), which determines the level of damage to the nerve branches, i.e., central or peripheral type irritation

with a reliability of 75%, giving us the opportunity, taking into account the level of damage, to choose the tactics of surgical or conservative treatment of trigeminal neuralgia.

The quality of life of patients was assessed using the questionnaires "Assessment of the quality of life in trigeminal neuralgia" and "Assessment of pain syndrome in trigeminal neuralgia" developed by the Republican Specialized Scientific and Practical Medical Center for Neurosurgery.

### Results and discussion

The results of observations of 171 patients with trigeminal neuralgia who were treated in the inpatient department of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department from 2019 to 2023 were studied.

All patients were divided into three groups according to treatment methods, the severity of trigeminal neuralgia, and the state of their somatic status.

The first group included 55 (32.2%) patients who underwent conservative treatment, blockade of the peripheral branches of the trigeminal nerve.

The second group included 57 patients (33.3%) who underwent Gasserian ganglion block and trigeminal nerve branch exeresis. The third group consisted of 59 patients (34.5%) who underwent microvascular decompression of the trigeminal nerve root.

By age, the patients were distributed according to the WHO classification, which provides for the identification of age groups: young age 14-19 years; younger middle age 20-44 years; older middle age 45-59 years; elderly age 60-74 years; old age 75-89 years.

The distribution of patients by age and gender showed that among the patients, women predominated - 103 (60.2%), there were 68 men (39.8%), which is 1.5 times less than women. The majority of patients 71 (41.5%) were of middle-aged and elderly age, the maximum number of patients was in the age group of 60-74 years, 52 (30.4%), which is consistent with the data of world scientists.

When examining the somatic status, it was revealed that among 171 patients, 69 (40.5%) patients had somatic pathology, manifested in the form of arterial hypertension in 53 (31.0%) patients, ischemic heart disease in 13 patients (7.8%). In 19 (11.2%) observations, diabetes mellitus was noted, in 4 (2.6%) patients liver pathology and in 1 (0.9%) renal failure.

An analysis of provoking factors based on the results of the study showed that almost all patients had: provoking factors such as chewing and talking in more than 93% of cases, the second place is taken by the factor of touch - up to 8% of observations, the rest are cold, brushing teeth, washing, shaving and opening the mouth in less than 5% of cases.

During examination of patients, the following symptoms were identified as the main criteria of trigeminal neuralgia: unilateral paroxysmal facial pain, the presence of a trigger zone in 171 patients examined; localization of trigger zones gave the following results, with a total of 33 (19.3%) observations; among 33 patients with trigger points, the nasolabial triangle ranks first in localization 16 (48.5), the mental region ranks second 8 (24.3%), the frontal-zygomatic region ranks

third 3 (9.1%), and the remaining zones are the oral cavity, cheek, parotid region, Vale points, neck in the area of the spinous processes of the III-IV cervical vertebrae from 3% to 6% of cases.

We also checked for symptoms of hypertonicity of the masticatory muscles, autonomic disorders, and hypoaesthesia of the innervation zones of individual branches or the entire half of the face. In this case, we were convinced that trigeminal neuralgia is characterized by the presence of short attacks (2-15 min), which can be repeated frequently (up to 30 times a day). The study of sensitivity disorders in the innervation zone of the trigeminal nerve branches gave the following results.

In our study, out of 171 total, 92 (54%) patients had sensitivity disorders in the innervation zone of the trigeminal nerve branches: 52.2% of cases of hypaesthesia, 40.2% of paresthesia, 6.5% of hyperaesthesia, and 1 observation of anesthesia as a result of previous surgical interventions. This case was observed among patients in the third group. As a result of multiple exeresis operations, sensitivity in the innervation zone was completely lost, and trophic changes in the facial muscles on the side of the lesion of the trigeminal nerve branches occurred.

Vegetative disorders in our patients were observed in 18 (10.5%) cases, of which 50.1% were hyperemia, 33.3% were lacrimation, 16.6% were salivation, if we consider by groups 55.6% were in the third group, 27.7% were in the second group, and the least were 16.7% in the first group. After treatment, vegetative disorders were restored.

Analysis of the 171 patients examined, by the location of the affected branches of the trigeminal nerve, showed the following results.

134 (78.4%) patients had trigeminal neuralgia on the right, 34 (19.8%) on the left, and in 3 (1.8%) observations on both sides.

In our observations, the second (33.3%) and second + third branches (4.6%) were most often affected in the patients under study, and, as noted above, right-sided neuralgia was noted in most cases, which proves its typicality.

Thus, in our observations, 2 branches were most often affected simultaneously in 50.9% of patients. Damage to all three branches was observed in 31.9% and one branch in 17.2%. Most often, the pain syndrome was on the right in 78.4%, on the left in 19.8% and on both sides in 1.8% of cases. The data we obtained from the study of patients are consistent with the literature data of world authors.

Positive results among the 171 patients under study were noted in 163 (95.0%), without changes in 8 (5.0%). The best indicators were in group 3, all patients in this group received positive results. This proves the effectiveness of the surgical intervention method with a differentiated approach to the treatment of trigeminal neuralgia, taking into account the somatic status of the patient.

Analysis of the obtained data showed that 87% of patients in the third group showed significant improvement, 13% showed improvement, no change, in the second group 25.5% showed significant improvement,

66.7% showed improvement, in the first group only 9.2% showed significant improvement, 83.3% showed improvement, in the first and second groups no change in almost equal proportions in more than 7% of cases.

In our studies, microvascular decompression of the trigeminal nerve root at the brainstem turned out to be a more effective surgical intervention method, since 87% of the total number of patients treated in this group showed significant improvement. In our studies, questionnaires from the Republican Specialized Scientific and Practical Medical Center of Neurosurgery were used to assess the quality of life and pain syndrome in patients with trigeminal neuralgia.

The use of the questionnaire "Assessment of the quality of life in trigeminal neuralgia" showed that the quality of life in all the study groups was similar: that is, before the operation, the quality of life, indicators in all groups were low.

After the treatment, the quality of life, indicators immediately began to improve in patients with trigeminal neuralgia, this was especially noticeable in the third group, and positive results were also shown by patients in the second and first groups.

The use of the questionnaire "Assessment of pain syndrome in trigeminal neuralgia" in the third period showed that the parameters of pain syndrome in the preoperative period in the studied patients in all groups differed from each other with a difference in points.

High indicators were recorded in the first group before the operation, which corresponded to a severe degree of severity of the pain syndrome, and after the treatment in all groups, a decrease in it to an average degree was observed in both the first and second groups, which was noted by the data obtained as a result of using the questionnaires.

Analyzing the anamnestic data of these patients, I would like to draw attention to the following points indicating the complexity of diagnosing the disease and, accordingly, incorrect treatment of patients. Thus, out of 5 patients with neuralgia of the first branch, 3 had previously been diagnosed with migraine, and appropriate therapy was carried out. However, the most difficult and causing certain damage to health are neuralgias of the 3rd or third branch. Almost all patients of the second group (57) consulted dentists about toothache.

Almost all patients underwent therapy at dentists, including tooth extraction. Further progression of pain allowed us to correctly establish a diagnosis and subsequently carry out therapy for the underlying disease.

According to the questionnaire "Assessment of pain syndrome in trigeminal neuralgia": a sum of up to 10 points - mild severity of trigeminal neuralgia, 11-21 points - moderate severity of trigeminal neuralgia, 22-32 points - severe severity of trigeminal neuralgia. Assessment of pain syndrome in trigeminal neuralgia according to the questionnaire made it possible to determine in 171 patients mild pain syndrome in 41 (24.4%), moderate pain in 121 (71.3%), severe pain in 9 (5.2%), and in the postoperative period - a complete absence of pain was noted in 166 (97.3%) and in 5 (2.9%) - mild pain syndrome.

According to the questionnaire "Assessment of the

quality of life in trigeminal neuralgia": a sum of up to 10 points is a slight deterioration in the quality of life, 11-21 points is a moderate deterioration in the quality of life, 22-33 points is, a significant deterioration in the quality of life. Assessment of the quality of life according to the questionnaire in 171 patients with trigeminal neuralgia showed a significant deterioration in the quality of life in the preoperative period in 130 (76.5%) patients, and a deterioration in the quality of life in 41 (24.4%). And in the postoperative period, patients with a significant improvement in the quality of life amounted to 18 (10.4%) and with improvement - 146 (85.4%), a slight improvement in the quality of life was noted in 7 (4.3%) patients.

### Conclusions:

1. Trigger zones in 171 patients in only 33 cases (19.3%) of observations, among 33 the following were revealed: nasolabial triangle 16 (48.5), mental region 8 (24.3%), frontal-zygomatic region 3 (9.1%), other zones such as oral cavity, cheek, parotid region, Valsalva points, neck in the area of spinous processes of III-IV cervical vertebrae from 3% to 6% of cases.

2. In our study, out of 171 total, 92 (54%) patients had impaired sensitivity in the innervation zone of the trigeminal nerve branches 52.2% of cases of hypesthesia, 40.2% of paresthesia, hyperesthesia 6.5% and 1 observation of anesthesia as a result of previous surgical interventions.

3. Vegetative disorders were observed in 18 (10.5%) cases in our patients, of which 50.1% were hyperemia, 33.3% were lacrimation, 16.6% were salivation.

4. Positive results after treatment of 171 patients were noted in 163 (95.0%), no changes in 8 (5.0%), which proves that all methods of treating neuralgia are quite effective when used in a differentiated manner.

5. Assessment of pain syndrome in trigeminal neuralgia using a questionnaire allowed us to determine mild pain syndrome in 171 patients in 41 (24.4%), moderate pain in 121 (71.3%), severe pain in 9 (5.2%), and in the postoperative period, a complete absence of pain was noted in 166 (97.3%) and 5 (2.9%) had mild pain syndrome.

6. Assessment of the quality of life using a questionnaire in 171 patients with trigeminal neuralgia showed a significant deterioration in the quality of life in 130 (76.5%) patients in the preoperative period, and a deterioration in the quality of life in 41 (24.4%). And in the postoperative period, patients with a significant improvement in the quality of life amounted to 18 (10.4%) and with an improvement - 146 (85.4%), a slight improvement in the quality of life was noted in 7 (4.3%) patients.

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**THE INFLUENCE OF DIFFERENTIATED SURGICAL TREATMENT ON THE QUALITY OF LIFE OF PATIENTS WITH HERNIAS OF THE LUMBAR SPINE****Mirzaev A.**

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ORCID ID: <https://orcid.org/0009-0001-8664-5939><https://doi.org/10.5281/zenodo.13863239>**Abstract**

The article of data on the effectiveness of modern methods of treatment of intervertebral hernias of the lumbar spine is presented. Historical aspects of the development of spinal neurosurgery, the main methods of surgical treatment. This publication presents the main methods of surgical treatment of herniated intervertebral disc, characterizes the positive and negative aspects of each method. A differentiated approach to the treatment of intervertebral disc herniations in the lumbar spine. Assessment of quality of life and pain syndrome using questionnaires. Determining the effectiveness of surgical treatment and the impact on the quality of life of patients.

**Keywords:** diagnostics, herniated disc, surgical treatment, conservative treatment, differentiated an approach.

**Relevance**

Lumbar intervertebral disc herniations have a significant impact on the lives of patients. Pain syndrome arising from intervertebral disc herniations limits a person's ability to work fully in up to 70% of cases and dramatically worsens the quality of life of patients [1,2,4,12].

In order to more accurately measure the subjective sensations of patients, various scales and questionnaires have been developed, and it is of great importance that these questionnaires and scales were filled in by the patients themselves or, in exceptional cases, from their words. In addition, various standardized questionnaires are filled in to more accurately determine the condition of patients. The use of standardized questionnaires makes it possible to comparatively evaluate the results of treatment, predict the outcome of surgery, determine risk groups and adequately select patients [5,6,7,10,12].

According to the literature, back pain in patients may be different and depend on the type of root compression in intervertebral disc herniations; pain occurs due to mechanical compression of the spinal nerve roots by a fallen fragment of the intervertebral disc pulp nucleus [3,8,9,11,12].

When diagnosing with MRI, it is easy to determine root compression. Nerve compression leads to deterioration of their blood supply, and, consequently, to the development of ischemia and damage. However, there are often situations in which clinical and electrophysiological symptoms of radiculopathy are detected in patients without characteristic changes according to MRI data. In some cases, MRI reveals root deformation, but there is no substrate for their compression [6,12].

The results of clinical and laboratory studies indicate that the cause of pain is often inflammatory changes in the nerve roots, and not just mechanical compression. In lumbar stenosis, which is the second most common cause of planned spinal surgeries, the mechanical factor is of decisive importance. Degenerative changes in the disc with its protrusion and decrease in height, together with deformation of the arches, vertebral processes and joints, as well as compaction and hypertrophy of the yellow and posterior longitudinal ligaments lead to direct compression or ischemia of the nerve roots [1,2,6,12].

Currently, the quality of life is assessed by various scales and questionnaires. For a complete study of the quality of life of patients, it is of great importance to assess the overall quality of life, quality of life by disease and symptom of the disease [5,10].

Thus, the issue of differentiated surgical treatment of intervertebral disc herniations remains not fully resolved. Pain syndrome arising from intervertebral disc herniations sharply reduces the quality of life of patients.

**Purpose of the study:** improving the results of treatment of patients with lumbar spine hernias by using differentiated treatment tactics with an assessment of the quality of life.

**Material and methods**

The study is based on the results of observations of 165 patients with lumbar pain who were treated in the inpatient department of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department from 2019 to 2023.

To establish a diagnosis and choose a treatment method, all patients underwent a comprehensive examination, including clinical, neurological and instrumental research methods.

In our studies, questionnaires were used to assess the quality of life of patients: the European Quality of Life Questionnaire Euro QoL-5D and a visual analogue scale (VAS) to determine the intensity of pain.

### Results and discussion

The results of observations of 165 patients with lumbar pain who were treated in the inpatient department of the Tashkent Medical Academy, a multidisciplinary clinic, and the neurosurgery department from 2019 to 2023 were studied.

All patients were divided into three groups according to treatment methods, severity of lumbar osteochondrosis pain syndrome, and somatic status.

The first group included 53 (32.2%) patients who underwent conservative treatment, blockades, physiotherapy, and other treatment methods. The second group included 55 (33.3%) patients who underwent endoscopic methods of removing a herniated disc between the 4-5 and 5-1 sacral vertebrae of the lumbar spine. The third group consisted of 57 (34.5%) patients who underwent surgery to remove a herniated disc using intralaminar access.

By age, patients are distributed according to the WHO classification, which provides for the allocation of age groups: young age 14-19 years; younger middle age 20-44 years; older middle age 45-59 years; elderly age 60-74 years; old age 75-89 years; In our observations, patients were aged from 24 to 79 years.

Distribution of patients by age and gender showed that among the patients, men predominated, there were 116 (70.2%), and women - 49 (29.8%), which is associated with the physical exertion of men during work. The majority of patients 68 (41.5%) were older middle and old age, the maximum number of patients fell on the age group 60-74 years, 50 (30.4%), which is consistent with the data of world scientists.

Examination of the somatic status revealed that out of 165 patients, 67 (40.5%) had somatic pathology, manifested as arterial hypertension in 51 (31.0%) patients, ischemic heart disease in 13 patients (7.8%). Diabetes mellitus was noted in 18 (11.2%) observations, liver pathology in 4 (2.6%) patients and renal failure in 1 (0.9%). It should be noted that a combination of two or more somatic diseases was noted in the same patient, this was especially typical for cardiovascular diseases.

In our studies, 112 (67.8%) of 165 patients underwent surgical treatment, the indications for surgical treatment were: cauda equina syndrome with increasing dysfunction of the pelvic organs and radiculo-ischemic manifestations; duration of radicular pain syndrome or pain in the lumbar region for at least 4 weeks; intervertebral disc herniation of any localization, but only at one level, confirmed by MRI with axial sections; lack of effect from conservative treatment.

Neurological symptoms in the second and third groups in total 173 cases, they could combine several symptoms at once in one patient in both groups. The most frequent complaint presented by patients of the second and third groups was pain in the lumbar spine

38 cases, the second most frequent complaint was gait disturbance and sensory disturbance 36 cases each, the third most common complaint was a forced body position due to pain syndrome 27 cases.

Analysis of the level of damage to the roots of the equine tail in the studied 165 patients showed the following results, twice as much observation at the level of LV-SI 106 (64.3%) compared to LIV-LV 59 (35.7%) this is due to the greatest load on the lumbar spine associated with a low-mobility sacrum.

Positive results among the 165 patients studied were noted in 156 (95.6%), without changes in 9 (5.4%). The indicators in all 3 groups were good, since a differentiated approach to the treatment of patients with lumbar pain is always justified.

This proves the effectiveness of treatment methods for patients with lumbar disc herniations using a differentiated approach.

The quality of life, study of 165 patients was achieved using the European Quality of Life Questionnaire EuroQoL-5D and a visual analogue scale (VAS) to determine the intensity of pain.

In all study groups, the parameters of the EuroQoL-5D questionnaire such as pain/discomfort and anxiety/depression worsened the most. The study of the quality of life of patients in all groups was conducted before and after surgical treatment.

Analysis of the results of the quality of life (QOL) study of 165 patients showed that the data obtained in all three groups are different, the deterioration of the QOL indicators of the first group does not differ much from normal, in the second group it was revealed that the QOL indicators of patients moderately worsened, in the third group this indicator of the QOL of patients worsened greatly and slowly recovered, this is due to the course of the disease and degenerative changes in osteochondrosis of the spine with concomitant somatic pathology.

The pain/discomfort and anxiety/depression descriptors were deviated from the norm to a greater extent in the second and third groups and were slowly restored, the QOL indicators of the patients of the first group returned to normal immediately after surgical treatment.

A study of 165 patients showed that the QOL parameters pain/discomfort and anxiety/depression suffer the most, this is facilitated by the emotional state of patients.

Pain syndrome as a strong irritant primarily affects the emotional state of patients, being a provoking factor in the deterioration of the QOL of patients.

For a full assessment of the QOL of patients, it is necessary to use two or more questionnaires covering more impaired descriptors and indicators. To study the parameters of pain syndrome, we used a scale (VAS) for the completeness of the study.

VAS scores before surgery revealed mild pain (1-3 points) in 20 (37.7%) patients in the first group, moderate pain (4-6 points) in 7 (13.2%), mild pain in 21 (38.2%) patients in the second group, moderate pain in 33 (60%), very severe pain (7-9 points) in one patient, unbearable pain (10 points) in one patient, mild pain in 6 (11%) patients in the third group, moderate pain in 42

(73.6%), very severe pain in 8 (14%), and unbearable pain in 1 (2%) patient.

After surgery, pain syndrome regressed to the point of disappearance in all three groups, mild pain persisted only in two patients in the first group, one patient in the second group, and four patients in the third group, which proves the effectiveness of treatment methods with a differentiated approach.

The visual scale and its five parameters allow a more detailed examination of the pain syndrome: no pain (0 points), mild pain (1-3 points), moderate pain (4-6 points), very severe pain (7-9 points), unbearable pain (10 points), which means the maximum possible sensation of pain syndrome.

#### Conclusions:

1. Distribution of patients by age and gender showed that among the patients, men predominated, there were 116 (70.2%), and women - 49 (29.8%), which is associated with the physical exertion of men during work. The majority of patients 68 (41.5%) were of middle and old age, the maximum number of patients fell on the age group 60-74 years, 50 (30.4%), which is consistent with the data of world scientists.

2. Analysis of the level of damage to the roots of the equine tail in the studied 165 patients showed the following results, twice as many observations at the level of LV-SI 106 (64.3%) compared to LIV-LV 59 (35.7%), this is due to the greatest load on the lumbar spine associated with a low-mobility sacrum

3. When examining the somatic status, it was revealed that among 165 patients, 67 (40.5%) patients had somatic pathology, manifested in the form of arterial hypertension in 51 (31.0%) patients, ischemic heart disease in 13 patients (7.8%). In 18 (11.2%) observations, diabetes mellitus was noted, in 4 (2.6%) patients, liver pathology, and in 1 (0.9%), renal failure.

4. In our study, 112 (67.8%) of 165 patients underwent surgical treatment. The indications for surgical treatment were: cauda equina syndrome with increasing dysfunction of the pelvic organs and radiculo-ischemic manifestations; duration of radicular pain syndrome or pain in the lumbar region for at least 4 weeks; herniated disc of any localization, but only at one level, confirmed by MRI with axial sections; lack of effect from conservative treatment.

5. Positive results among the 165 patients studied were noted in 156 (95.6%), unchanged in 9 (5.4%). The indicators in all three groups were good, since a differentiated approach to the treatment of patients with lumbar pain is always justified.

6. The VAS scores before surgery revealed mild pain (1-3 points) in 20 (37.7%) patients in the first group, moderate pain (4-6 points) in 7 (13.2%) patients, mild pain in 21 (38.2%) patients in the second group, moderate pain in 33 (60%) patients, very severe pain (7-9 points) in one patient, and unbearable pain (10 points) in one patient, and mild pain in 6 (11%) patients in the third group, moderate pain in 42 (73.6%) patients, very severe pain in 8 (14%) patients, and unbearable pain in 1 (2%) patients.

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# PEDAGOGICAL SCIENCES

## THE INNOVATIVE POSITION OF DISTANCE LEARNING IN THE HIGHER EDUCATION SYSTEM

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### Abstract

Compared to traditional forms of education, distance education optimally develops students' independence, activity, awareness, and creativity, effectively solves the strategic issues facing modern teacher training in the information society. The irreplaceable role and place of increasing the quality and efficiency of higher education also highlights the relevance of distance education. It is also advantageous in terms of creating the same opportunity for them to study regardless of their place of residence, health status, standard of living and financial support. On the other hand, distance learning is also very cost-effective. It provides an opportunity to study without incurring additional costs (transportation, housing and other costs).

These factors indicate the importance and relevance of the topic chosen for research. Integration into the world, globalization, rapid information processes cause significant changes in all areas of modern society and increase the role of human capital as the main factor in the successful development of the state. Changes in the education system, especially in higher education, the need for capable, competitive specialists who can meet the needs of society and the state, along with their self-education, have also brought up the issue of informatization of education.

The application of distance education technologies in all areas was the focus of national leader Heydar Aliyev's attention years ago as an urgent issue, and in this regard, he adopted the "National Strategy on Information and Communication Technologies for the Development of the Republic of Azerbaijan" covering the years 2003-2012 [5]. . As a continuation of this, the declaration of 2013 as the "Year of Information and Communication Technologies" in the Republic of Azerbaijan by the head of the country, Mr. Ilham Aliyev, and the laying of the foundation of the University of Information Technologies are among the steps aimed at the informatization of the society and, accordingly, the training of educated and competent specialists.

At the same time, starting from 2007-2008, Azerbaijan State Pedagogical University started using electronic test technologies for innovative development of education, current and final evaluation of education quality. With the joint initiative of the university's administrative, professor and teaching staff, technical specialists, the holding of test exams became more organized, which gave students the opportunity to check their knowledge more accurately using electronic resources [2].

In addition, the experience of Azerbaijan on the informatization of education was presented at the "ITU World Telecom 2009" forum held in Geneva from October 5 to 9, 2009. At the events held in connection with this forum, representatives of many countries were informed about the creation of the Azerbaijan Education Network (AZEDUNET), the Information and Resource Center, the "Electronic School", as well as the National Education Program, and the achievements of the country in the field of application of information technologies were demonstrated [6, p. 125].

The transition to the information society makes the problem of the formation of modern thinking in the new generation even more urgent, creates the need for fundamental changes in education, and creates a fundamental basis for students' adaptation to education and strengthening of distance learning tendencies.

**Keywords:** improvement, information, distance learning, new approaches

In modern conditions, young personnel must master not only the knowledge of their specialty, but also the latest achievements of science and technology, be able to use distance education tools, and search for new sources of information to improve themselves every day [10, p.63].

In recent years, the widespread use of computer technology in education has greatly facilitated the organization of distance education for students. Thus, information and computer technologies optimize educational discipline, distance education, activities, learning foreign languages, independent training, deep learning of professional knowledge, and the educational process of conducting educational work. The use of information technologies allows students to be actively involved in work, to acquire knowledge,

and to increase the level of distance education and professionalism.

Distance education ability is developed during independent activity through information sources, in search of information as an ability determined by the psychological and intellectual indicators of each student.

The main goal of the educational reform implemented in our country is to make distance education and independent activity of students one of the centers of gravity of education. From this point of view, independent, creative thinking, universal knowledge and modern thinking, broad-minded, competitive and enterprising personnel preparation is one of the main goals of the education system [8, p. 236]. In this regard, the main goal of the application of

distance education technologies in education is to create interest in self-education in students, to prepare them for this activity in a systematic, consistent and purposeful way, to instill in them the necessary skills for independent activity. Thus, the introduction of distance learning into the educational environment leads to a radical change in the learning process. Based on this, one of the national priorities in our republic is the informatization of education.

Mr. President puts forward the idea that only if this happens, the young generation can be formed as professional personnel in accordance with the requirements of the time. In his opinion, both material and technical provision and modernization of the learning and teaching process should be done at the same level in every educational institution. Only in this case, it is possible to achieve the desired result. In world experience, even the most prestigious universities are never satisfied with the status they have earned. He is constantly striving for innovation.

Therefore, reforms in higher schools should be permanent. In other words, constantly following scientific innovations, understanding them, establishing mutual relations with higher schools with advanced experience can encourage our education to reach the world level in the true sense of the word [3, p.91].

In the conditions of informatization of education, the main criteria for having the skills of organizing distance education activities can be listed as follows:

- to create an independent problem based on the obtained information or to be able to see the problem in a normal state;
- to propose a method for data analysis, collection and processing;
- draw conclusions and see the possibilities of practical application of the obtained results;
- evaluate the results of their work and prove their correctness;
- to apply the possibilities of information technologies.

Thus, the introduction of distance learning into the educational environment leads to a radical change in the learning process. Based on this, one of the national priorities in our republic is the informatization of education. Even in highly developed countries, the main financial resources are directed to education and training of ICT literate professionals.

Experience shows that the development of distance education-based education plays an important role in solving a number of the following issues:

- increases knowledge and experience to live and operate in modern society;
- bringing new forms and methods to the learning process increases the quality of education;
- gives everyone at any age the opportunity to study and improve their knowledge, etc.

Informatization of education is the process of providing education with modern information technologies, along with theoretical and practical work carried out in educational institutions in the psychological and pedagogical direction. Informatization is an important condition for the

implementation and management of educational activities, and an important factor for the development of society.

The process of distance planning and organization of education in higher education institutions begins with equipping educational institutions with distance education technologies, preparing electronic textbooks and personnel in this field. In the preparation of personnel for the organization and management of the distance education-based learning process, the creation of a teaching-methodical base, the preparation of teaching-methodical literature, and the organization of information infrastructure are important issues.

The President of the Republic of Azerbaijan on the approval of the tasks defined in the field of information and communication technologies and the "Action Plan regarding the declaration of 2013 as the "Year of Information and Communication Technologies" in the Republic of Azerbaijan" based on the "Azerbaijan 2020: Vision of the Future" Development Concept. On March 28, 2013, it adopted Order No. 2815.

As we know, lack of computers is the main factor that slows down the process of planning and organizing distance education in higher education institutions. In accordance with the solution of this problem, the President of the Republic of Azerbaijan, Mr. Ilham Aliyev, approved the "Program for provision of general education schools in the Republic of Azerbaijan with information and communication technologies" by the order dated August 15, 2004. After the implementation of this program, local computer production was stimulated, software for the management of educational institutions was developed, electronic textbook portals were created, many educational institutions were provided with access to the Internet, etc. [6].

The process of remote education plays an important role in improving the quality of education, providing opportunities for students to receive higher education, creating self-education, interest and inclination to study, and training national personnel in the field of ICT as an important strategic issue. ir. Today, the establishment of the Institute of Information Technologies under ANAS, the preparation of intellectual projects based on ICT in various fields, the creation and development of computer networks and systems are among our achievements. In the future, success in education, as well as in other fields, will depend on the development of information and communication technologies and their correct use.

Remote education in higher education institutions provides high-quality educational services in the following content:

- required information remains in memory for a long time;
- teacher's self-education, qualification improvement, attestation, etc. gives favorable opportunities in matters;
- the acquisition of knowledge becomes easier, it creates conditions for the use of rapidly updated information, self-education activities, etc.

As people around the world adapt to new ways of working, studying, and socializing, we see new trends

emerge and evolve. In 2020, FutureLearn commissioned YouGov to conduct global research to explore the future of learning. The main themes of this study were personal development and career aspirations, the power of education and online learning, and expectations for future education. According to research, self-education in the digital age is easier than ever. Much of this is due to round-the-clock news and access to various websites that provide a constant stream of information. Perhaps not surprisingly, social media plays an important role in the organization of distance education. The study found that Millennials (those born between 1981 and 1996) and Generation Z (those born after 1997) use every platform to self-educate. For example, 37% of Generation Z and 22% of Millennials use social networks for learning [99]. Referring to this information, it should be noted that information and communication technologies have an irreplaceable role in the development of self-education.

It is an undeniable fact that the development of human potential and the level of knowledge of countries that pay attention to education and its organization are higher. In recent years, in order to further improve the level of education in our country, schools that meet new modern requirements have been built, the material and technical base of educational institutions has been strengthened, textbooks have been updated, and strategies and concepts that promote the development of education have been adopted. Therefore, according to the level of literacy, Azerbaijan is ahead of many neighboring countries.

Despite the work done in the direction of the development of education, there are still problems that have not been fully resolved. One of them is that distance education, which is specified in the Law "On Education" as a form of education, is not widely applied in the field of higher education. For example, in connection with the coronavirus pandemic, which is one of the important problems of the current year, there was a need for online education in educational institutions. Although the teachers tried to conduct online lessons with programs such as "Teams", "Zoom", "Ekurs.az", they could not achieve the desired results. Despite all the planned efforts, the problems that arise in the first period are the lack of an internet line at the homes of many students, the lack of psychological preparation of teachers and students for online classes, the lack of experience in the field of online communication, the lack of the same skills in using IT equipment, the lack of material and technical bases in higher education institutions and other objectives. was related to factors. However, in developed countries, the distance education system has penetrated the entire sphere of society faster.

For this, in unexpected situations like this, the most important goal and task of all higher education institutions should be to ensure that distance learning classes are as content and quality as face-to-face classes, and their integration. However, we should especially note that in the last two years we have been able to achieve results that we have not achieved in ten years in the field of distance education.

Distance education is one of the forms of continuous education and realizes the rights of people to receive education and information. It expands the educational opportunities of citizens within the country. Distance learning allows schoolchildren, students, unemployed, military and legal entities to benefit from the scientific and educational potential of leading universities, institutes, professional development and professional exchange centers. Distance learning provides conditions for additional education in addition to basic activities and education.

After the spread of the Covid-19 pandemic, teaching in all educational institutions was temporarily suspended from March 3, 2020, in order to prevent the virus. In order to overcome the interruptions in education, a form of distance education has been introduced. Classes are organized through various platforms and applications, teachers conduct training online. Basic in organizing online classes Skype, Zoom, Microsoft Teams programs are widely used [4, p.58].

During the organization of distance education, the solution of additional problems in the organization of the educational process of the university also reveals the following needs:

- creation of a pedagogical theory of lifelong personality development based on the achievements of psychology, sociology, cultural studies, philosophy for the sake of ensuring the unity of learning, education and development processes;
- comprehensive integration of higher education institutions with priority areas of scientific research at the initiative of both state and private organizations;
- comprehensive application of new information technologies in the educational process of the university;
- training of mobile, entrepreneurial, creative thinking specialists who are ready for lifelong, continuous self-education [11].

We analyzed several works to determine the degree of elaboration of the dissertation work. Talibov, Y. "Teachers' self-study program on pedagogy", Mahmudova, R.M. "Possibilities and ways of student independent work in higher school", Hashimova, A.Ş. "The system of self-education of students and young people", Agayev, A.A. "Selected pedagogical works", Ilyasov, M.I. "Choice of Profession, Specialization", Rustamov, F.A. Dadashova, T.Y. "High school pedagogy", Aliyeva, Z.I. "Pedagogy", Jabrayilov, I.H. "Azerbaijani education in the period of independence: theoretical and practical aspects" and the works of other Azerbaijani researchers have widely commented on the issues of self-education and independent work. Ahmadov, I.B., Abbasov, A.M. Alizadeh, M.N. Seyidzadeh, E.V. Musayev, I.K., Ilyasov, M.I., Aliguliyeva, R.M. Mahmudova, R.Sh., Hamidov, S.S., Karimov, S., Farzana, C.G., Bunyatov, A.R. and others have extensively addressed issues related to distance education in their works.

Foreign educators Ismail, G. Seda, Ch. Buquet, D., Filizok, R., Özer, B., Toker, M.M., Jacques, D., Samaras, A.P., Sergio, S. Fabio, A. Maura, C. Luisa, F. et al. Distance learning in their work, self-education,

learning how to learn have been touched upon. Zair Bek, E.S., Yakimanskaya, I.S., Ilyazova, L.M., Obratsov, P.I., Sagitova, R.R., Stashkevich, I.R., Sukhanov, P.V., Шахова, И.Н., Шуклина, Е.А. Osmolovskaya, I.M., Shvyrev, B.C., Zharinov, V.M., Yakovleva, A.L., Koltsova, N.V. and other Russian pedagogues have widely commented on the issue of distance learning in higher education institutions [13].

The main goal of the research is to study the main criteria for the development of the organization of students' distance learning in higher education institutions.

In accordance with the set goal, the following main tasks of the research are defined:

1. To determine the degree of development of the problem and the socio-historical preconditions for the development of students' educational activities in the conditions of planning and organizing education in a distance form.

2. To theoretically substantiate the motivational-action approach that determines the development strategy of students' educational activities in the conditions of distance planning and organization of education in higher educational institutions.

3. To prepare and theoretically justify the pedagogical concept for the development of distance learning of students in the conditions of the development of education in a distance form.

4. To develop a model for the development of distance activity of students in the conditions of informatization of education, to identify examples and to justify its technology.

5. To identify and justify the possibilities of creating optimal conditions for the development of distance learning activities of students by creating a distance learning environment in the university.

6. To determine the success of the process of development of distance activity of students in the conditions of informatization of education, to develop possible criteria and indicators and to theoretically justify them.

The theoretical basis of the research is the study of the experience of foreign countries and Azerbaijan in the field of distance education activities of students in the conditions of distance education planning and organization in higher education institutions, the study of the basic principles of the modern theory of personality development and self-education activities, the accepted concepts and strategies for the organization of education in distance form [4, p. 278]. The theoretical importance of the research is the creation of a work system for the development of distance learning activities in the conditions of remote activity of students in the conditions of distance organization and planning of education in higher educational institutions, which are of great socio-economic importance in the preparation of future teachers. In the study, the theoretical propositions related to distance education, personality development and the use of information technologies were included, and the work was carried out from the point of view of the methodological regulation of the process of development of distance education activities of

students in the conditions of the distance activity of students in the conditions of the organization and planning of education in the form of distance education in higher education institutions. The presented motivation-action approach is theoretically justified [7, p. 367].

The complexity and versatility of the researched subject requires relying on a system of approaches aimed at the unity of personality, activity, society and cognition, which allows to present various facts, regularities and dependencies of the development of students' ICT skills in the form of a single theory. The methodological guidelines for the research are: a systematic approach to the planning and organization of higher education institutions in a remote form and to determine the systematic development of students' remote activity in the conditions of informatization of education in this direction; action approach - empirical (test, observation, survey, conversation, interview); statistical (data collection, statistical summary, processing, generalization and description); pedagogical diagnosis; experimental (conducting experimental studies, expert evaluations) [9, p.96].

At the current stage of development of the society, in the conditions of the organization and planning of distance education in higher education institutions, it has emerged as a necessity to reconsider the role of distance education of students. Thus, the process of development of distance education of students is one of the factors that meet the needs of the individual, society and the state [13]. Targeted distance education activity is an activity guided by the needs and motives of the students themselves, expressed by setting independent tasks, searching for ways to achieve them in order to gain new knowledge and work experience. The organization of education remotely gives every student the freedom to choose his own learning path throughout his life. The organization and planning of education in a distance form in higher education institutions is an interconnected structure that is combined with general educational goals, focused on the needs and opportunities of students, the structure and content of education, the integration of pedagogical technologies. implies the unity of components [1, p.56].

The pedagogical concept of the development of students' educational activity in the conditions of distance organization and planning of education in higher educational institutions is based on the set of the mentioned provisions:

- within the educational process of the university, the activity of distance education provides not only acquired knowledge, skills, habits, but also individual distance education and personal development throughout life;

- the university's distance learning process involves the gradual formation of the student's subjective position, and motivation is based on the activity approach;

- the application of information technologies to the distance learning process of the university is based on the principles of their integration with pedagogical technologies;

- the development of students' lessons in a distance form of educational activity takes place in the process of solving problems and determining ways to achieve goals based on conscious, independent choice, evaluating the final result, synthesizing cognitive, personal and subject experience obtained in certain situations close to reality;

- continuous distance learning of students takes place under the influence of an innovative educational environment.

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# PHILOLOGICAL SCIENCES

## CORRELATION OF SPEECH AND GLOBAL STRATEGIES IN POLITICAL DISCOURSE AND DISCOURSE OF INTERNET COMMUNICATION

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### Abstract

Contemporary linguistics contains numerous studies dedicated to researching political discourse against the background of any military actions. The present research is dedicated to studying the implementation of the CONFRONTATION strategy in the discourse of Internet communication as a consequent responsive reaction to the strategies realised in the political discourse against the background of the ongoing military actions in Ukraine and published in different social media. This work aims to show the direct correlation between the initial nature of political content, published or reported on the matter of the military actions in Ukraine in the media and the responsive nature of the feedback to it provided in posts or comments to this content. English and German spoken and/or written public statements by high-ranking officials, deputies and political leaders, dedicated to the daily events and changes in Ukraine as well as comments related to them, posted on social media will be used as research material. The scientific novelty of this study lies in the following: the classification of psychological strategies of self-presentation is for the first time used in the context of speech strategies realised in political discourse to implement global strategies, in particular – influencing the target audience; the strategy of emotional propaganda for the first time acquires the definition of a global strategy of political discourse.

**Keywords:** political discourse, media discourse, Internet communication, communicative strategy, global strategy, manipulation, persuasion, propaganda, confrontation, causality, causal relations.

Since ancient times the phenomenon of political discourse has attracted the attention of philosophers and representatives of other humanities. Being a multi-disciplinary phenomenon, political discourse has been not only the focus of linguistics but also of social studies.

Within the framework of the present research, we find it completely appropriate to identify the notion of political discourse with the one of political rhetoric.

The first attempts to single out political rhetoric as an independent type of speech activity go back to ancient times: it is from there that rhetoric originates – one of the three key ancient discursive directions, which was located next to grammar and logic/dialectic, and one of the main tasks of which is, first, the strategy of PERSUASION. The very first mentions of rhetoric date back to the 5th century, BC. (10, p. 1; 15)

In the light of philosophical studies, rhetoric is highlighted within the teachings of the sophist philosophers, who defined it not only as a set of means of argumentation and, accordingly, persuasion but as a key educational discipline – rhetoric studies, which delves into the study of persuasive language, examining how rhetoric constructs political realities and impacts communication. (15; 36)

Aristotle, in turn, had a somewhat different and deeper view of rhetoric, not considering it an art of creation, instead giving it the definition of an art of action, namely, the embodiment of power realised through speech: the philosopher was the first to speak of humans as of “political animals” due to their ability to express their thoughts verbally. (2; 3; 15)

A big significance to the phenomenon of political rhetoric was also given by Roman rhetoricians, such as

Cicero and Quintilian, who emphasised the political advantages of rhetoric, certainly referring to their Greek forerunners, including Gorgias, Plato, Isocrates, and Aristotle. (17, p. 38)

Since in many cases, the addressee on the influence of which both his speech and non-speech strategies are oriented in the political discourse is the society, the use of political-discursive practices is also widely covered in psychology.

Given the direct connection between political discourse and the discourse of power, we consider it reasonable within the framework of this study to establish a correlation between the exercise of power and the individual's need for it. Thus, there is a need to provide a classification of individual needs, the brightest and most illustrative of which in the field of modern psychological research is the so-called “pyramid”, modelled and presented in 1943 by the American psychologist A. Maslow, which graphically represents the hierarchy of human needs. This is, in particular, a classification of human needs, which is based on human goal setting, and according to which “human needs are located in a hierarchy” (41, p. 370). They include *physiological needs*, *the safety need*, *the need for self-esteem*, *the need for love* and finally *the need for self-actualization*, which is the last and the highest stage in the hierarchy of human needs. (41, pp. 394-395)

While the first stages of Maslow's hierarchy embrace primarily basic and instinctive needs, the need for power can rather be related to both esteem and self-actualization, which belong to the highest stages of the pyramid and are not the needs possessed by every individual. *The esteem need* is here realized through the desire for power and often aligns with the need for recognition and respect from others, while *the need for self-*

*actualization* in this context is manifested in achieving positions of influence or making a significant impact that can fulfil this need properly.

The study of political rhetoric within social psychology unveils the art of persuasion, the complexities of language, and their impact on democratic processes. In the realm of social psychology, interest in rhetoric has grown as part of the “*turn to language*” movement. This movement rejects cognitivism and emphasises approaching talk and text as strategic communicative actions rather than mere expressions of inner psychological processes.

It is worth mentioning that the tendency to consider rhetoric as the art of communication has survived to nowadays: representatives of contemporary digital humanities, e. G. E. Losh, in her development of J. Habermas’s theories, postulates that digital technology and electronic networks enable public rhetoric, especially from political institutions, to reach a wider audience. G. E. Losh shows how classical rhetorical principles, such as the right timing and the types of rhetoric that Aristotle identified, can help us understand and evaluate digital texts. She also explores how digital rhetoric can create new forms and modes of expression that challenge or change the conventional ones. She argues that digital rhetoric is not only about how to communicate effectively but also about the ethical and political implications of doing so. (35, pp. 47-48)

In the meantime, within some other scientific research digital rhetoric is argued to be not only a matter of style or technique but also a matter of ethics and politics as it involves questions of power, identity, and participation in the public sphere. (59; 63)

S. Condor, along with her colleagues, has contributed significantly to the study of political rhetoric. Their work sheds light on the strategies used to construct persuasive arguments in political debates. (9)

The topic of political rhetoric spans various academic disciplines and touches upon the fundamental activities of democratic politics: the role of ambivalence and vagueness in democratic political life is revealed as identities are claimed, displayed, and attributed during political discourse. (28)

The direct focus of our research is political discourse (in the context of our work identified with political rhetoric), namely, political public address as a discursive phenomenon that has a strategic nature. Thus, the existing experience of studying the phenomenon of political discourse in the field of linguistic studies is of key importance for this research.

The fundamental works performed in the realm of discourse analysis offer deep insights into political discourse and mechanisms that shape it and therefore can be considered a valuable contribution both to discourse analysis and political science. Thus, it is reasonable and appropriate to provide a short overview of the political discourse definitions and descriptions, given in some of the main and widely known linguistic research papers.

T. A. van Dijk, the “founding father” of discourse analysis, in one of his works defines political discourse as a compilation of all discursive activity, which is both “the text and talk” realised by the political actors, such as presidents, heads and/or members of governments,

leaders, members and/or speakers of different political organisations, both at the internal and external levels. (11, p. 12)

Unlike some other fields of discursive practices (medical, legal, or educational discourse), the political discourse can be characterized by the vast number of participants, who bring this discourse to action. The politicians here are “actors”, who are often the ones to produce the initial messages, while the audience, to which these messages are directed, are the “recipients”. (11, p. 13) The latter in turn might also be conditionally divided into various groups by the criterion of what kind of function they have in terms of political discourse (voters, citizens, rebellions etc.). (56)

R. Wodak is another renowned linguist who has intensively engaged with the notion of political discourse. A range of her investigations conducted in the field of pragmatic linguistics are devoted to considering the various manifestations of political discourse phenomena from different perspectives.

The work “Critical Discourse Analysis (CDA)” (2003) performs the quintessence of reflection and construction of power ideologies and relations in discourse and enables the profound understanding of the language importance in creating the social realities by the individuals. (60)

In the book “The Discourse of Politics in Action: Politics as Usual” the researcher investigates how politicians “do politics” on a micro level and how they operate in everyday life within the halls of the European Parliament. In essence, the definition of political discourse, presented by R. Wodak, comprises not just the language used in politics, but also the social practices, power dynamics and the professional habits of politicians. (61)

“The Politics of Fear. The Shameless Normalization of Far-right Discourse”, published in 2021, provides an interpretation of some political discursive practices, such as “coded language”, that started to be used by the politicians to “sound” more restraint in the light of the 20<sup>th</sup> century’s almost overall totalitarianism results. (62, p. 68)

J. Habermas, a German philosopher and social theorist, whose works are widely engaged with linguistic theories and concepts, developed a theory of language based on the concept of communicative rationality. The scientist was also the one to apply his linguistic theory to analyse various forms of communication such as law, democracy, and media, having written extensively on political discourse.

According to J. Habermas, political discourse is a form of rational communication that aims to reach a consensus about the common good. Political discourse involves the use of valid arguments, evidence, and norms that can be justified in an ideal speech situation, where everyone has equal access and opportunity to participate. Political discourse is based on the principle of discourse ethics, which holds that only those norms and actions are valid and can be agreed upon by all affected parties in a rational dialogue.

Summarising the experience of defining and describing the phenomenon of political discourse performed in the works by J. Habermas related to this topic, the following set of goals has been achieved:

- ❖ Development of a discourse theory of democracy and law, based on the idea of an ideal speech situation where rational communication leads to a consensus about a common good; (24)
- ❖ Exploration of the concept of communicative rationality, which is the capacity to coordinate action through speech that implies validity claims; (22)
- ❖ Discussing the role of the media and the public sphere in contemporary society. (23)

The research of the early 21<sup>st</sup> century stick to the argument that language is in the centre of political activity, being the main condition of its realisation. (21, p. 1) This statement roots back to the pragmatic linguistic studies, namely – to the speech acts theory, which grants the language with the pragmatic features: “speaking means acting”. (1; 45)

Since the political discourse in the present research is considered against the background of mass media and social networks, it is appropriate to emphasize that both are important fields for political discourse, as they enable the production, dissemination, and exchange of political information and opinions among diverse actors and audiences. The media space has become a significant counterpart to traditional political discourse, political conversations, and advertisements. (42; 58)

Social networks and mass media can influence the public agenda, political participation and the political outcomes of elections and policies, and they have significantly transformed the field of political discourse: social media platforms like Twitter and Facebook are increasingly used in a political context. They are believed to have the potential for increasing political participation. (50)

In the context of mass media political discourse has undergone significant changes with the advent of new technologies and the rise of social media platforms (social networks). Some of these transformations are:

- ❖ **Mediatization of Politics.** Political discourse is increasingly mediatized meaning that media has become an integral part of political communication. (8)
- ❖ **Marketization of Media.** The field of Media has become marketized, which means that market forces and commercial interests drive it. (8)
- ❖ **Framing and Agenda Setting.** The media has the power to frame political issues and set the public agenda. (19)

However, they also pose challenges and risks to the quality and integrity of political discourse, such as:

**The spread of misinformation** and fake news on social media platforms is a significant risk to the political discourse quality and integrity, as it provides false information, thereby misleading the audience which can be referred to MANIPULATION strategy.

Social media platforms can also create spaces, called “*echo chambers and filter bubbles*”, where individuals are exposed primarily to opinions that align with their own. This, in turn, can lead to **polarisation**

in discourse: the phenomenon, where language or actions attract or reinforce an individual’s position on a binary or what they view as a binary. (4; 6; 19)

The notion of **censorship** within the mass media and social networks refers to the practice of suppressing and restricting content that is considered objectionable, harmful, sensitive, or inconvenient by governments, media outlets or other controlling bodies. (27; 48; 49; 54; 55)

On the positive side, social networks and mass media have democratised access to information, allowing more people to participate in political discourse. (57)

These aspects highlight the complexity of political discourse in the era of mass media and social networks and the need for media literacy among the public. (47)

In terms of this research, political discourse is considered as such, that is not only realised in terms of mass media and social networks but is also interconnected with the discourse of the media space, or media discourse. Moreover, the way the initial message is produced in the realm of political discourse might significantly differ from how it is transmitted in the media. (Wilson 1990: 17) Therefore, we find it reasonable and appropriate to pay special attention to outlining the latter as a linguistic phenomenon, as well as highlighting its interdisciplinary connections.

A significant contribution to the further development of media discourse as a direction of discursive studies was made by T. A. van Dijk, namely – his theory of social interaction, in terms of which the researcher defines discourse as one of its forms. Applying the socio-cognitive approach, the scientist concentrates on the cognitive aspects of discursive activity realisation and perception, which, in turn, enables the definition of media discourse as such, which is created via the cognitive processes of media users. (14; Mammadov 2022)

In his work “What is political discourse analysis?” Dijk sets a parallel between the phenomenon of political discourse, overviewed in the previous paragraph of this paper, and the notion of media discourse, which can also be characterised by a large number of participants, towards whom this activity is directed. (11, p. 13)

At the same time, T. A. van Dijk argues for the absence of a direct and immediate connection between discursive and social structures considering the discourse functioning through the prism of cognitive connections instead. Such a point of view might be used for a more detailed interpretation and understanding of how social networks and mass media influence discourse and vice versa. (12)

The research by T. A. van Dijk, performed on the surface of critical discourse analysis, studies the discursive implementation of social power, and, consequently – inequity. This perspective can serve as a starting point in considering discursive reproduction, in other words – verbalization of power in terms of media space. (13)

Investigations of the linguist, realised directly in the media discourse area evidence the fact of constructing the social reality by the media texts, which, in turn, provides an opportunity for in-depth studying the social networks discourse. It is beyond any doubts, that the occasion, a political speech or statement is devoted to,

as well as its target audience are not only immediately correlated, but also significantly influence the substantial core, selection by the speaker of the engaged strategies, as well as variousity of their implementation. (11; 12; 13; 61)

R. Wodak is inclined to consider media discourse as such that, due to its daily enormous production, has a capacity of producing a big influence on the audience, especially in Western society: “people watch or read ‘news’ because they think ‘news’ is about reality”. (60, p. 274) Media makers, including broadcasting, publishing institutions and nowadays – those who produce content on the platforms of social networks, in attempting to “establish and protect democracy” demonstrate a significant extent of autonomy and freedom, sometimes – even despite the conditions of imposing censorship. (60, p. 298)

M. Talbot in “Media Discourse: Representation and Interaction” defines media discourse as such, that has a function of mediation, and namely in terms of the present research – a mediation platform between the actors of political discourse and their target audience, the function of which belongs to the population. (53)

Therefore, it is considered to be a wide interaction field that provides a “solid ground” to emphasise the interdisciplinary connections of media discourse with linguistic anthropology, sociolinguistics and cultural studies.

The area of media discourse as a linguistic phenomenon has also become one of the nowadays linguistic researchers’ foci, particularly – in discourse studies, especially regarding the rapid development of digitalization. It involves the analysis of language and discourse in various social media contexts as well as the study of language changes induced by social media and the relationship between language variation and society in the digital world. (34; 52)

The up-to-date linguistic research works on the discourse of mass media and social networks provide an extensive overview of the current state of investigation in the field of media discourse in the linguistics realm. They highlight the importance of considering the social and cognitive aspects of discourse, which are crucial for understanding communication on the media platforms; discuss the impact of social media content on the way people interact and share information, as well as the role of media linguistics in the language of modern mass media; prove that most social media texts are short online conversational posts or comments that do not contain enough information for natural language processing (NLP) tools; present the “status quo” of linguistic studies on social media in the past decade and define seven main research methods. (5; 32; 52)

Some researchers criticise the linear “top-down” model of media-space, which is depicted as “sender-receiver”, arguing that the imposing of the produced content, and accordingly – its meaning on the audience often takes place. (25)

Texts presented in the media space, in particular – placed on social network platforms, in most cases, take the form of posts or comments on them and are often immersed in a non-linguistic contextual environment,

which can be served by the user’s profile and his interaction with other users of the social network. Thus, taking into account the social-communicative interaction, the discourse of mass media and social networks can be characterised as more difficult to process than ordinary texts published in real-time, because social media posts often lack a clear structure and format, as they belong to different users, and correspondingly – composed in different languages and have stylistic differences. (5)

These studies underscore the significant impact of mass media and social networks on language and discourse, making it a rich area for linguistic research, and offering insights into how language is used in these digital platforms. The investigations also provide evidence that media discourse has a major role in such key fields of linguistics as pragmatics and Critical Discourse Analysis.

Besides being a linguistic phenomenon, the discourse of media is widely investigated in humanities, revealing its strong interdisciplinary connections.

In the last decades, we have witnessed a sustainable and rapid development of digitalization, the access to the Internet became available in no effort, and the consumption indicators of the content produced and published on mass media platforms and social networks are getting higher. A wide range of studies conducted in the fields of psychology, sociology and social psychology is devoted to revealing the statistical data, which would demonstrate the indicators of addressing to various sources of information on mass and social media as well as the degree of their influence on consciousness, mentality, and mental state of the users, without mentioning the constantly developing software, that is engaged in gathering the data showing how frequent various online-sources are used or even just visited.

A field of Internet communication, in particular – the discursive activity in social networks might be considered as a wide branch of media discourse and thus represents a big area of linguistic research. Some of its aspects are already lightened, nevertheless there are still a lot of perspectives to see.

Military actions taking place in Ukraine created a huge field not only for political, but also for linguistic research. The discourse of wartime brings its significant changes to the social communication process, moreover nowadays, when Internet-access is no longer a problem.

The hypothesis of the present research lies in the supposition that there is a direct correlation between the speech and global strategies implemented in the political discourse and the strategy of CONFRONTATION as a responsive reaction, realised in the discourse of Internet communication, as feedback to the political statements: the local strategies, realised by the politicians serve a trigger, provoking implementation of CONFRONTATION towards them by the users of social networks as ones who impersonate the so-called “people’s voice”.

Within the framework of the present article the local strategies rendered by the politicians in their statements, posted on social-media platforms, namely – on

the platform X (former Twitter) were categorized according to the taxonomy of self-presentation strategies, generated by E. Jones and T. S. Pittman. (30, pp. 231-262)

INGRATIATION strategy is aimed at causing the favour of the addressee with an attempt of the speaker to appear attractive in the eyes of the addressee. This strategy involves the "*power of charm*". (30, p. 235)

SELF-PROMOTION strategy is somewhat similar to INGRATIATION, but is directed at demonstrating one's own competence in certain issues. SELF-PROMOTION correlates with the technique of "showing-off" and involves the "*power of expert*". (30, p. 241)

INTIMIDATION strategy correlates with the "*power of fear*" and corresponds the technique of making demands and/or threatening. The speaker has to impose the addressee their being dangerous in case, when the latter refuses to do what they are required to. (30, p. 238)

One more strategy is EXEMPLIFICATION, which means explanation through example. This strategy involves manifesting one's skills and engaging the "*power of mentor*". Here the task of the speaker is to convince the addressee, that the former can be the one to follow and listen to. (30, p. 245)

The last strategy is SUPPLICATION, demonstration of weakness and dependence; it aims at appearing before the addressee as a weak, dependent person, whose esteem is not very high. This strategy engages the "*power of sympathy*" and correlates with the tactic of *self-handicapping*. (30, p. 247)

The classification of speech strategies developed in the previous research (31) defines three types of speech strategies, namely – *metaspeech* (with the aim of contact establishment), strategy of *informing* (aimed to deliver any kind of message to the addressee) and strategy of *assessment* (with the purpose of positive or negative evaluation of self, the addressee or different phenomena). Within this study the strategies stated above were generated to describe verbalizing of self-presentation. Hereby we find it appropriate to apply them in analysis of the comments to the political statements.

Choosing different classifications for conducting the strategic analysis of political statements and comments to them can be explained by the higher level of implementation of self-presentation strategies as local ones by the politicians, whose aim is to produce the desired impression on their voters, whereby the commentators are usually average citizens who exercise the freedom of speech to express their opinion.

A basis for classifying and identifying global strategies used in political discourse, as well as varieties of the global strategy of CONFRONTATION in the discourse of Internet communications, was the list of GLOBAL STRATEGIES presented in a previously conducted dissertation research.

The empiric material, gathered for this article, manifested that the political discourse engages the global strategies of COOPERATIVE APPROACHING, MANIPULATION, PERSUASION and the strategy of EMOTIONAL PROPAGANDA.

The global strategy of COOPERATIVE APPROACHING is, as defined in the previous research, aimed at reducing the communicative distance between speaker and addressee or initiation of interaction between them. Besides, in both cases, the synergistic nature of these strategies should be taken into account, in particular, adding to these definitions that increasing/decreasing communicative distance can be cooperative – such that contributes to harmonization of interpersonal relationships, or at least does not threaten them. (31, p. 156)

MANIPULATION, in terms of this paper, is regarded as a strategy that refers to the use of mass media and social networks to influence public opinion or behaviour in a way that serves the interests of a certain group, often through deceptive and or unethical means. In the realm of linguistic research, the strategy of MANIPULATION is considered as a mechanism for achieving the goal of the initiator of communication, who seeks to embed certain information in the consciousness of the addressee, which can mean an attempt to correct his worldview and value system. (18; 31, p. 180; 43)

PERSUASION strategy comes from the notion of persuasiveness. The latter in turn is defined as the influence of the author of an oral or written message upon the addressee with the aim of persuading him, encouraging him to perform/not perform certain actions. A persuasive strategy is also considered multi-level structure, which, in turn, actualizes the interaction of argumentative actions / steps in order to substantiate the central conclusion. (7, p. 24; 26, p. 78)

The next to describe will be the strategies of RATIONAL and EMOTIONAL ARGUMENTATION, which actually belong to the PERSUASIVE strategy.

RATIONAL ARGUMENTATION is correlated with rational thinking, and/or with the "common sense", the aim of which is considered to be substantiation and widening of the knowledge authenticity of an array of logic as well as gnoseologic procedures. (Sergeev 1987: 12) The strategy of RATIONAL ARGUMENTATION might be interpreted as a complex socio-cognitive verbal activity aimed at justifying or refuting a certain point of view. (37, p. 6)

EMOTIONAL ARGUMENTATION is implemented by means of "semantically empty" emotive attributes or stylistic (stylistic-semasiological) techniques – tropes, which are reproduced using both lexical (figurative words or idioms), as well as syntactic units (if the trope has an expanded form and embodied in a phrase, a sentence or a larger text fragment). (29, pp. 4-5; 38, p. 50; 40, p. 243).

SUGGESTION is considered as a psychological influence on the consciousness of an individual with a purpose suggesting to him desired attitudes, which are not realized and contradict of his will (51) as "the process of influencing the mental sphere of the unconscious, connected with a decrease in criticality during the perception of implied content in the absence of purposeful active understanding of it, detailed logical analysis, and evaluations in correlation with the past experience and the current state of the subject" (44).

The named characteristics allow us to consider SUGGESTION as an influence which is qualitatively opposed to PERSUASION, where the action is on the consciousness of the individual occurs through an appeal to her own critical judgment (33).

One more global strategy, which appears and is considered in the realm of this research is EMOTIONAL PROPAGANDA. Generally, it is somewhat related to EMOTIONAL ARGUMENTATION but has a little different nature.

The phenomenon of *propaganda* is referred to an attempt to manipulate the beliefs of an addressee or to impose them a certain point of view or attitude, which would be advantageous for the implementors of propaganda. Usually, propagandists have a certain set of goals and in order to achieve them, facts and arguments, which are about to be publicly presented, experience a lot of changes. (16)

Within the framework of the present research the EMOTIONAL PROPAGANDA is regarded as a global strategy intended to produce an effect on the emotions of the addressee, which is realised in the dimension of MANIPULATION STRATEGY.

At first glance, the strategy of EMOTIONAL PROPAGANDA manifests no differences from that of EMOTIONAL ARGUMENTATION. The peculiarity

both of them have in common lies in the emotional impact they are intended to produce on the addressee. Nevertheless, there is also a very important feature that make them differ from one another, namely – the goal of realising each of them: while EMOTIONAL ARGUMENTATION is proven to aim at PERSUADING the opponent, EMOTIONAL PROPAGANDA is intended to realize MANIPULATION of the opponent's attitudes and beliefs. Thus, both these strategies engage emotional impact, but have different global goals.

The strategy of CONFRONTATION is described in a range of works as well and is based on the model "I am higher, you are lower". In our work we implement the experience of our previous research, where the CONFRONTATION strategy has two variants of realisation, namely – CONFRONTATIVE APPROACHING, which aims at conflict shortening of the distance between the communicants, and CONFRONTATIVE DISTANCING, which means opposition of the one communicant to the other. (20; 31)

The scheme given below renders the realization of global and speech strategies in the political discourse as well as the varieties of CONFRONTATION strategies in Internet communication and their correlation with the speech strategies, implemented in Internet-discourse.

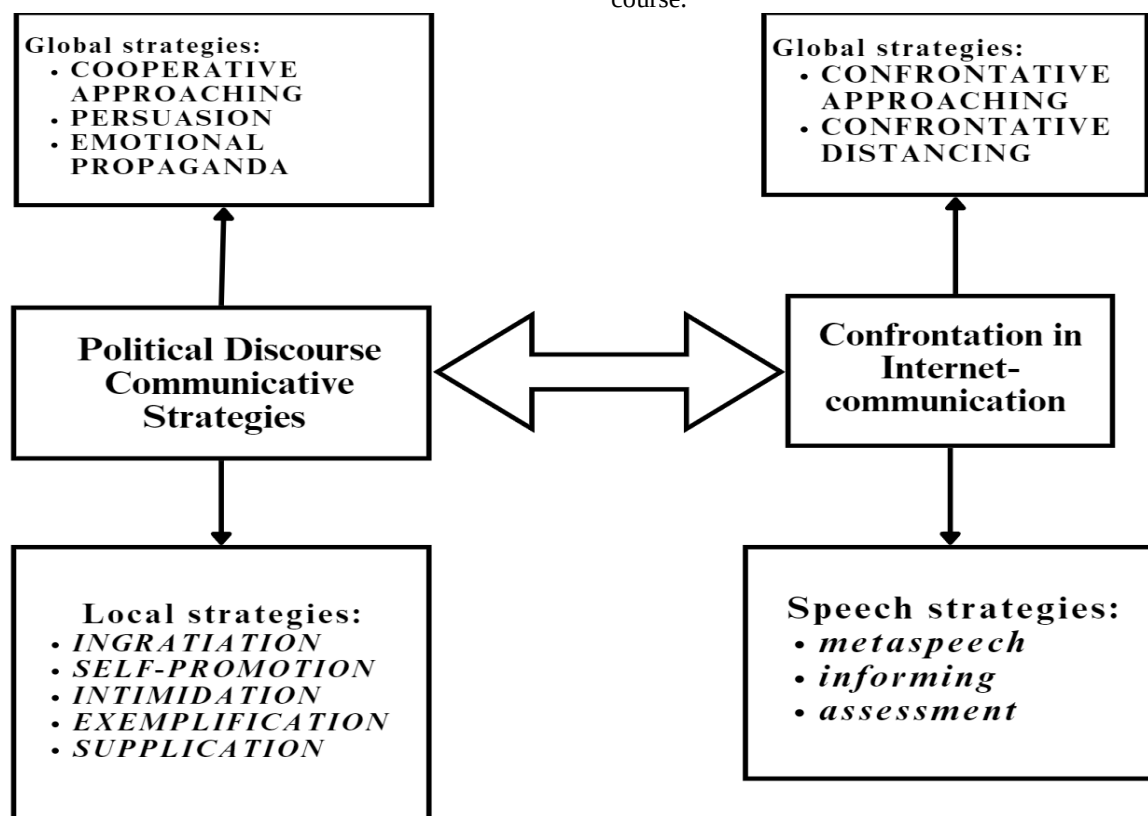


Fig. 1. Interaction of political discourse communicative strategies and the strategy of CONFRONTATION in Internet communication.

The analysed empiric material reveals the implementation of the above-stated strategies as follows.

(1) Statement: *Total disregard for human life and constant terror is what Russia is trying to spread. <...> Protecting life in Ukraine with a sufficient number of air defence systems, providing our soldiers with the*

*necessary weapons of the required range, and exerting pressure on the terrorist state so that Russia does not have time to adapt is the way to bring peace closer. Russian terror must lose. The world is capable of ensuring this.* (83)

Comment: *You are the one destroying Ukraine, little dictator.* (73)

The example (1) contains the text of the post at the official profile of the Ukrainian President V. Zelensky on the platform X (former Twitter). The fragment manifests realisation of such strategies as INTIMIDATION (the word “terror” is used to provoke the fear of the addressee), and SUPPLICATION, verbalized through “*The world is capable of ensuring this*”, meaning that the world community is capable of sustainable supporting Ukraine. The abovementioned correlates with the global strategies of COOPERATIVE APPROACHING (V. Zelensky uses the word combination “*our soldiers*”, which is more colloquial, in an official statement, in order to position himself verbally closer to his nation) and EMOTIONAL PROPAGANDA (an attempt to influence the emotions of the audience by the means of repeating the word “terror” in order to produce fear and anxiety as well as strengthening adjective “total” in “*total disregard of human life*”) as well as in the statement “*Russian terror must lose*” the modal verb “must”, which means the highest degree of obligation, was used by the speaker rather as an emotional marker to emphasize the importance of the utterance.

A bright example illustrating engaging CONFRONTATION strategy in comments is a responding comment to the given political statement, which involves such speech strategies as **assessment**, and tactic of negative assessment: the author of the comment claims the Ukrainian President to be “*destroying Ukraine*”. Within the same strategy and tactic implementing irony and sarcasm can also be observed: the commentator calls V. Zelensky a “*little dictator*”, aiming at showing him cruel and ridiculous. Another important speech strategy, realized in the given fragment, is that of **informing**, involving the tactic of asserting, which is rendered in the purpose of the whole utterance. The global strategies implemented in this fragment are represented, first of all, by the strategy of CONFRONTATIONAL APPROACHING: the author of the comment addresses the President by the means of the personal pronoun “you” in the 2<sup>nd</sup> person singular, which in Ukrainian language, as well as in German, means shortening the distance between the conversation partners. Given the general connotation of the whole utterance, the aim of such distance shortening is confrontation.

(2) Statement: *Der wirtschaftliche Schaden für unser Land, der durch die mutmaßlich von #Selenskyj – und nicht etwa #Putin, wie man uns weismachen wollte – angeordnete Sprengung von #Nordstream entstanden ist, sollte der #Ukraine "in Rechnung" gestellt werden. Jegliche den deutschen Steuerzahler belastende "Hilfszahlungen" sind einzustellen.* (64)

Comment: *Es ist beeindruckend, wie vorsichtig Sie sich ausdrücken. Ich bin jedoch der Meinung, dass Sie im Unrecht sind. Ihre Worte lassen lediglich Ihre Nähe zu Putin erkennen. Die Vorstellung, dass Taucher von einer Segeljacht aus der Pipeline zerstört haben könnten, ist geradezu lächerlich – technisch schlichtweg unmöglich.* (78)

The given example represents the statement dedicated to the explosion at the Nordstream gas-pipeline,

published on the official account of Dr. Alice Weidel – a German politician from the party AfD (Alternative für Deutschland), where she expresses her opinion towards what happened.

Considering the local strategies, represented in this statement, the ones to be implemented here were INGRATIATION (affirming that “*Jegliche den deutschen Steuerzahler belastende "Hilfszahlungen" sind einzustellen*”, the politician shows her being concerned about the German working population, which corresponds to an attempt to be liked by the target audience) and INTIMIDATION: the statement contains the affirmation, that Ukraine will have to pay the dues for all of the support it received from Germany, which is certainly not a very nice perspective for the Ukrainian population from the financial point of view, besides the politician marks the word “Ukraine” with the hashtag, which facilitates finding this post on the X platform and correspondingly potentially broadens the number of users who can read it. The global strategies, implemented here, are COOPERATION (the utterance “*unser Land*” as well as the intonation of the whole statement demonstrate that the politician positions herself along with her people, trying to get closer to her electorate), and EMOTIONAL PROPAGANDA (expressing her resentment with the financial help, provided to Ukraine by Germany, the politician claims it to be a burden for German tax-payers, with the aim to realise the emotional influence on the audience), and CONFRONTATION which is here implemented through verbalizing the idea of invoicing Ukraine for all the financial support it received from Germany as well as for the accident on the gas-pipe, for which, according to her opinion, Ukraine is the one to blame.

Strategic analysis of the responses to the given statement in the comments to it evidenced implementation of **assessment** with the tactic of negative assessment, verbalized in sarcastic manner (*Es ist beeindruckend, wie vorsichtig Sie sich ausdrücken.*). Along with that, the commentator renders also the **informing** strategy, involving the tactic of announcing, which is realised in notifying the politician about clarity of her true intentions. The CONFRONTATION rendered in the comment refers to CONFRONTATIVE DISTANCING, aimed at mocking an addressee with the aim of enlarging the communicative distance.

(3) Statement: *What happens to Ukraine matters to all of Europe, all of NATO, and all of the world. We are united against Putin's war. We are united behind Ukraine. And we are united behind a vision of the world where free countries never fear aggression from a brutal tyrant next door.* (76)

Comment: *What you are doing in Ukraine is robbing the American taxpayers blind to cover up yours and Hunters crimes over there... Hush money.* (70)

The political statement, represented in the example (3) was made by the President of the USA J. Biden and published on the social media platform X (former Twitter). Analysed from the point of view of the speech strategies, here, as well as in the most of previous fragments, the strategy of INGRATIATION was realized: *What happens to Ukraine matters to all of Europe, all of NATO, and all of the world.* The American President

reminds the audience, that Ukraine will not fight alone, thus trying to verbally produce a positive impression upon the target audience, in other words – to ingratiate the addressee. The global strategy, implemented in this fragment, is obviously EMOTIONAL PROPAGANDA: J. Biden resorts to such as repetition (*We are united against Putin's war. We are united behind Ukraine. And we are united behind a vision of the world <...>*) as well as emotionally marked vocabulary (*a brutal tyrant*). Therefore, J. Biden does not intend to manipulate, but is still inclined to emotionally persuade the audience in the necessity to continue providing Ukraine with necessary support, though his statement does not contain any explicit arguments.

The reaction to this statement rendered in the comment to it also involves the **informing** speech strategy, the tactic of asserting. The comment implies, that the President of the USA J. Biden is trying to cover up the crimes of the American government towards their own nation, e.g. “money laundering”, meaning that the aim of the USA hereby is not to support Ukraine, but to rob the American tax-payers. The global strategy of CONFRONTATION, namely CONFRONTATIVE APPROACHING is here realised through the disrespectful manner of communication, which is meant to shorten the distance with the addressee with confrontative purpose.

Another statement, made by J. Biden and published on his official account on the platform X (former Twitter) expresses the US President's being surprised with people, judging him and laughing him out for the reason of confusing the names of Russian and Ukrainian Presidents instead of paying attention to his political opponent D. Trump calling the actions of Russian Federation “genius” and “wonderful”.

(4) Statement: *When that butcher Putin invaded Ukraine, Trump called it “genius” and “wonderful”. But people would rather talk about how I mix up names.* (72)

Comment: *You literally bribed the Ukrainian government to fire a prosecutor and your son was taking money on your behalf from Ukraine. You are corrupt to your core.* (74)

This example contains also implementation of the implied EXEMPLIFICATION strategy: by understatement of D. Trump and V. Putin, J. Biden aims at showing himself as an example to follow, implying “*I am not the one to initiate military actions in the other country and not the one to approve it*”. Both of speech strategies realised in this fragment can here be associated with the global strategy of SUGGESTION as a part of PERSUASION strategy (an intention to convey certain kind of emotions to the audience), and EMOTIONAL PROPAGANDA, which are here interrelated. Using the emotionally marked words in an official statement, politician has the goal of underestimating his opponents in the eyes of the audience.

The given comment to this statement involves, first of all, **informing** speech strategy with the tactic of asserting, verbalised in the affirmation, that American President was the one to “*bribe the Ukrainian government*”, at the same time realising the strategy of **assessment** with the tactic of negative assessment, as well.

The only global strategy that can be observed here is CONFRONTATION, realised in CONFRONTATIVE APPROACHING: the commentator verbally shortens the distance between himself and the politician, using the disrespectful form of communication combined with the accusations on bribery and corruption.

The example (5) contains a political statement, made by the Chancellor of Germany O. Scholz, published on his official account with one of the comments to it, given below.

(5) Statement: *Germany is and will remain the strongest supporter of Ukraine in Europe. We will support Ukraine for as long as it takes. It was good meeting you today in Frankfurt, @ZelenskyyUa!* (66)

Comment: *Es ist ein zynischer, teurer und vor allem mörderischer Stellvertreterkrieg, der gegen den Willen der Bevölkerung, und haushaltswidrig, finanziert wird. Es könnte längst Frieden sein. Was Sie tun, Herr Scholz, ist verachtenswert.* (68)

The fragment (6) represents the political statement of R. Metsola – the current President of European Parliament, towards the events in Ukraine, published on her official account on the platform X (former Twitter) with one of the comments to it, written by one of the platform users.

(6) Statement: *Unwavering support, resolute assistance and firm commitment. We stand with Ukraine. Today, @Europarl\_EN calls for further aid to Ukraine and for stronger sanctions against the aggressor and accomplices. To ensure Ukraine's sovereignty, security in Europe and peace.* (69)

Comment: *Roberta, you are failing the people of the EU by making them poorer. If you're failing us, why should the people of Ukraine have confidence in you? I believe you are a failure, and you'll fail them too. Will you resign if that happens?* (79)

In both of the statements, politicians appealed to the local strategies of INGRATIATION, directed at producing a positive impression upon the addressee, as well as implied EXEMPLIFICATION by positioning themselves as compassionate political leaders, whose example might be followed. Regarded through the prism of global strategies implementation, both fragments involve the strategy of COOPERATIVE APPROACHING, verbalized in intention to keep supporting Ukraine under any circumstances. SUGGESTION as a manifestation of PERSUASION, verbally implemented in, for example, using the superlative degree of comparison “*the strongest supporter*”, “*unwavering support*”, “*resolute assistance*” which intensifies the emotional influence of the utterance and aims at persuading the audience in the continuity of the further support, but at the same time contains no argumentation and therefore can be also considered as EMOTIONAL PROPAGANDA.

The speech strategies detected in the comment to the statement in fragment (5) belong, first of all, to **assessment** with the tactic of negative assessment. The commentator evaluates the actions of German Chancellor as something outrageous, using the utterances with the negative connotation (*zynisch, teuer, mörderisch*). Strategy of **informing** with the tactic of asserting is here realised in the utterance “*Es könnte längst Frieden*

sein”, where the speaker aims at pointing to the necessity of establishing peace. CONFRONTATION, namely CONFRONTATIONAL DISTANCING here can be observed in blaming O. Scholz for not fostering peace, and finds its implementation in this fragment in the utterance “Was Sie tun, Herr Scholz, ist verachtenswert”.

The strategic intentions of the comment to the statement of R. Metsola, given in the example (6), are similar to that of the fragment (5). First of all, the strategy of **assessment** with the tactic of negative assessment is here also implemented by the means of the word “fail” with a negative connotation, addressed to a politician. The strategy of **informing** with the tactic of requesting information is also realised here by the question “Will you resign if that happens?”, asking R. Metsola for resignation in case she “fails”. The strategy of CONFRONTATION, similarly to some of the previous fragments, is rendered in this fragment by CONFRONTATIONAL APPROACHING, namely – in shortening the communicational distance with the conflict purposes, expressed by the means of appealing to the politician in the comment using just her first name “Roberta”.

(7) Statement: *Great to be in Oslo for my last official visit and to meet my friend and colleague PM @jonasgahrstore. I welcomed #Norway's increased defence spending, reaching 2% of GDP, and its key support to #Ukraine. We addressed the importance of stepping up #NATO support so Ukraine can prevail.* (71)

Comment: *The farce rolls on, where the mass media's most important task is to lull the public into believing that Ukraine can win the war if we continue to uncontrollably deliver weapons and money on an assembly line so that the war industry remains satisfied and, above all, pushes for an escalation instead of peace negotiations.* (77)

This statement belongs to J. Stoltenberg – the General Secretary of the NATO Alliance, dedicated to one of his last official visits to Norway. Here the local strategy of INGRATIATION was implied in the whole utterance, namely in its attempt to appeal to the favour of the audience, positioning himself as an empathic politician. To the global strategies, realised in this statement belong, first of all, COOPERATIVE APPROACHING, which can be observed in the intention of the whole statement to foster collaboration with Ukraine and PERSUASION with the elements of RATIONAL ARGUMENTATION, revealed in providing a statistical report of “reaching the 2% of GDP”.

The speech strategies detected in the comment to this statement include, first of all, the strategy of **informing** with the tactic of asserting verbalized through the supposition of and mass media's attempt to fool the audience (“mass media's most important task is to lull the public”), as well as the strategy of **assessment** with the tactic of negative assessment, verbalized in “The farce rolls on” as well as in the negative evaluation of actions of international organisations towards what is going on in Ukraine: “pushes for an escalation instead of peace negotiations”. The strategy of

CONFRONTATION is here rendered in CONFRONTATIONAL DISTANCING and objectivates in the critics, expressed in the comment towards the politician.

(8) *Today's powerful discussions show the unique value of this #EuropeanPoliticalCommunity. Our resolve to support Ukraine is stronger than ever – we clearly reaffirmed that with President @ZelenskyyUa. Together we will ensure our energy security and take a comprehensive approach to the challenge of migration. Alone, these are daunting challenges.* (67)

Comment: *Don't you think that you go too far? Not a day goes by without hearing, reading #Ukraine or worse seeing #Zelensky. Simply, it's the best way to disgust a person than to serve them all the same dish even if it's their favourite...* (80)

Charles Michel, the President of the European Council, in his statement, similarly to his political colleagues in the previous statements engages the local strategy of INGRATIATION, by showing that as the head of one of the key European international organisations is actively participating in resolution of military conflicts: “resolve to support Ukraine is stronger than ever”. The global strategy, actualized in this fragment, is COOPERATIVE APPROACHING (“Together we will ensure our energy security and take a comprehensive approach <...>”, “Together, we will get it done”), aimed at expressing support and solidarity to the addressee.

The comment to this statement realises, first of all, the speech strategy of **informing** with the tactic of requesting information (using a rhetoric question “Don't you think that you go too far?” the commentator is inclined to point to the politician's being wrong) along with the strategy of **assessment**, with the tactic of negative assessment expressed in reprimanding him for excessively frequent mentioning Ukraine and its President V. Zelensky in his rhetoric. The global strategy of CONFRONTATION in its manifestation in CONFRONTATIVE DISTANCING is here rendered both with the above-mentioned rhetoric question, as well as with the intonation of the comment as a whole.

The fragments (9) and (10) belong to Ursula von der Leihen, the President of the EU Commission.

(9) Statement: *President @ZelenskyyUA, we will continue supporting Ukraine.* (81)

Comment: *It is unlikely that you have tried to negotiate peace. Then your meeting doesn't make sense.* (75)

(10) *Europe is the number one public investor in Ukraine's defence sector. Our EU Defence Innovation Office is up and running, with EU staff in Kyiv and a support team in Brussels. It works as a hub to connect Ukrainian and EU defence industries, to the benefit of both.* (82)

Comment: *No, Ursula. No. Europe do not have money. The money “Europe” waste is tax-payers money. People money. Workers' money. Is it clear? Or shall I explain it to that rotten thing you call brain and soul? Because trust me. You will meet a Judge. Soon. Why soon? Check your birth date.* (65)

Both statements realise the local strategy of INGRATIATION, which is here involved, like in the previous cases, to impress the audience positively: as the President of the EU Commission, U. von der Leihen identifies Europe as the main supporter and investor for Ukraine. The global strategy, that is realised in both fragments is COOPERATIVE APPROACHING, which is manifested in utterances like “<...> we will continue supporting Ukraine”, implying that the speaker, as the Head of key EU Organisations, identify themselves the same as the other EU Commission employees, ready to fulfil faithfully their obligations, and PERSUASION, implemented here with RATIONAL ARGUMENTATION, especially in example (10), where the politician provides arguments to the initial utterance: “Our EU Defence Innovation Office is up and running, with EU staff in Kyiv and a support team in Brussels. It works as a hub to connect Ukrainian and EU defence industries, to the benefit of both”.

As to the comments to these statements, they both realise the **informing** speech strategy with the tactic of **asserting** which in fragment (9) might be seen in the whole text of the comment and in fragment (10) in the utterance “Europe do not have money”. Besides, the comment in fragment (10) contains the tactic of **requesting information**, which also belongs to the strategy of **informing** (“Is it clear? Or shall I explain it to that rotten thing you call brain and soul?”). These comments are also very interesting examples of implementing the CONFRONTATION strategy, both with APPROACHING and DISTANCING. In example (9) implementing the CONFRONTATIVE DISTANCING can be concluded from the sceptic intonation of the whole message, while fragment (10) contains not only CONFRONTATIVE DISTANCING, observed in blaming the EU Commission President for taking money from the working population of EU, who pays taxes, to sponsor the war, as well as appealing to her religious values (“You will meet the Judge. <...> Check your birth date” where the word “Judge” means “God”), but also APPROACHING (primarily manifested in disrespect, that the commentator shows towards the politician addressing to her only by her first name in the comment “No, Ursula”).

**Conclusions.** The results of the conducted research allow us to conclude, that its hypothesis was approved: the global strategies implemented in political statements posted on social media have the capability of evoking CONFRONTATION in feedback to them, and, given that local strategies are one of their realisation instruments in the context of political statements, the taxonomy of the strategies, initially developed by E. Jones and T. S. Pittman to be applied for self-presentation, have perspectives to be used for strategic analysis of political discourse, which primarily aims at influencing the target audience. However, the analysed political statements did not show any potential of realising the local strategies of SELF-PROMOTION, which despite its similarity with that of INGRATIATION has more perspectives to be realised in the discourse of political debates; the strategies of INTIMIDATION and SUPPLICATION were detected occasionally. Regarding the taxonomy of speech strategies used to characterise

the comments to political statements **metaspeech** strategy was not detected to be implemented, which can be explained with its aims not corresponding the aims of analysed type of communication. It is also quite reasonable to conclude, that the range of global strategies implemented in political statements is rather wide, while All of the provided responses to the given fragments of political statements manifest attempts to resist being emotionally persuaded and/or manipulated via the CONFRONTATION strategy involvement, the presupposition of which can be formulated as follows: “I am not one to be fooled”. The practical significance of the present research lies, in particular, in its wide perspectives for further studies in the field of pragmatic linguistics and social linguistics, as well as shows a range of interdisciplinary connections with political science, psychology and sociology.

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#### Illustrative Material Sources

# PHYSICAL SCIENCES

## STRING THEORY: ANOTHER APPROACH TO PHENOMENA

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### Abstract

Since 1915, the interrelation of the concepts of space, time, and gravity has suggested the possibility of a larger theoretical framework. This theory, which combines all the forces of space, time and nature in a quantum mechanical model, employed the Euler-beta function to form a unified framework for the string theory, which resembles tiny strands of energy. Various approaches have been proposed to explain both the physical field and the properties of matter through strings. In the work presented, why and in what forms the phenomena that occur with the vibration of the strings were clarified, and a few parameters of the strings were calculated using the mass of the string, considered the smallest mass. New string theory: an attempt has been made to explain a few phenomena taking place in the microcosm with a semi-string. At the same time, an attempt was made to explain the Compton effect, which makes the particle nature of light clearer, and the creation of electrically charged and uncharged particles based on string theory.

**Keywords:** String theory, semistring concept, smallest mass, Compton effect, creation of electric charges.

**Introduction.** A. Einstein combined space and time with the theory of special relativity and showed that movement in space affects the passage of time. A. Einstein further connected the concepts of space, time and gravity with the theory of general relativity and showed that the distortions in space and time are caused by gravity. These facts were a great achievement in science. A. Einstein envisaged a larger theory - a powerful framework that would take into account all the forces of nature, space and time - a combination he called a unified theory. However, A. Einstein's attempt ended in failure. Most of his contemporaries consider the search for a unified theory hopeless, misguided. The main concern of theoretical physicists became quantum mechanics - the emerging framework for describing atomic and subatomic processes [1]. Particles on this scale have such small mass that gravity is essentially negligible in their interactions, and thus general relativistic effects have been largely neglected in quantum mechanical calculations for decades. Then, in the late 1960s, attention turned to a different force—the strong force that binds protons and neutrons in atomic nuclei. Gabriele Veneziano, a young theorist at the European Center for Nuclear Research, made a major breakthrough in 1968 when he suggested that a 200-year-old formula, the Euler-beta function, could explain a large amount of data. A few years later, Leonard Susskind of Stanford University, Holger Nielsen of the Niels Bohr Institute, and Yoichiro Nambu of the University of Chicago significantly strengthened Veneziano's ideas by showing that the underlying mathematics of the equation minus the vibrational motion of the fibers led to string theory, which resembles tiny filaments of energy. The theory suggests that the strong force and particles are made up of strings. However, strings failed in its first incarnation as a representation of a powerful force, and many thought it unlikely to succeed as a solution to

a more complex problem. This view resulted in the emergence of theoretical problems of string theory. First, some of his equations did not fit the theory, and second, the theory's mathematics required the Universe to have not only three spatial dimensions, but six other spatial dimensions. Due to these problems, the number of researchers working with string theory was reduced to two individuals in 1980 - Schwarz and Michael Green of Queen Mary College, London. However, in 1984, these two theorists made a major breakthrough. In a remarkable calculation, they proved that the equations of string theory are consistent. Based on these calculations, they realized that string theory has the potential to unify all types of matter with the 4 main forces in the Universe in a single quantum mechanical model [2]. After this result was published, researchers turned their attention to string theory. Within a few months, a unified framework of string theory was formed. Just as the different vibrational patterns of a pipe string produce different notes, so in string theory, the different vibrations of small strings were thought to produce different particles of nature. The mass and charge of the particle is determined by how the string vibrates. For example, string theory claims that an electron is made up of strings that go through a particular vibrational pattern, while envisioning quarks as strings that go through a vibrational pattern. Essentially, physicists claim to exist in particles found experimentally to link the forces of nature between vibrational patterns. Thus, string theory was proposed as the sought-after unification of all forces and all matter. Between 1984 and 1994, many theoretical physicists attempted to complete string theory by transforming this abstract, purely mathematical framework into a concrete, predictive theory of nature.

**Case in point:** With the creation of the universe, time and space began to emerge simultaneously, and

matter began to expand from a single point. Therefore, matter and the physical realm, which are the manifestations of matter, have the same source. This source is the smallest particle in existence. It is clear that the smallest particle in existence must possess both matter and field properties. Given the properties of this primordial particle, all phenomena can be explained by this emerging theory, and this fact can eliminate existing contradictions. Sims have these properties. For this reason, string theory is considered the first major achievement after A. Einstein's theory. Everything that exists in matter as a whole is composed of strings. On the other hand, we know that energy is the most important quantity that exists in the Universe. Matter, as a whole, is built on a single energy. Trying to learn the secret of the universe, Nikola Tesla said, "If you want to know the secret of the universe, look at the relationship between energy and frequency." Based on these facts, we can say that the uniform energy causes the strings to vibrate at a certain frequency, or vice versa, the vibration of the strings at a certain frequency causes the total energy that exists in the Universe. The reason that the concepts of space and time are a single whole can be attributed to the fact that matter is built on a single energy. The different types of energy that we observe in the macro world are actually different manifestations of the unified energy of matter. These facts show that the strings vibrate in different ways, when they vibrate, they form a physical field, and when they collide with each other, they form the corresponding particle. Different collisions produce different particles, different particles produce different atoms, and different atoms- different substances, and different substances reveal the wealth that exists in the Universe [3].

$$\frac{M_S}{M_A} = \frac{M_A}{M_{GS}} \rightarrow M_S = \frac{M_A^2}{M_{GS}} \rightarrow M_S = \frac{(1,6830928 \cdot 10^{-27})^2}{1,99266862 \cdot 10^{30}} = 1,42161187 \cdot 10^{-84}$$

Here  $M_{GS}$  is the total mass of the solar system,  $M_A$  is the mass of the smallest atom, and  $M_S$  is the mass of a string.

Since strings are considered (for now) to be the smallest particles in the universe, we can say that the mass of  $1.42161187 \cdot 10^{-84}$  kg is the smallest known mass. There is no mass smaller than this value in the universe. Using the mass of a string, the values of a number of quantities can also be calculated:

1) If the number of wires in a hydrogen atom is  $N$ :

$$M_H = N \cdot M_S \quad \text{from} \quad \text{here} \quad N = M_H / M_S = 1.8393271 \cdot 10^{57}.$$

2) The mass of the smallest existing quark is  $1.7 \text{ MeV}/c^2 = 3.02726556 \cdot 10^{-30}$  kg. Based on this value, it is possible to calculate the minimum number of strings needed to create one quark:

$$N = M_k / M_S = 3.02726556 \cdot 10^{-30} / 1.42161187 \cdot 10^{-84} = 2.12945996 \cdot 10^{54} \approx 2.13 \cdot 10^{54}$$

Here  $M_k$  is the mass of the quark.

3) The smallest elementary particle with rest mass that exists is the electron. The minimum number of strings needed to create an elementary particle.

**Problem Solving:** Although the strings have a single source of energy for their vibration, they do not all vibrate in the same way. Only the strings that vibrate in the same way and shape combine to form the corresponding particle. Strings vibrating in different forms do not combine in this form, they only form a physical field in one place. To explain this picture, let's introduce the concept of "semi-string". Since there is a concept of direction in 3-dimensional space, we can say that these substrings can be directed in different directions. As a result of the interaction of half strings with the same direction, the corresponding form of vibration appears. Strings with identical vibration patterns can join, and this process takes place over a very short period of time. It is known that elementary particles undergo interconversion. They can be destroyed and re-born[4]. As a result of this, we can mention the event of the destruction of the elementary particle as a result of the change of the vibrating form of the strings existing inside the elementary particles, and the formation of a new particle as a result of the combination of strings with a new form. The reason for the change of this vibration form is the presence of identical and different vibrating strings located in different directions around one string and the energy exchange between them. The dimensions of strings are so small that the ratio of a single string to an atom is equal to the ratio of one atom to the entire solar system. All objects that exist in the space we exist in have mass and shape. Based on this fact, we can say that strings have mass and determine the value of this mass by mathematical calculation.

$$N = M_e / M_S = 9.11 \cdot 10^{-31} / 1.42161187 \cdot 10^{-84} = 6.40821886 \cdot 10^{53} \approx 6.4 \cdot 10^{53}$$

Here  $M_e$  is the mass of the electron.

4) Considering the mass of the Universe in kg, it is possible to approximately calculate how many strings exist in the Universe:

$$N = M_k / M_S = 10^{53} / 1.42161187 \cdot 10^{-84} = 7.03426878 \cdot 10^{136}$$

5) Based on the relationship between energy and frequency, we can say that strings have a certain frequency and wavelength. Let's calculate the wavelength of a string using the expression  $\lambda = h/p$ :

$$\lambda_s = \frac{h}{p} = \frac{h}{cm_0} \\ \lambda_s \approx \frac{6,626 \cdot 10^{-34}}{299792458 \cdot 1,42161187 \cdot 10^{-84}} \rightarrow 1,5606 \cdot 10^{42} \text{ m.}$$

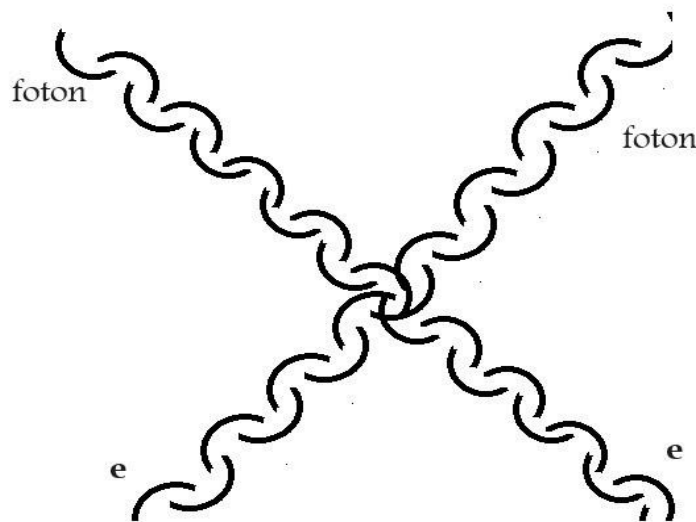
6) The wavelength of the electromagnetic wave with the largest observed wavelength is  $\lambda \approx 10^5$  m. The ratio of the wavelength of a string to the wavelength of an electromagnetic wave

$$\frac{\lambda_s}{\lambda_E} = \frac{1.56 \cdot 10^{42}}{10^5} = 1.56 \cdot 10^{37}$$

This ratio is equal to  $1.56 \times 10^{37}$ . So, the wave created by the strings is not an electromagnetic wave. It is this fact that explains why the results of accelerator-based tests fail. Obviously, it is impossible to observe strings with such a small wavelength. The wavelength of the strings is  $3.8 \times 10^{34}$  times larger than the Earth's equator. For the Sun, this value is equal to  $2.24 \cdot 10^{33}$ . The wavelength of the string is completely approximate. Fully applying the h-Planck constant and the speed of electromagnetic interaction propagation (c) to strings, as we do in the expression, is not correct. Planck's constant is associated with particles. Inside the particles there are about  $10^{53}$  strings. Although the propagation speed of the electromagnetic interaction is very high, it is not the fastest speed in the Universe. It turned out that the rate of expansion of the Universe is greater than the rate of propagation of the electromagnetic interaction. As the universe expands, the physical field is created (its existing mass increases). We mentioned that the physical field is created through strings. It can be concluded that the propagation speed of the strings is greater than the propagation speed of the electromagnetic interaction. These facts reduce the accuracy in calculations for physical quantities. Because strings have such a small mass that prevents them from being detected directly, theorists are increasingly working to uncover testable indirect effects of string theory. In this regard, the dimensions of strings in string theory pose an additional obstacle. Imagining these extra dimensions as small and hidden is a reasonable explanation for their apparent absence. This is because strings are so small that they must vibrate in extra dimensions to form such a large Universe. Unfortunately, the equations of string theory allow the extra dimensions to take many different geometric forms, making it extremely difficult to make definitively verifiable predictions. Studying the influence of multi-dimensional spaces on these factors is a very complex issue. As we know, the 3dimensional space we live in is formed by the combination of a large number of 2-dimensional spaces. Similarly, 4dimensional space is formed by combining 3-dimensional spaces. We can never fully understand 4-dimensional space. Because we haven't seen what he looks like before. We cannot imagine what we do not see. Therefore, generally speaking, we cannot see and understand events, objects, entities, etc. that occur in multi-dimensional spaces. As we mentioned, every physical object existing in 3-dimensional space has mass, shape, etc. properties. But we cannot say that this fact is the same for 4-dimensional space [5]. That is, it is not entirely clear to say that matter is composed of strings in multidimensional spaces. It would be more

correct to try to explain the phenomena related to our space with string theory.

Let's try to explain the Compton effect, which consists of the interaction of two elementary particles that behave like a particle (matter) and a wave (field), with string theory. These two elementary particles have the smallest masses in existence (the smallest number of strings in existence) and combine the properties of matter and field in them, as in strings. According to these approaches, it is possible to explain the Compton effect with string theory. Arthur Compton observed in 19<sup>23</sup> when he was studying the scattering of X-rays by various substances that the scattered rays contained rays of wavelength  $\lambda$  as well as rays of larger wavelength  $\lambda'$ . The difference  $\Delta\lambda = \lambda' - \lambda$  depends only on the parameters (we can call it the angle) between the original beam and the scattered beam.  $\Delta\lambda$  does not depend on the composition of the scattering substance and the wavelength  $\lambda$  of the incident light. All the features of the Compton effect can be explained by the fact that photons corresponding to X-ray waves are scattered from practically free electrons because of elastic collisions. Free electrons are those electrons whose energy of binding with their own atom is much smaller than the energy that a photon can impart to an electron during a collision. Note that a photon cannot give all of its energy to an electron (or any other particle) during an elastic collision. In this case, the laws of conservation of energy and momentum would be violated. Suppose a photon with energy  $\hbar\omega$  and momentum  $\hbar k$  falls on an electron at rest. Before the collision, the energy of the electron is  $mc^2$  (m-is the rest mass of the electron), and its momentum is 0. After the collision, its momentum is P, and its energy is  $(P^2c^2 + m^2c^4)^{1/2}$ . As a result of the collision, the energy and momentum of the photon changes  $-\hbar\omega'$  and  $\hbar k'$ [6]. It is clear that there are strings that vibrate in different forms inside the photon and the electron. The energies of elementary particles are proportional to the number of strings inside them. As a result of collision, strings of electron and photon interact. Part of the strings inside the photon goes to the electron, and part of the strings inside the electron goes to the photon. At this time, the number of strings inside the photon and electron changes. As a result, the difference in number leads to a change in the energy and, accordingly, the momentum of the particles. The difference between the bond energy between an atom and an electron and the energy resulting from the photon-electron interaction causes this scattering to occur at a certain angle. Since the number of strings inside the photon is relatively small, they create a small energy difference on the atom and a noticeable energy difference on the electron. Scattering of photons from electrons that are tightly bound to their atoms occurs in such a way that the photon is scattered from the entire atom and energy and momentum are exchanged with the entire atom.



When the mass of the atom is much larger than the mass of the electron, then the Compton shift is negligible,  $\lambda'$  being practically the same as  $\lambda$ . As the atomic number increases, the relative number of tightly bound electrons with the atom increases, thereby weakening the binding line. In light elements (in which the number of strings is relatively small), the electron is considered free because the binding energy is small, and therefore  $\Delta\lambda$  does not depend on the type of substance. Since the number of strings in heavy elements is greater, this bond energy cannot be ignored, and since the bond energy of electrons is different in different elements,  $\Delta\lambda$  depends on the type of substance [7]. So far, we have looked at the state where the electron is at rest. However, if the electron is in motion, then the electron can give (or receive) some of its energy to the photon, and because the photon receives additional strings, its energy increases (or decreases), and its wavelength decreases (or increases). This effect is called the inverse Compton effect. It was possible to successfully explain the Compton effect based on string theory. We will give more details in the next posts. Strings are formed from pairs of semistrings. Half-wires carry charge and mass in the form of a "curved dipole" in the shape of 1/4 of a circle. Each half-string has a charge of  $e/12$ , and in the case of quarks, when 4 half-strings are combined, they get a charge of  $4 \cdot (e/12) = e/3$ . When half strings of the same form are connected, they get a charge of  $2 \cdot (e/12) = e/6$ . The mass of the half-strings connected in this way changes, and if opposite charges are taken into account in the opposite connection, they will accumulate and increase the mass.

$$N_1 \cdot (e/12) + N_2 \cdot (e/12) = (N_1 + N_2) \cdot (e/12)$$

where  $(N_1 + N_2) \cdot m$  is the mass of the string,  $m - 1$  is the mass of the half string.

Thus, it was explained that the electric charges of the positron and the proton with  $q=e$  are the same, but

their masses are different. If the half-strings are combined in the same harmony, the charge and mass increase, if they are combined in opposite harmony, the charge changes, and the mass increases. The combination of half-wires as a result of mutual influence is described.



This indicates the formation of a vibrating string.

String theory can also explain all the properties of matter. The development of string theory will allow a better study of matter and complete elimination of contradictions between divisions of physics. If the theory of the smallest microscopic component of matter - the string theory - was confirmed through the observations of the discovered micro-events and the largest astronomical realm of the cosmos, the result would be consistent with A. Einstein's search for unity.

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# SOCIAL SCIENCES

## EFFECTS OF USING SMART DEVICES ON ACADEMIC RESULTS OF THE STUDENTS OF MAWLANA BHASHANI SCIENCE AND TECHNOLOGY UNIVERSITY (MBSTU)

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### Abstract

In this study our attempts is to find out the relationship between the academic performances of the student of Mawlana Bhashani Science & Technology University (MBSTU) with their uses of smart device. For this purpose, a survey was conducted over 255 students from various departments of MBSTU by stratified sampling with proportional allocation. Out of 255 student 55.7% are Male students and 44.3% are Female students. A structured questionnaire has been developed to gathered data from students. Cross tabulation and chi-square test have been applied to investigate the relationship between use of smart device and academic performance of the students and several graphical presentations are used in this study. From this study it is found that there is a significant relationship between use of smart devices and CGPA of the respondents ( $P\text{-value}=0.00$ ). This research indicates that there is a significant relationship between use of smart device and Health problem ( $P\text{-value}=0.00$ ) and there no significant relationship between use of smart device and study hampered. Thus, this study suggest that students should reduce to intense use of smart device and if they use it in study purpose they will be performed a good result.

**Keywords:** Effects, Smart devices, Academic results, MBSTU

### Introduction

Smart device is an electronic device, generally connected to other devices or networks via different wireless protocols such as Bluetooth, NFC, Wi-Fi, etc, that can operate to some extent interactively and autonomously. Several notable types of smart devices are Mobile, Tablet, Laptop, Gaming devices etc. It can be designed to support a variety of factors, a range of properties pertaining to ubiquitous computing and to use in three main system environments: physical world, human centered environments and distributed computing environments.

One smart device having web-browsers that can be connected through internet. It is a sources of education and entertainment though the uses of numerous applications. Smart device has become more popular to all generations because of its social networking applications such as twitter, Facebook that concepts people under umbrella.

A report by Kvavik and Caruso (2005) found that 62% of students own a desktop computer, while 55% own a laptop, 90% own a cellular phone, and 38% own a music device. Although some research has shown the impact computer and electronic mail use has on student learning, little research has been conducted to explore the impact of various types of technology use, including instant messaging, blogs, iPod, and Facebook on student development. In addition, little has been done to explore the differences between students based on gender and ethnicity.

Users of smart device habitually engage in browsing web, checking email, pocking social networking

sites, sending text messages, watching movie, playing games with touch and giant screen facility. However, the excessive usage of smart devices become addicted to it.

By using smart device interacts among people in which they can create, share and exchange information and ideas in virtual communities and network. It creates the opportunity to network with other members who share similar or common interest, dreams and goals. They usually interact each other by using social media network like Facebook, Twitter, LinkedIn, imo, Viber, WhatsApp, Skype and Messenger etc. These are currently available in Laptop, Tablet, iPhone, Android, Windows phone, Nokia Symbian60 and Blackberry. It is popular because there is no cost to message friends and family other than the internet data plan that users already have on their devices.

In 2015, the International Telecommunication Union estimated about 3.2 billion people or almost half of the world's population, would be online by the end of the year. Of them, about 2 billion would be from developing countries, including 89 million from least developed countries.

In Bangladesh, the smart device users are increasing rapidly and among them most are young adults. It becomes more popular among young generation, specially students, who study in college and university. It is increasing very rapidly. With the rapid growth of smart device users, the negative consequence of these devices usage is increasing. There also some positive and negative effects of using smart devices on academic performance of MBSTU students. Furthermore,

the perception of university students on smart devices addiction was investigated and the possible impact of this on the academic performance was evaluated.

### Background of the study

Due to the enormous development of technologies, this era can also be called the age of technology. With the purpose of serving in the social, educational and employment world technology is become the most essential tool ([www.customessaymeister.com](http://www.customessaymeister.com)). Social network sites, online games, video-sharing sites and gadgets such as iPods and mobile phones are now fixtures of youth culture (UNICEF, 2011). They have so permeated youth lives that it is hard to believe that less than a decade ago, these technologies barely existed. An important question which this paper tries to address is how smart devices affect academic performance of these young people. Technology is an integral part of most students' lives, hence it is important to understand the impact it has on academic achievement. We want measure the student academic performance by student academic results (CGPA). Most of the researcher around the word used the GPA to measure the student performance (Galiher, 2006; Darling, 2005; Broh, 2000; Stephen & Schaban, 2002).

According to Bangladesh telecommunication regulatory commission (BTRC), the total number of internet subscriber is 66.862 million up to September 2016, of which 62.968 million subscriber use mobile internet. About 80% internet users of Bangladesh are on a single social networking website, Facebook (BTRC, 2016).

The awareness of possible negative consequences of smart device usage certainly reduces the overuse of smart device. Few studies have been articulated the impact of smartphone addiction on students' academic performance (e.g., SAMAHA; HAWI, 2016; HAWI; SAMAHA, 2016), stress (CHIU, 2014).

Therefore, this study attempts to explore the impact of smart device on students' academic performance of MBSTU in Bangladesh.

### Motivation of the study

Empirical studies in traditional learning of determinants of students' performance have pointed to issues such as student's aptitude, class attendance, gender differences, study effort, instructor's teaching style, modern technology experience, academic environment and service received. There is also a factor which influences the result of a student, what is their smart devices expenditure. We found that Student age has no influence on overall academic success. We also found that Students who active on phone in the time of study also influence on overall academic success.

This study can contribute to find out the smart device related factors and other factors, which are responsible for student's inflexible behavior towards study, along with identifying those factors, which help a student to make progress in her studies. This study focuses on investigating the factors affecting performance of graduate and post graduate students. A survey was conducted to collect information and responses of students, regarding factors affecting their performance. At the end of the study, it is exposed that various variables have positive effects on the improvement of academic achievement.

### Objective of the study

The aim of the study is to find out the effects between smart devices usage and academic performance among the students of Mawlana Bhashani science and technology university (MBSTU). The objectives were pointed out as follows:

- To find out the relation among the uses of smart devices and academic performance of the overall MBSTU students.
- To investigate the effects of smart device on academic performance of the MBSTU students' faculty wise.
- To investigate the effects of smart device on academic performance of the MBSTU students' department wise.

### METHODOLOGY AND DATA COLLECTION

Accurate data collection and methodology used for any study are of main importance for any meaningful statistical investigation. So to describe a clear description on such aspects, selection of area and frame, sample selection, preparation of questionnaire, collection of data, tabulation and analytical method etc. we briefly discussed in this chapter. The methodology of survey involved the following stages.

#### Sources of data

The data needed the study were collected through formal interview schedule. The information collected from students of MBSTU. We collect data from people through face to face interview. The formulation of problem is far more often essential than its solution which may be a merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angel require creative imagination and marks real advance in science. In the following paragraphs we discuss the steps of methodology of this science. Research process consists of series of actions or steps necessary to effectively to carry out research and desired sequencing of these steps. The steps are:

- i. Define research problem
- ii. Review the literature
- iii. Formulate hypothesis
- iv. Research design
- v. Data collection
- vi. Analysis of data
- vii. Interpretation and report writing

The working procedure of the survey study, statistical analysis of the surveying report will be discussed.

#### Preparation of Questionnaire

Preparation of questionnaire is essential part of any research work. It is considering as the heart of survey operation. The questionnaire is the only media of communication between the investigator and respondent's. So the questionnaire should be designed with utmost care and caution so that all relevant and essential information for the enquire may be collected without any difficulty.

- Questions of sensitive and personal nature should be avoided.
- Questions should be capable of brief solutions.

- Questions should be in accordance to the objective of the survey.
- The size of the questionnaire should be simple, clear and unambiguous.
- Questions should be brief.
- Questions should be arranged in a logical order.

### Study Population and Design

The word population is the addition or whole set of individuals whose characteristics are of interest to us. In conducting any survey it is essential at first to define the target population clearly. The total number of respondents in MBSTU is our study population. The design of the study is investigator's plan of answering the research questions. The objective of selecting a study design is to minimize possible errors by minimizing the reliability and validity of the data in the study.

### Sampling Unit

We actually have considered MBSTU (Mawlana Bhashani Science and Technology University) for our study.

### Selection of area

It is most essential to select area where the particular purpose for study can be fulfilled. According for my small survey I have selected MBSTU, where I have

easily found the respondents. Only students of MBSTU are covered by the survey.

### Sampling Technique and Sample Size

This research was conducted to observe the usages of smart devices and impacts on academic performance. For this by using stratified random sampling with proportional allocation technique 255 students were selected as sample.

At an early stage in the planning of any investigation decisions must be made concerning the study population. That is concerning the population of individual units to be investigated. My study population is the students of MBSTU under the 5 faculties. A sample elements selected with the intention of finding out something about the total population from which they are taken. A convenient sample of 255 subjects was selected from the study area. Available subjects were entered into the study until a sample size of 255 was reached. The sampling frame use for the study where enrolment of each student provided by 15 departments of MBSTU.

As we consider stratified sampling with proportion allocation. We know that, the sample size in the  $i^{\text{th}}$  stratum

$$n_i = nN_i / N$$

Where,  $n$  = totalsamplesize,  $N_i$  = size of  $i^{\text{th}}$  strata,  $N = \sum N_i$  = totalpopulation.

Here we consider each department as strata.

**Sample taken by each strata are shown in the following table:**

| Name of The Department | Population Size | Sample Size | Name of The Department | Population Size | Sample Size |
|------------------------|-----------------|-------------|------------------------|-----------------|-------------|
| Statistics             | 275             | 18          | BMB                    | 140             | 9           |
| Mathematics            | 275             | 18          | Pharmacy               | 140             | 9           |
| Chemistry              | 300             | 20          | Textile                | 210             | 14          |
| Physics                | 300             | 20          | CSE                    | 275             | 18          |
| BGE                    | 275             | 18          | ICT                    | 275             | 18          |
| ESRM                   | 300             | 20          | Economics              | 200             | 13          |
| FTNS                   | 300             | 20          | BBA                    | 300             | 20          |
| CPS                    | 300             | 20          |                        |                 |             |

### Collection of data

We applied questionnaire method to data collection. For collection information we should have a good knowledge about the population. Each characteristic of study population was observed before sampling. We apply the sample procedure in every student. We collected data from each faculty of Mawlana Bhashani Science Technology University (MBSTU). The respondents were filled up the questionnaires short time

and not to discuss other. We tried our best to collect all information properly.

### Result and discussion

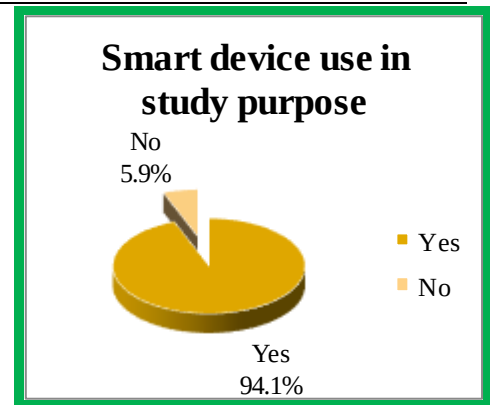
**Cross tabulation for finding the association between using smart device and CGPA of the students**

### Hypothesis:

$H_0$ : there is no relationship between CGPA and using smart devices of the respondents.

$H_1$ : There is a relationship between CGPA and using smart devices of the respondents.

|                    |     | CGPA of the students |           |           |           | Total |
|--------------------|-----|----------------------|-----------|-----------|-----------|-------|
|                    |     | 2.00-2.50            | 2.50-3.00 | 3.00-3.50 | 3.50-4.00 |       |
| Using smart device | Yes | 3                    | 17        | 136       | 84        | 240   |
|                    | No  | 0                    | 2         | 0         | 13        | 15    |
| Total              |     | 3                    | 19        | 136       | 97        | 255   |



#### Chi- square test

|                    | Value               | df | P-value |
|--------------------|---------------------|----|---------|
| Pearson Chi-Square | 19.335 <sup>a</sup> | 3  | .000    |

**Comment:** From the above table, we see that the value of Pearson chi-square is 19.335 degrees of freedom 3 and the corresponding p-value is 0.00 respectively, which is significant at 5% level of significance. Therefore, we can reject the null hypothesis, thus we conclude that there is a significant relationship between CGPA and using smart devices of the respondents.

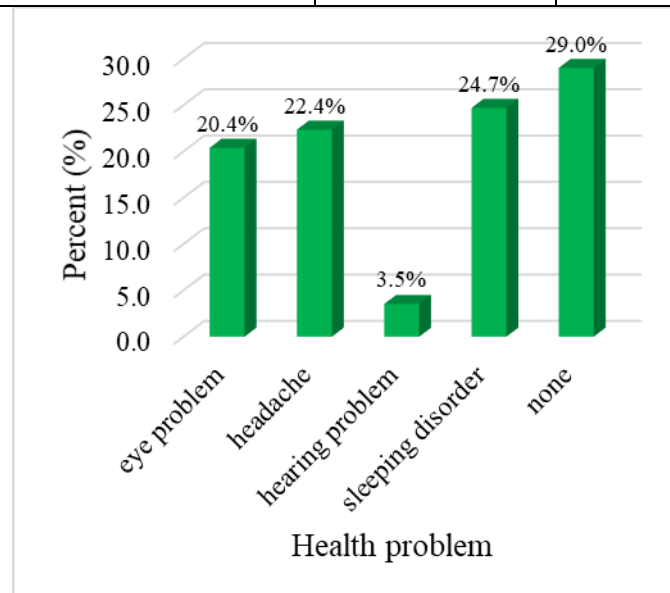
**Cross tabulation for finding the association between using smart device and Health problem of the students**

#### Hypothesis

H<sub>0</sub>: There is no relationship between use of smart device and health problem

H<sub>1</sub>: There is a relationship between use of smart device and health problem

|                |                   | Use of smart devices |    | Total |
|----------------|-------------------|----------------------|----|-------|
|                |                   | Yes                  | No |       |
| Health problem | Eye problem       | 52                   | 0  | 52    |
|                | Headache          | 54                   | 3  | 57    |
|                | Hearing problem   | 5                    | 4  | 9     |
|                | Sleeping disorder | 60                   | 3  | 63    |
|                | None              | 69                   | 5  | 74    |
| Total          |                   | 240                  | 15 | 255   |



#### Chi-square test

|                    | Value               | df | p-value |
|--------------------|---------------------|----|---------|
| Pearson Chi-Square | 27.708 <sup>a</sup> | 4  | .000    |

**Comment:** From the above table we see that the value of chi-square is 27.708 with degrees of freedom

4 and the corresponding p-value is .000, which is significant at 5% level of significant. Therefore we reject

the null hypothesis, thus we can say that there is a relationship between use of smart device and health problem.

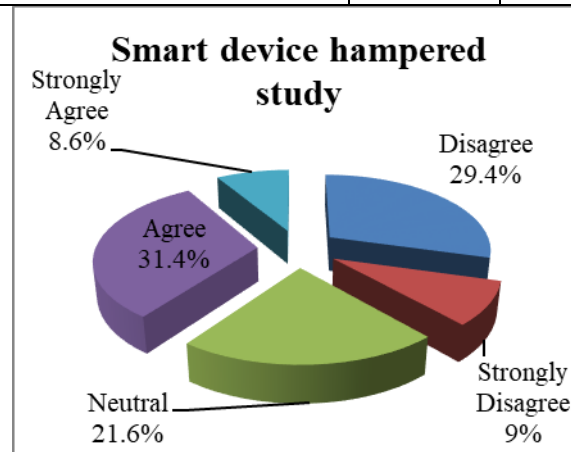
**Cross tabulation for finding the association between using smart device and hampered of the study.**

### Hypothesis

H<sub>0</sub>: There is no relationship between use of smart device and study hampered

H<sub>1</sub>: There is a relationship between use of smart device and study hampered

|                              |                   | Use of smart devices |    | Total |
|------------------------------|-------------------|----------------------|----|-------|
|                              |                   | Yes                  | No |       |
| Smart devices hampered study | Disagree          | 71                   | 4  | 75    |
|                              | Strongly disagree | 22                   | 1  | 23    |
|                              | Neutral           | 51                   | 4  | 55    |
|                              | Agree             | 74                   | 6  | 80    |
|                              | Strongly agree    | 22                   | 0  | 22    |
| Total                        |                   | 240                  | 15 | 255   |



### Chi-square test

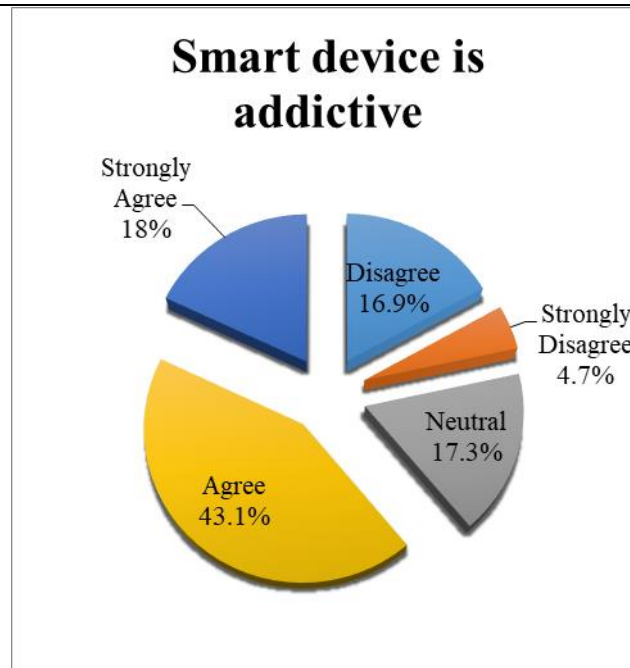
|                    | Value              | df | P-value |
|--------------------|--------------------|----|---------|
| Pearson Chi-Square | 2.084 <sup>a</sup> | 4  | .720    |

**Comment:** From the above table we see that the value of chi-square is 2.084 with degrees of freedom 4 and the corresponding p-value is .720, which is insignificant at 5% level of significant. Therefore, we cannot

reject the null hypothesis, thus we can say that there is no relationship between use of smart device and study hampered.

### Frequency distribution of addictivity on smart devices

| Smart device is Addictive | Frequency | Percent |
|---------------------------|-----------|---------|
| Disagree                  | 43        | 16.9    |
| Strongly Disagree         | 12        | 4.7     |
| Neutral                   | 44        | 17.3    |
| Agree                     | 110       | 43.1    |
| Strongly Agree            | 46        | 18.0    |
| <b>Total</b>              | 255       | 100.0   |



**Comment:** From above we see that the opinion about “smart devices are addictive” 4.7% respondents are Strongly disagree, 16.9% are Disagree, 17.3% are Neutral, 43.1% are Agree and 18% are Strongly agree. Thus, we can say that Smart devices are addictive.

#### Recommendation

We found that there is light relationship between smart device usages and CGPA of the students. The student who use smart devices for study purpose have higher CGPA than those who do not use. However, if a student spent more time on smart devices than it has a negative impact on his CGPA. It will be better for improve CGPA if the following steps would be taken

- Students should be avoiding the addictivity to smart devices.
- The students should make routine to use the smart phone.
- At the time of class and study the phone should be switch off or silent mode.
- In the deep night time after 12 am students should not use smart phone.
- At the time of examination various social apps like Facebook, WhatsApp's, Skype, should off or little use.

#### Conclusion

Now-a-days smart device has become very essential device, people can't think a single moment without it. There are many useful directions to use smart devices. But some people has become addictive to it. For this reasons they may suffer in the future life. The purpose of this was to assess the smart devices related factors and other factors which affects the academic performance of the MBSTU students. An perfect solution can improve the academic performance of the students. We observe that there is a significant relationship between CGPA and study uses smart devices. That means who uses smart devices for academic study purpose have a good CGPA than who uses for others. There is a significant relationship between use of smart devices and Health problem. That is who uses smart devices may suffering from different types of health problem.

There are some another factors such as marital status, prepared class lesson regularly, attend class regularly and followed teacher lecture that influence the academic performance. The students followed these regularly, he/she has a achieved good academic performance. Therefore, this research is very important for the MBSTU students because it provides a better understanding of the context for smart device use.

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# TECHNICAL SCIENCES

## ARTIFICIAL INTELLIGENCE IN AUTONOMOUS SYSTEMS: APPLICATIONS AND THE FUTURE

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### Abstract

The work analyzes key technologies underlying autonomous systems, such as machine learning, big data processing, and sensor networks. Particular attention is paid to practical examples of the use of artificial intelligence (AI) in autonomous systems, and security, reliability, and ethics issues related to their implementation are discussed.

The article emphasizes the importance of further research and development in this area, since autonomous AI-controlled systems can significantly increase the efficiency and safety of processes, as well as open up new horizons in automation and independent work in a wide variety of industries.

**Keywords:** autonomous systems, artificial intelligence, management, ethics and security, prospects mathematics teacher and possibilities of using artificial intelligence.

The age of the digital revolution has opened new horizons for humanity. One of the most ambitious and, at the same time, controversial achievements of this time was autonomous systems with artificial intelligence (AI). These systems, endowed with the ability to learn and make decisions, transform our society, economy, and even the very nature of human existence. This manifesto aims to address and highlight the key aspects and challenges associated with autonomous systems and to suggest ways to implement them ethically and effectively in our society.

### Prospects and opportunities

Autonomous systems with AI have tremendous potential to improve quality of life. They can streamline production processes, improve transport safety, improve medical diagnosis and treatment, and make our homes and cities smarter and more convenient. Such systems are capable of performing tasks with high accuracy and speed beyond human capabilities. For example, in the medical field, AI can analyze medical images in incredible detail, and in transport, it can reduce accidents thanks to autonomous driving systems. "Artificial intelligence is the study of how to create computers that can perform tasks that were ever thought possible only for human intelligence," wrote Russell, S., & Norvig, P. (2020). *Artificial Intelligence: A Modern Approach*. 4th ed. Pearson.

### Ethics and responsibility

However, with great power comes great responsibility. One of the main issues facing society is the ethics of using autonomous systems. AI decision-making, especially in critical areas such as health or safety, requires careful oversight and transparency. How do we ensure that AI algorithms act fairly and do not introduce bias or discrimination? How to ensure that autonomous systems work in the interests of all mankind and not just a narrow circle of people or organizations? These issues require developers, governments, and citizens to work together to create effective norms and standards.

### Economic and social consequences

Autonomous systems with AI can affect the labor market and the economy, as the replacement of human resources with robots leads to job cuts, which causes concern among the population. On the other hand, it also opens up new opportunities for job creation in the development, maintenance, and management of these systems. Therefore, it is very important to think over retraining and advanced training strategies for employees to minimize negative consequences and create conditions for economic growth.

"Autonomous robots are designed to operate independently, adapting to changing environments through complex decision-making processes and sensor-based perception, which allow them to perform tasks without human intervention," wrote Valavanis, K. P., & Vachtsevanos, G. J. [*Autonomous Robots: Modeling, Planning, and Control*. Wiley. 2015, interview]

### Sustainable Development and Security.

The introduction of autonomous systems should take into account issues of sustainable development and safety. AI systems can become targets of cyberattacks or can be used for malicious purposes. Therefore, it is crucial to develop effective measures to ensure their safety and protection from abuse. Innovation must be coupled with robust data protection mechanisms and compliance with security standards. Many study authors emphasize the importance of the security of autonomous systems, which is a key aspect when discussing their prospects. Tak Cao, Y., & Wang, X. wrote: "The security of autonomous systems is a critical factor for their successful operation and trust on the part of users; it is necessary to integrate risk assessment methods at all stages of design and operation." . ["Safety in Autonomous Systems: An Analytical Review." *Systems Engineering*, 22(4), p. 305-317, 2020].

### Human interaction and cooperation

The introduction of autonomous systems should not be seen as a replacement for humans but as a way

to complement and improve human potential. These systems need to work in tandem with the individual, supporting and empowering us. Human-AI interactions must be based on trust and mutual respect, where technology serves as tools for the common good. Так в статье Valavanis, K. P., & Vachtsevanos, G. J. указано "Autonomous robots are designed to operate independently, adapting to changing environments through complex decision-making processes and sensor-based perception, which allow them to perform tasks without human intervention." [Autonomous Robots: Modeling, Planning, and Control. Wiley, 2015]

### Conclusion

Autonomous systems with artificial intelligence represent not only a technological achievement but also a challenge that requires a conscious approach. We must strive to ensure that their introduction contributes to the creation of a fairer, safer, and more prosperous society. It is necessary to realize the responsibility when using AI, respect for human dignity, and the need for joint efforts to solve emerging problems. We are on the verge of a new era, and it depends on us how we will use this power for the benefit of all mankind.

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## METHODS OF EVALUATION OF THE ECONOMIC EFFICIENCY OF THE USE OF INFORMATION TECHNOLOGIES IN THE FINANCIAL ACTIVITIES OF ENTERPRISES

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### Abstract

The article is devoted to the analysis of IT efficiency assessment methods. Economic efficiency of IT application is the ratio of profit and total costs of the enterprise. The purpose of the article is to study the methods of economic efficiency of IT application. To achieve the set goal, it is necessary to solve the following issues: to give the concept of economic efficiency of IT, to learn the main methods of evaluating the economic efficiency of IT. Taking into account the scientific innovation-financial indicators, recommendations on increasing the effectiveness of the activity were developed. MRP, MRPII and ERP are focused on the internal organization of the enterprise, and CSRP systems include a full range of business technologies from future product design, taking into account customer requirements for warranty, service and maintenance. The main stages of evaluating the effectiveness of IT application in the enterprise can be summarized in 3 stages: preparation, analysis and evaluation of the choice of technology; application – analysis.

**Keywords:** economy; information technologies; assessment; efficiency

### Introduction.

**The urgency of the problem.** The role of Information Technologies (IT) in modern times is significantly greater. These technologies are developing day by day. It can be said that IT is used in all fields [1]

A generally accepted approach to determining the economic efficiency of an IT application is the ratio of the enterprise's profit and total costs. However, the effectiveness of the evaluation based on only one indicator reduces the scope and creates a limited economic picture. This problem is that the effect of information technology on the profitability of an enterprise is mediated and it is aimed at improving business processes of the enterprise, increasing efficiency, obtaining analytical data, making management decisions, etc. It is difficult to measure the actual profitability of IT from the overall profit of the enterprise. Therefore, the value of the performance indicator will not be able to provide accurate information about the rationality of a certain information technology. This is related to the problems of determining the results of automation, since it is not enough to calculate the efficiency as the difference between the resources spent and the savings achieved.

The purpose of the article is to study the methods of economic efficiency of IT application.

In order to achieve the set goal, it is impossible to solve the following issues: to give an understanding of

the economic efficiency of IT, to learn the main methods of evaluating the economic efficiency of IT.

Taking into account the scientific innovation-financial indicators, recommendations on increasing the effectiveness of the activity were developed.

### Economic efficiency of IT implementation.

The countries of the world are becoming globalized day by day, new scientific achievements are achieved, new information technology products are emerging, and the demands placed on the world economy are subject to change. If in the last century the world economy was mostly based on oil, gas, and gold, now it is an undeniable fact that it is formed on IT. It is true that even today oil import and export occupies a very important place in the world economy. However, experience shows that the economies of those countries develop more, which, along with natural resources, produce science-intensive products. In this regard, the role of IT in the world economy is undeniable. One of the main directions in increasing the role of IT in economic development is the creation of corporate information systems and the expansion of their use. Achieving higher results in this direction requires expanding the application of information systems in the country [2].

In order to evaluate the effectiveness of investments in information technologies and their role in the

development of information systems, which are of special importance in economic development, there are currently various approaches. One of these approaches is the methods of evaluating the country, region or individual enterprise according to individual indicators and aspects, taking into account the current situation. Here, the calculation and comparative evaluation of financial ratios is usually carried out with the application of information technologies. However, it should be noted that such an approach does not allow a full evaluation of the results of the application of information technologies. In the second group approach, the use of expert methods is preferred [3].

Using this method, it is possible to determine in advance the income that will be obtained by the application of information technologies. It is more appropriate to evaluate the effectiveness of the application of IT to the economy not only at the initial stage and at a certain stage of the process, but at every stage in general. It is this form of application of the methods that allows the correct use of rapidly changing, modernizing IT.

Determining economic efficiency is a more complex issue and must be evaluated in terms of strategic goals and the development of the entire enterprise. The information technology market is developing very dynamically in response to the needs of the business environment, so there is a new CSRP (Customer Synchronized Resource Planning), total organizational resource planning, integration of customer-oriented strategy and synchronized interactions with customers. These information technologies are next-generation technologies, if MRP, MRPII and ERP focus on the internal organization of the enterprise, then CSRP systems incorporate complete business technologies from future product design, taking into account the customer's warranty, service and maintenance requirements. According to the information of the world consulting companies, for the majority of enterprises where such systems are applied, the stock reserves are reduced by an average of 11%, operating costs are reduced by 12%, administrative costs are reduced by 10%, delivery time is improved by 13%, production compliance is reduced by 12%; production cycle decreased by 14%. However, 27% of the heads of enterprises participating in the survey said that they did not return the investments spent on the application of information technologies, and 28% said that they could not evaluate the effect received [4].

Only 35% of companies implement integrated information systems without exceeding the budget, and only one third of such projects are completed according to the planning schedule. As a result, many enterprises do not get the expected benefits: only 8% of them will receive 80-100% of the planned functions. This modern stage of enterprise management automation is also characterized by an increase in indirect effects: standardization of processes, integration of various information products, flexibility and promptness of responding to the needs of consumers, which adds difficulties to the assessment process [4].

The efficiency of using information systems in the economic management of the enterprise directly depends on two main factors: the effect on improving the

management efficiency of the enterprise and the reduction of the cost of the enterprise, which increases the profitability of the enterprise. Enterprise information infrastructure management processes, and especially IT processes (information technologies), are related to the purchase of technologies, project development, preparatory work, development of new management technologies, and substantial investment of resources for personnel training [5].

The main stages of evaluation of IT implementation and use efficiency in the enterprise can be summarized in 3 stages: preparation, analysis and evaluation of technology selection; implementation - analysis and evaluation of direct costs and justification of expediency; application - assessment of the economic efficiency of the application and calculation of intellectual depreciation and the gradual modernization of information technologies in the future.

Economic efficiency is calculated at all stages of IS design: 1) when investigating for the creation of an enterprise, there is a preliminary calculation of the expected economic efficiency; 2) a detailed calculation of the expected economic efficiency at the stage of technological design has been completed; 3) application to industrial activity, determination of actual economic efficiency. However, predictive calculations in the first stages of work preparation and design [5].

The calculation of economic efficiency after the introduction or modernization of the information system or individual information technologies is often considered in the framework of two methodological directions in the national economy, the first is based on the annual economic effect, and the second is based on the calculations of the integral economic effect. During the calculation of the annual economic effect, the annual sales volume, production costs, profit from sales during the reporting period (after the change in the information system of the enterprise) are compared with similar indicators during the base period (before the change in the enterprise).

If the economic effect is calculated, a comparison of the indexes of the cost and income side of the enterprise's activity is carried out during the entire reporting period from the beginning of the changes in the IS of the enterprise. However, both methods of calculating economic efficiency do not allow an accurate assessment of the enterprise's contribution to the overall economic development. This is due to many factors that can affect the comparative indices. For example, the annual sales volume may change due to the introduction of new technological developments, changes in demand or advertising policy.

Therefore, it is necessary to determine the economic effect of using IT based on all factors: economic, organizational, technical and social factors. Financial, qualitative and predictive analysis methods are used for this. Financial analysis is a commonly accepted tool for justifying any business project. The methods in this analysis use traditional approaches to the calculation of economic efficiency, taking into account the characteristics. The superiority of financial methods in the main principles taken from the classical theory of determining economic efficiency.

Also, through financial methods, the economic parameters of IS creation and implementation can be evaluated similar to the evaluation of any other investment projects. Qualitative analysis methods complement quantitative calculations that help to evaluate all factors of IS efficiency and compare them with the company's overall strategy. This group of methods allows professionals to select the most important characteristics of systems, regardless of product characteristics and enterprise activity, and change the ratio between indicators using importance coefficients. Forecasting methods use statistical and mathematical models to estimate risk probability. An information system is used to evaluate the future effect of such methods; They are not as widespread in practice as others.

### CONCLUSION

First result. All groups of methods for assessing the economic efficiency of the enterprise allow to obtain comprehensive information about the use of the enterprise at all stages of its development.

The second result is that, despite the fact that in modern conditions any enterprise has a fairly large se-

lection of various methods and methodologies for evaluating the efficiency of use, businessmen prefer analysis with two indicators: the total cost of ownership and the return on investments (the coefficient of return on investments).

The third result. Total cost of ownership describes the full set of costs for the implementation and use of information systems, including the indirect costs associated with the development, implementation, and operation of the information systems, in addition to the direct costs of the information systems.

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## ARTIFICIAL INTELLIGENCE FOR AUTOMATED TESTING AND BUG TRACKING

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The article is dedicated to the use of artificial intelligence for software testing automation and bug tracking. It describes the key aspects of implementing intelligent testing systems, including automatic test scenario generation, code analysis, defect prediction, and log analysis. Specific examples of tools that demonstrate an increase in the speed and efficiency of testing are considered. The article provides statistical data confirming the growing popularity of the use of intelligent systems in software testing among large companies, which allows improving product quality and optimising processes.

**Анотація**

Стаття присвячена використанню штучного інтелекту для автоматизації тестування програмного забезпечення та відстеження помилок. Описуються ключові аспекти впровадження інтелектуальних систем тестування, що включають автоматичну генерацію тестових сценаріїв, аналіз коду, прогнозування дефектів та аналіз логів. Розглянуто конкретні приклади інструментів, які демонструють підвищення швидкості та ефективності тестування. Наведені статистичні дані, які підтверджують зростання популярності використання інтелектуальних систем у тестуванні програмного забезпечення серед великих компаній, що дозволяє покращити якість продуктів і оптимізувати процеси.

**Keywords:** artificial intelligence, test automation, software testing, bug tracking, machine learning, intelligent systems, code analysis, test scenario generation, defect prediction, software product quality assurance.

**Ключові слова:** штучний інтелект, автоматизація тестування, тестування програмного забезпечення, відстеження помилок, машинне навчання, інтелектуальні системи, аналіз коду, генерація тестових сценаріїв, прогнозування дефектів, забезпечення якості програмного продукту.

**Актуальність проблеми.** Процес розробки програмного забезпечення в сучасному світі є ресурсоємним і складним, поєднуючи в собі всі етапи життєвого циклу продукту: від планування та проектування до самого процесу розповсюдження та підтримки [1]. Одне з важливих місць займає тестування, яке покликане гарантувати високу якість продукту шляхом мінімізації кількості помилок. Серйозним недоліком такого підходу є те, що ручне тестування може затягнутися на дуже довгий час, що вносить свій внесок у виникнення помилок обумовлених людським фактором [2]. Автоматизація тестування програмного забезпечення останнім часом перетворилася на важливий інструмент, який дозволяє скоротити час, підвищити точність і збільшити ефективність [3]. Завдяки розвитку штучного інтелекту з'явилася можливість застосовувати інтелектуальні системи автоматизації тестування, завдяки чому виявлення дефектів значно покращується і передбачає менше втручання людини.

**Що таке інтелектуальна система автоматизації тестування?** До інтелектуальних систем автоматизації тестування відносяться рішення, які використовують штучний інтелект і машинне навчання в процесах пошуку і відстеження помилок, автоматизації процесів тестування [4]. Такі системи можуть адаптуватися до змін у програмному забезпеченні, виявляти приховані помилки та надавати глибокий аналіз продуктивності системи. Це дозволяє тестувальникам і розробникам зосередитися на більш складних завданнях, зменшивши кількість рутинних операцій.

**Використання штучного інтелекту для автоматизованого тестування.** Штучний інтелект і машинне навчання дозволяють автоматизувати в області тестування наступні процеси [5].

1. Генерацію тестових випадків. За допомогою штучного інтелекту можна проаналізувати вимоги і згенерувати тестові сценарії, що включають кілька

варіантів дій користувачів [6]. Таким чином, підготовка тестів займає набагато менше часу, а покриття тестів збільшується.

2. Тестування користувацького інтерфейсу. Інструменти зі штучним інтелектом виконують автоматизоване тестування користувацького інтерфейсу, імітуючи взаємодію користувача з програмним продуктом [7]. Ці інструменти призначені для пошуку проблем у функціонуванні заданих елементів інтерфейсу.

3. Прогнозування дефектів. За допомогою машинного навчання, аналізуючи попередні дані про помилки, можна передбачити, які частини коду мають високу ймовірність розміщення дефектів [8]. Це дозволить розробникам сконцентруватися на критично важливих частинах системи.

4. Аналіз коду та тестів. Інтелектуальні системи можуть автоматично аналізувати код для виявлення потенційних вразливостей, відхилень від стандартів і структурних проблем. Штучний інтелект також здатний аналізувати результати тестів, щоб набагато швидше визначити, що йде не так і де це відбувається.

**Відстеження помилок за допомогою штучного інтелекту.** Відстеження помилок - одна з основних частин процесу забезпечення якості програмного продукту. Штучний інтелект може значно збагатити цей процес завдяки кільком функціям. Наприклад, системи штучного інтелекту можуть автоматично аналізувати системні журнали і виявляти потенційні вразливості або помилки, які не були виявлені за допомогою людського аналізу [9]. Це значно прискорює процес виявлення критичних проблем. Ще однією важливою перевагою штучного інтелекту є можливість класифікувати та визначати пріоритетність помилок на основі їхньої критичності, що дозволяє командам тестувальників та розробників зосередитися на вирішенні найбільш важливих завдань. Системи штучного інтелекту також значною мірою сприяють автоматизації процесу аналізу першопричин, що значно економить час при спробі виправити помилку. Це дуже корисно у випадках складних помилок, коли ручний пошук першопричини може зайняти багато часу. Його переваги полягають у тому, що інтелектуальна система вчиться на попередніх виправленнях і застосовує знання в нових випадках. Це прискорює процес виправлення помилок і допомагає постійно вдосконалювати систему з кожним новим етапом відстеження та усунення проблем.

**Переваги використання штучного інтелекту в тестуванні та відстеженні помилок.** Однією з переваг використання штучного інтелекту у відстеженні помилок є те, що він дає значний приріст швидкості під час тестування. Тестування, що виконується за допомогою інтелектуальних систем, дозволяє підвищити продуктивність порівняно з ручним тестуванням, оскільки сотні і тисячі тестів можуть бути автоматично виконані в режимі реального часу. Крім того, штучний інтелект підвищує точність під час тестування, а отже, зменшує вплив людського фактору і робить процес перевірки програмного продукту інтенсивним і всебічним. Ще

одна важлива перевага полягає в тому, що інтелектуальні системи автоматично отримують інформацію про будь-які зміни в програмному забезпеченні, отже, їхні стратегії тестування адаптуються в реальному часі. Це позбавляє команду від рутинної роботи, дозволяє їм зосередитися на творчих і критичних аспектах розробки та значно підвищує продуктивність праці [10].

**Методи, що застосовуються для реалізації інтелектуальних систем.** Інтелектуальні системи автоматизації тестування програмного забезпечення використовують різноманітні методи й підходи для забезпечення точності, швидкості та масштабованості процесу тестування. Ось кілька конкретних методів та прикладів їхнього використання в реальних сценаріях.

1. Одним з найважливіших способів застосування штучного інтелекту в автоматизованому тестуванні є машинне навчання для аналізу коду і прогнозування дефектів. Приклади включають використання глибокого навчання в системах на кшталт Diffblue Cover [11] для генерації тестів на основі коду та історичних даних про дефекти. Згідно з експериментами, таким системам вдалося зменшити кількість критичних помилок на 30-40%, а також прискорити тестування на 20-25% порівняно з ручним підходом.

2. Генерація тестових сценаріїв за допомогою штучного інтелекту. Інструменти на кшталт digital.ai [12] автоматично генерують тестові кейси мобільних додатків шляхом сканування інтерфейсів і поведінки користувачів. Система може генерувати тести для більш ніж 80% тестового покриття інтерфейсу користувача за лічені хвилини, скорочуючи час підготовки сценаріїв в середньому на 2-3 дні, якщо це робиться вручну.

3. Автоматизація регресійного тестування. Регресійне тестування – це повторне виконання тестів, яке дозволяє бути впевненим, що зміни в коді не призвели до появи нових помилок. Автоматизувати регресійне тестування можна за допомогою розумних інструментів, одним з яких є Functionize [13]. Система здатна самостійно адаптуватися до змін у коді, автоматично оновлюючи тестові випадки. Завдяки використанню Functionize продуктивність тестування зросла на 60%, а кількість виправлень вручну зменшилася на 50%.

4. Аналіз поведінки користувачів і прогнозування вразливостей. Завдяки штучному інтелекту можна аналізувати активність реальних користувачів і передбачати точки збою, які можуть виникнути. Наприклад, Appliflow [14] виконує автоматичний аналіз змін на веб-сторінках для виявлення прихованих проблем - наприклад, графічних помилок, які людське око навряд чи зможе помітити. За допомогою цієї системи вдалося зменшити кількість пропущених візуальних дефектів на 45% [15].

Аналіз логів та аналіз першопричин. Інтелектуальні платформи, такі як Splunk і Logz.io, безперервно відстежують логи додатків, заздалегідь передбачаючи події, які можуть призвести до аварій. Класифікуючи помилки за допомогою штучного інтелекту, ці інструменти дають вам можливість визначити першопричини з системного журналу.

Наприклад, ця система скорочує середній час виявлення та усунення проблем на 35%.

6. Тестування на основі моделей. Серед підходів, які може використовувати штучний інтелект, є тестування на основі моделей. Система аналізує бізнес-логіку програми і створює тести на основі моделей поведінки користувачів або на основі очікуваних результатів роботи системи. За допомогою цього методу можна зменшити кількість ручної роботи на етапі розробки тестових кейсів на 50-70%, що може бути особливо корисним у великих системах з розгалуженою логікою, таких як ERP або CRM-системи.

**Статистичні дані.** У звіті, наданому Capgemini у 2023 році, було зазначено, що 48% великих організацій вже використовують штучний інтелект в процесах тестування програмного забезпечення, а ще 32% зроблять це протягом двох років. У компаніях, які використовують інтелектуальні системи для автоматизації тестування, швидкість випуску оновлень зросла з 25% до 40%, а кількість помилок у виробничому середовищі скоротилася на 30-50% [16].

Використання штучного інтелекту дозволяє суттєво підвищити ефективність автоматизації тестування, зробивши цей процес ще більш гнучким, швидким і надійним. Це допоможе не тільки в підвищенні якості продукту, але і в оптимізації ресурсів, що має серйозне значення в умовах стрімкого розвитку технологій і підвищення вимог до якості програмного забезпечення.

**Приклад успішного впровадження.** Компанія Google активно застосовує штучний інтелект для автоматизації тестування своїх продуктів. Згідно з дослідженням компанії, за допомогою інтелектуальних систем крос-платформне тестування браузера Chrome було прискорено на 20%, а витрати на тестування скоротилися на 15%. При цьому точність виявлення критичних дефектів зросла на 30%, що значно зменшило кількість екстрених випусків оновлень [17].

**Виклики впровадження штучного інтелекту в автоматизацію тестування.** Незважаючи на значні переваги використання штучного інтелекту в автоматизації тестування програмного забезпечення, існує також кілька проблем, які можуть супроводжувати його впровадження. Одним із головних є висока вартість впровадження, оскільки інтелектуальні системи можуть бути досить дорогими, особливо на початковому етапі. У випадку з невеликими компаніями це є стримувальним фактором від впровадження таких систем. Крім того, робота зі штучним інтелектом вимагає технічних навичок - дуже висококваліфікованих фахівців з машинного навчання та тестування програмного забезпечення. Ще однією проблемою є якість і кількість тестових даних, оскільки від цього залежить ефективність роботи інтелектуальних систем, а їх кількість може бути обмеженою [18].

**Висновки.** Інтелектуальна автоматизація тестування програмного забезпечення - це величезний стрибок вперед для забезпечення якості програмного забезпечення. Вона може значно підвищити ефективність тестування, зменшити кількість

помилки і заощадити час на їх пошук. Хоча впровадження штучного інтелекту вимагає значних ресурсів і технічних знань, потенційні вигоди від його використання перевищують витрати, роблячи його важливою частиною сучасної розробки програмного забезпечення.

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**THE IMPACT OF BIG DATA ON MARKETING AND ADVERTISING IN THE HOTEL INDUSTRY****Halan O.***Candidate of Technical Sciences, Associate Professor of IT, State University of Infrastructure and Technology (Kyiv, Ukraine).***Skorokhodov M.***Second-level (educational and scientific) higher education student of the State University of Infrastructure and Technology (Kyiv, Ukraine)***ВПЛИВ BIG DATA НА МАРКЕТИНГ ТА РЕКЛАМУ В ГОТЕЛЬНІЙ ІНДУСТРІЇ****Галан О.В.***Кандидат технічних наук, доцент каф ІТ, Державний університет інфраструктури та технологій (Київ, Україна)***Скороходов М.***Здобувач вищої освіти другого (освітньо-наукового) рівня Державного університету інфраструктури та технологій (Київ, Україна)*<https://doi.org/10.5281/zenodo.13863446>**Abstract**

The article examines the influence of Big Data technologies on marketing strategies of the hotel industry. The main methods of collecting and analyzing large volumes of data, their application to improve customer service and increase loyalty are considered. Special attention is paid to the analysis of practical cases of Big Data implementation in the hotel business, and the main challenges faced by Ukrainian hotels when implementing these technologies are identified. The prospects for the development of the hotel industry thanks to the use of big data processing technologies have been determined.

**Анотація**

У статті досліджено вплив технологій Big Data на маркетингові стратегії готельної індустрії. Розглянуто основні методи збору та аналізу великих обсягів даних, їх застосування для покращення обслуговування клієнтів та підвищення лояльності. Особлива увага приділена аналізу практичних випадків впровадження Big Data в готельному бізнесі та визначено основні виклики, з якими стикаються українські готелі при впровадженні цих технологій. Визначено перспективи розвитку готельної індустрії завдяки використанню технологій обробки великих даних.

**Keywords:** Big Data, hotel industry, marketing, data analysis, customer loyalty, personalization of services, technologies, big data, business analytics.

**Ключові слова:** Big Data, готельна індустрія, маркетинг, аналіз даних, клієнтська лояльність, персоналізація послуг, технології, великі дані, бізнес-аналітика.

Вплив Big Data на маркетинг та рекламу в готельній індустрії є незаперечною революцією у способах, якими готелі привертають та зберігають своїх клієнтів. За допомогою аналізу великих обсягів даних, готелі отримують унікальну можливість визначити потреби, уподобання та поведінку своїх клієнтів, а також передбачати їхні майбутні вимоги. Це відкриває широкий простір для створення персоналізованих маркетингових кампаній та пропозицій, які не лише привертають нових клієнтів, а й забезпечують лояльність та задоволеність вже існуючих. В даній статті ми розглянемо ключові аспекти використання Big Data в готельній індустрії, а також вплив цих технологій на стратегії маркетингу та реклами, що дозволяє готелям досягати нових висот ефективності та конкурентоспроможності.

Мета статті полягає в дослідженні впливу інноваційних технологій Big Data на сучасний маркетинг та рекламу у готельній галузі. Ця стаття спрямована на розкриття потенціалу аналізу великих обсягів даних у вигляді інструменту для розробки та впровадження ефективних маркетингових стратегій, спрямованих на задоволення потреб сучасних

клієнтів, а також на виявлення можливостей персоналізації рекламних пропозицій для максимального залучення та утримання аудиторії.

Сучасний готельний бізнес стикається з безпрецедентними викликами та можливостями, що створюються завдяки швидкому розвитку технологій та зміні у споживчому поведінці. Інновації в області Data Science відкривають нові горизонти для готелів у сферах маркетингу, реклами та оперативного управління. Аналіз великих обсягів даних (Big Data) стає невід'ємною частиною стратегій розвитку для багатьох готелів, допомагаючи їм адаптуватися до змін у ринковій конкуренції та вимогах клієнтів.[1]

У наш час, важливою або навіть необхідною стає наявність фахівців з Data Science в команді готелю. Вони використовують дані для вдосконалення стратегій маркетингу, управління доходами, а також для поліпшення обслуговування та персоналізації досвіду перебування гостей. Однак, варто зауважити, що використання Big Data вимагає не лише технічної експертизи, але і здатності аналізувати та інтерпретувати дані з позиції бізнесу.

Одним з основних аспектів впливу Big Data на готельний бізнес є його значення для маркетингу та реклами. Збір та аналіз великих обсягів даних дозволяє готелям краще розуміти свою цільову аудиторію, її потреби та уподобання. На основі цих даних розробляються персоналізовані маркетингові кампанії, спрямовані на максимальне залучення та утримання клієнтів. Крім того, аналіз великих даних дозволяє готелям ефективно спрогнозувати попит на послуги та адаптувати свою маркетингову стратегію відповідно до цих тенденцій.

Внутрішні та зовнішні дані грають важливу роль у формуванні успішних маркетингових стратегій для готелів. Внутрішні дані, такі як інформація про транзакції та програми лояльності, допомагають в управлінні доходами та розробці персоналізованих пропозицій для клієнтів. Зовнішні дані, зокрема відгуки та бронювання, є важливими для репутаційного менеджменту та визначення стратегій взаємодії з конкурентами.[2]

Загалом, глибока аналітика Big Data може принести готелям значний користь у трьох основних напрямках: вона допомагає створити особливу цінність для гостей, оптимізувати маркетингові та операційні процеси, а також сприяє смарт-трансформації готелів, що веде до створення персоналізованих та високоякісних досвідів перебування для клієнтів.

Українські готелі та компанії в галузі туризму поступово впроваджують аналіз великих даних у свою діяльність, проте, існують певні виклики, пов'язані з організаційними аспектами та вартістю впровадження таких технологій. Однак, враховуючи потенціал, який вони можуть надати, ці виклики здаються більшими можливостями для розвитку та залучення клієнтів. Відчути всі переваги Big Data у готельному бізнесі — це крок у майбутнє, де кожен гість отримує індивідуально налаштований та неперевершений досвід використання.

У сучасному бізнесі використання великих обсягів даних, відомих як Big Data, стає все більш розповсюдженим, особливо у галузі маркетингу та реклами. Великі дані можуть бути використані для аналізу різних аспектів бізнесу, включаючи фінансову діяльність, операційні процеси та стратегії маркетингу. Ось детальніше про те, як ці дані впливають на маркетинг та рекламу в готельній індустрії:

1. Фінансові дані: Вони надають можливість оцінювати фінансовий стан компанії, включаючи доходи, витрати та прибуток. Ці дані допомагають розробляти ефективні стратегії маркетингу та реклами, враховуючи бюджетні обмеження та потенційні доходи.

2. Операційні дані: Вони стосуються бізнес-процесів, таких як обробка замовлень, обслуговування клієнтів та управління запасами. Аналіз цих даних допомагає вдосконалювати сервіс та ефективність роботи готелю, що може впливати на репутацію та задоволеність клієнтів.

3. Статистика маркетингу: Великі дані дозволяють відстежувати ефективність маркетингових

кампаній, аналізувати відгуки клієнтів та визначати їхній інтерес та потреби. Це дозволяє готелям створювати персоналізовані пропозиції та залучати нових клієнтів.

4. Ціноутворення конкурентів: Аналіз цін на конкуруючі готелі допомагає розробляти конкурентоспроможні стратегії ціноутворення та реклами, що дозволяє зберігати та залучати клієнтів.

Використання великих обсягів даних (Big Data) у маркетингу є ключовим фактором для досягнення успіху в сучасному бізнесі. Такий підхід має безліч переваг, які допомагають покращити стратегії, підвищити ефективність та зробити кращі рішення. Давайте розглянемо деякі з них детальніше:

1. Створення повного портрета споживача: Великі дані дозволяють збирати, обробляти та аналізувати великі обсяги інформації про споживачів. Це допомагає компаніям створювати детальні портрети своїх клієнтів, включаючи їхній вік, стать, інтереси, покупкові звички та багато іншого.

2. Прогнозування реакції користувачів: Аналізуючи великі дані, маркетингологи можуть передбачити, як користувачі відреагують на певний продукт або рекламну кампанію. Це дозволяє підготувати більш ефективні стратегії маркетингу та реклами.

3. Диференціація продуктів і маркетингового підходу: Завдяки великим даним компанії можуть ідентифікувати різні сегменти своєї аудиторії та налаштувати індивідуальні стратегії маркетингу для кожного з них. Це дозволяє збільшити ефективність маркетингових кампаній та підвищити конверсію.

4. Оптимізація рекламного бюджету: Аналіз великих даних дозволяє визначити найбільш ефективні канали реклами та розподілити бюджет таким чином, щоб максимізувати результативність рекламних кампаній. Це допомагає зменшити витрати на рекламу та підвищити її ефективність.

5. Створення digital-маркетингу: Великі дані дозволяють розробляти та впроваджувати цифрові стратегії маркетингу, такі як таргетована реклама в Інтернеті, контент-маркетинг та маркетинг в соціальних мережах. Це дозволяє компаніям досягати більшої аудиторії та підвищувати свій вплив в Інтернеті.

6. Отримання адекватного уявлення про власний продукт: Аналіз великих даних допомагає компаніям отримати інформацію про ефективність свого продукту, реакцію споживачів та можливості для його покращення. Це дозволяє компаніям підтримувати свої продукти на ринку та залучати більше клієнтів.

Крім того, методи аналізу та обробки великих даних, такі як:

Data Mining - це процес використання різноманітних алгоритмів та методів для виявлення корисних залежностей та закономірностей в великих наборах даних. Цей підхід включає в себе такі методи як навчання асоціативним правилам, класифікація, кластерний і регресійний аналіз. Data

Mining дозволяє виявляти приховану інформацію, яка може бути корисною для вирішення різних завдань, включаючи прогнозування трендів, виявлення аномалій та підтримку прийняття рішень.

Краудсорсінг - це процес залучення добровольців для категоризації та збагачення даних. Цей підхід дозволяє швидше та ефективніше аналізувати великі обсяги інформації, оскільки він використовує добровільну допомогу сторонніх осіб. Краудсорсінг може включати в себе категоризацію тексту, класифікацію зображень, анотування даних та інші завдання, які допомагають зробити дані більш доступними для аналізу.

Машинне навчання використовує алгоритми, які навчаються на основі даних, для прогнозування та класифікації інформації. Цей підхід включає в себе методи штучних нейронних мереж, мережевого аналізу, методи оптимізації та генетичні алгоритми. Машинне навчання дозволяє автоматизувати процес аналізу даних та робити прогнози на основі зібраних даних.

Прогнозна аналітика використовує математичні моделі для передбачення майбутніх подій та трендів на основі історичних даних. Цей підхід дозволяє аналізувати попередні патерни та тенденції, щоб зробити прогнози щодо майбутніх результатів. Прогнозна аналітика використовується для прогнозування продажів, ринкових тенденцій, витрат та інших показників, що є важливими для прийняття стратегічних рішень.

Імітаційне моделювання використовується для створення віртуальних моделей бізнес-процесів для аналізу різних стратегій та їх впливу на результати. Цей підхід дозволяє експериментувати з різними сценаріями та прогнозувати їхні наслідки без реального впровадження. Імітаційне моделювання допомагає компаніям зрозуміти, які стратегії можуть бути найбільш ефективними та які мають найменший ризик.

Просторовий і статистичний аналіз використовується для вивчення взаємозв'язків між різними змінними, такими як місцезнаходження, час, демографічні дані та інші. Цей підхід дозволяє виявляти географічні та структурні залежності в даних, що може бути корисно для розуміння різних аспектів бізнесу та прийняття стратегічних рішень.

Візуалізація аналітичних даних використовує графіки, діаграми та інші візуальні засоби для представлення результатів аналізу даних. Цей підхід дозволяє зробити дані більш доступними та зрозумілими для користувачів, що допомагає зробити кращі рішення на основі аналізу.

Кожен з цих методів має свої унікальні переваги та застосування в маркетингу, що дозволяє компаніям отримувати більше цінної інформації та зробити кращі стратегічні рішення.

Отже, використання великих даних в готельній індустрії може допомогти підвищити ефективність маркетингових та рекламних стратегій, покращити обслуговування клієнтів та збільшити конкурентоспроможність готелю на ринку.

Успішні випадки використання технологій big data в інших компаніях. Декілька компаній, таких

як Netflix, Amazon, Tesla, Procter & Gamble, Google, JP Morgan та Walmart, відомі своїм успішним використанням Big Data у маркетингових стратегіях.[3,4,5]

Наприклад Tesla активно використовує технології штучного інтелекту та аналізу великих даних у своїх автомобілях з системою автопілоту за допомогою передових сенсорних систем, таких як камери, радары та лідари. Ці сенсори збирають дані про навколишнє середовище та дорожні умови, які потім аналізуються вбудованим комп'ютером автомобіля за допомогою алгоритмів штучного інтелекту.

Наприклад, якщо сенсори автомобіля виявляють пішохода, що переходить вулицю, алгоритми штучного інтелекту визначають, чи перебуває пішохід на шляху автомобіля і, у разі потреби, вживатимуть евакуаційних заходів для уникнення зіткнення.

Крім того, Tesla використовує машинне навчання, яке дозволяє автомобілю вчитися та адаптуватися з плином часу. Шляхом аналізу даних, зібраних сенсорами автомобіля, алгоритми машинного навчання можуть виявляти патерни та тенденції, що використовуються для поліпшення його водійських характеристик.

Крім поліпшення водійських характеристик, Tesla також використовує штучний інтелект та аналіз великих даних для підвищення загального рівня безпеки автомобіля. Шляхом аналізу даних з сенсорів автомобіля, вбудований комп'ютер може вчасно виявляти потенційні загрози безпеці та вживати заходів для їх попередження.[3]

JPMorgan Chase успішно використовує технології Big Data для аналізу даних, отриманих з різних джерел, включаючи власний веб-сайт. Ця компанія займається наданням фінансових послуг різним клієнтам, включаючи корпоративних клієнтів, уряд та неприбуткові організації, тому важливо аналізувати великі обсяги даних для розуміння їхніх потреб та звичок.

Один з методів, які використовує JPMorgan Chase, - це аналіз даних з веб-сайту Chase.com. Велика кількість розділів на сайті дозволяє збирати дані про користувачів та їхні поведінкові моделі. Це допомагає виявляти зацікавленість клієнтів у певних продуктах та послугах, що в свою чергу дозволяє розробляти ефективні стратегії залучення та утримання клієнтів.

Отримана інформація про взаємодію клієнтів з різними розділами сайту, такими як розділи про банківські продукти, послуги безпеки та обслуговування клієнтів, а також акції та промо-коди, дозволяє JPMorgan Chase адаптувати свої послуги та пропозиції до потреб своїх клієнтів.

Використання технологій Big Data дозволяє JPMorgan Chase ефективно використовувати великі обсяги даних для прийняття стратегічних рішень у сфері маркетингу, взаємодії з клієнтами та управління ризиками. Це сприяє покращенню якості обслуговування клієнтів та збільшенню конкурентоспроможності компанії на ринку фінансових послуг.[4]

Netflix є відмінним прикладом компанії, яка успішно використовує технології Big Data для трансформації свого бізнесу в індустрії стрімінгу контенту. Почавши як сервіс прокату DVD поштою в початкових 2000-х, Netflix вдало перетворився на глобального гіганта, завдяки розпізнаванню потенціалу великих обсягів даних та використанню передових технологій.

Однією з ключових технологій, які використовував Netflix, була система персоналізованих рекомендацій, що працювала на основі алгоритмів машинного навчання. Аналізуючи величезні обсяги даних користувачів, вони забезпечили персоналізовані рекомендації контенту для кожного окремого абонента, підвищивши задоволеність клієнтів та зменшивши втрату аудиторії.

Крім того, Netflix інвестував у потужну інфраструктуру стрімінгу, використовуючи такі інструменти, як Apache Kafka, Apache Flink та Amazon Web Services (AWS). Це дозволило їм забезпечити безперервний доступ до контенту для мільйонів глядачів по всьому світу.

Використання технологій Big Data значно покращило якість послуг Netflix, збільшивши прибуток та активно залучаючи нових абонентів. Аналіз даних допоміг їм вирішувати стратегічні завдання, включаючи виробництво оригінального контенту та розширення глобальної присутності.[5]

Отже, маркетингові інновації у готельній індустрії сьогодні неможливі без використання великих обсягів даних (big data). Вони стають ключовим інструментом для аналізу та розуміння потреб споживачів, ефективного просування та персоналізації сервісу. Завдяки аналізу великих даних готелі можуть створювати детальні портрети своїх клієнтів, передбачати їхню поведінку та реагувати на зміни у вимогах.

Digital-маркетинг, оптимізований за допомогою аналітики великих даних, дозволяє готелям не лише привертати увагу аудиторії, а й ефективно спілкуватися з нею. Аналізуючи дані про споживачів, готелі можуть розробляти персоналізовані

рекламні кампанії, пропозиції та послуги, що значно підвищує їхню привабливість для клієнтів та забезпечує конкурентну перевагу.

Застосування big data в маркетингових стратегіях готелів також допомагає оптимізувати розподіл рекламного бюджету, прогнозувати попит на послуги та підвищувати ефективність маркетингових кампаній. Це дозволяє готелям максимізувати свій потенціал на ринку та досягати більшого успіху у конкурентній боротьбі.

Отже, інтеграція big data в маркетингові стратегії готелів відкриває широкі можливості для підвищення ефективності, залучення нових клієнтів та збільшення лояльності існуючих. Вона стає ключовим фактором успіху у сучасній готельній індустрії, де конкуренція надзвичайно висока, а вимоги споживачів постійно зростають.

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**DEFECTS IN HEAT TREATMENT OF PRODUCTS FROM STRUCTURAL STEELS AND WAYS TO ELIMINATE THEM****Fomikhina I.**

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**ДЕФЕКТЫ ТЕРМИЧЕСКОЙ ОБРАБОТКИ ИЗДЕЛИЙ ИЗ КОНСТРУКЦИОННЫХ СТАЛЕЙ И ПУТИ ИХ УСТРАНЕНИЯ****Фомихина И.В.**

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**Abstract**

The article studies technological defects of heat treatment and their influence on the change in structure and destruction of products made of structural steels provided to the accredited Testing Center of the Institute of Powder Metallurgy named after Academician O.V. Roman of the National Academy of Sciences of Belarus by leading enterprises of mechanical engineering and petrochemistry of Belarus. The causes of defect formation and ways of their elimination are shown. Analysis and systematization of the research results will allow eliminating technological defects of heat treatment, increasing the reliability and durability of products made of structural steels.

**Аннотация**

Исследованы технологические дефекты термической обработки и их влияние на изменение структуры и разрушение изделий из конструкционных сталей, предоставленных в аккредитованный Испытательный центр Института порошковой металлургии имени академика О.В. Романа НАН Беларуси, ведущими предприятиями машиностроения и нефтехимии Беларуси. Показаны причины образования дефектов и пути их устранения. Анализ и систематизация результатов исследования позволят устранить технологические дефекты термической обработки, повысить надежность и долговечность изделий из конструкционных сталей.

**Keywords:** technological defects, heat treatment, structural steels, destruction, structure, properties.

**Ключевые слова:** технологические дефекты, термическая обработка, конструкционные стали, разрушение, структура, свойства.

При термической обработке стали могут возникнуть следующие технологические дефекты: недостаточная твердость, пятнистая твердость, повышенная хрупкость, обезуглероживание и окисление поверхности, коробление, деформации и трещины.

Причиной их возникновения является нарушение технологических режимов термической обработки. При нагреве доэвтектоидной стали ниже температуры  $A_{c1}$  фазовые превращения происходят не полностью и в структуре стали присутствует феррит, который в ходе закалки не претерпевает изменения, вызывая понижение твердости. Перегрев стали приводит к росту зерна, образованию структуры крупноигльчатого мартенсита и, как следствие, к повышенной хрупкости стали. Обезуглероживание и окисление поверхности происходят при нагреве сталей в печах без контролируемой атмосферы. Обезуглероживание характеризуется выгоранием углерода в поверхностных слоях детали и резко снижает твердость ее поверхности. При окислении на поверхности детали образуется окалина, которая приводит к неравномерной твердости, в результате чего возникает необходимость дополнительной обработки. Для предохранения от окисления и обезуглероживания детали необходимо нагревать в печах с контролируемой защитной или

нейтральной атмосферой. Деформации, коробление и трещины образуются при слишком резком или неравномерном охлаждении или нагреве деталей. Для предотвращения указанных дефектов необходимо правильно назначать режимы термической обработки.

**Макро- и микротрещины.** Деформация, коробление и трещины являются следствием внутренних напряжений. Медленное охлаждение при закалке в области мартенситного превращения – самый эффективный способ уменьшения напряжений и устранения дефектов этого вида. Мелкие детали, также как и простые по форме, без острых углов и резких переходов, менее склонны к короблению. Более сложные по форме детали целесообразно изготавливать из легированных, закаливаемых в масле сталей, чем из углеродистых, закаливаемых в воде [1, 2].

Трещины – неисправимый дефект, предупредить который можно конструктивным решением (избегать в изделии конструктивных элементов, которые могут стать концентраторами напряжений) и тщательным соблюдением режимов термообработки. Деформация, т.е. изменение раз-

меров и формы изделий, всегда сопровождается процессы термической обработки, особенно закалки. Несимметричную деформацию изделий в практике часто называют короблением. Деформацию можно уменьшить подбором соответствующего состава стали и условий термической обработки, а избежать коробления можно, обеспечив равномерность нагрева под закалку и правильное положение детали при погружении в закалочную среду.

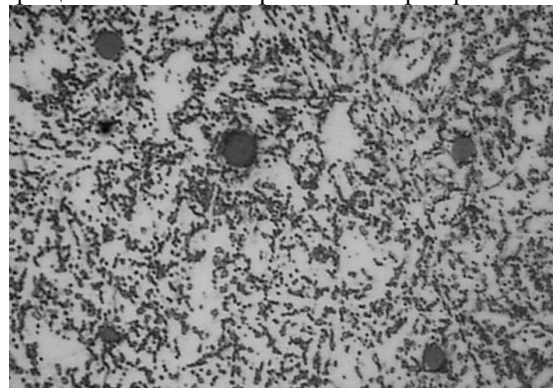
Образование трещин после отжига по стандартным режимам наблюдалось в поковке из стали 40X13. Исследование микроструктуры показало, что в образце присутствует незначительная загрязненность неметаллическими включениями. Наблюдаются точечные оксидные включения не более 2 балла (рис. 1, а). Материал находится в отожженном состоянии. Микроструктура неоднородна и представляет собой зернистый перлит (рис. 1, б).

Присутствуют участки бейнита, образованные в результате подстуживания поковки (рис. 1, в). Неоднородность структуры и наличие участков бейнита вызвали напряженное состояние в материале и растрескивание. Наблюдается раскрытая трещина с оксидным слоем по краям, выходящая на поверхность поковки, глубиной до 1,4 мм и шириной раскрытия порядка 0,3 мм (рис. 1, г). В сердцевине поковки присутствует множество закрытых микротрещин, заполненных оксидом, с обезуглероженом краем (рис. 1, д, е). Характер изменения микроструктуры вокруг микротрещин и заполнение их оксидами свидетельствует об образовании их при прокатке. Термообработка (отжиг) раскрыла более глубокие и развитые трещины проката.

Исследование микроструктуры показало, что трещины в поковке образовались при прокате.



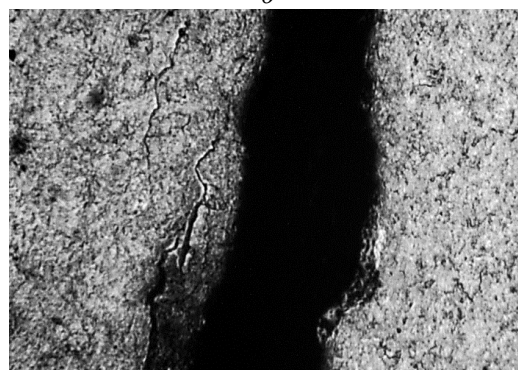
а



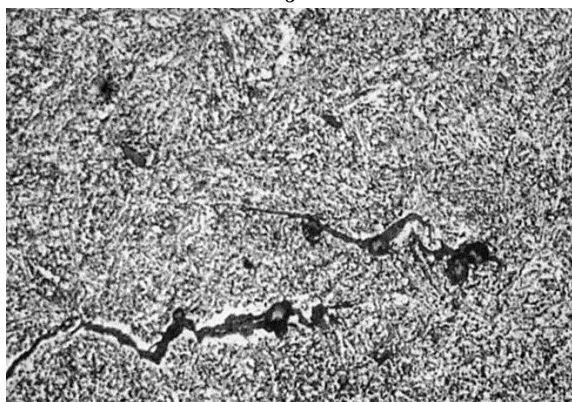
б



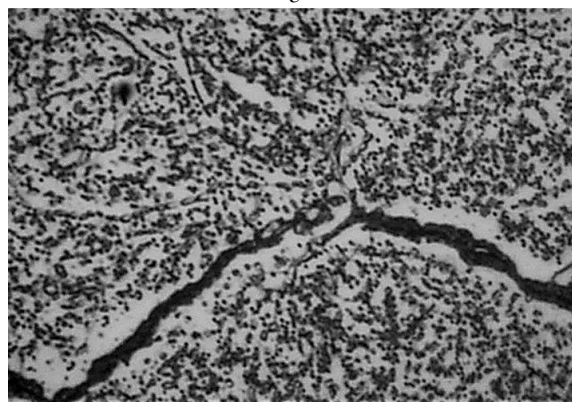
в



г



д



е

Рис. 1. Микроструктура поковки из стали 40X13 после отжига (а, в, д, x100), (б, г, е, x500): а – загрязненность неметаллическими включениями; б, в – неоднородность структуры; г-е – трещины, раскрывшиеся во время отжига

Для определения причины разрушения венца и шестерни был проведен анализ элементного состава, исследование структуры, морфологии излома, измерение твердости.

Ближайшим отечественным аналогом материала шестерни является сталь марки 20Г (ГОСТ 4543-71 «Прокат из легированной конструкционной стали»), но отличается более высоким содержанием марганца (по ГОСТ Мп должно быть 0,70 – 1,00 %). Общий вид венца и шестерни, морфология излома под смятым зубом шестерни представлены на рис. 2. Определено, что вершины зубьев венца и шестерни смяты (рис. 2, а, б, в, г, е).

В результате разрушения на шестерне отсутствуют три зуба. Начало разрушения зубьев находится на участке сопряжения зубьев с основным металлом шестерни, характер излома вязкий (рис. 2, г). Определено, что разрушение шло постепенно (усталостное разрушение). Первые трещины появились на зубе № 1 в нескольких местах и распространялись постепенно, пока не слились в единый фронт. Затем прошло катастрофическое разрушение. На зубе № 2 очаг разрушения находится в одном месте, что свидетельствует об ударной нагрузке. Это значит, что развалившийся зуб № 1 ударил зуб № 2 и произошло катастрофическое одномоментное разрушение.

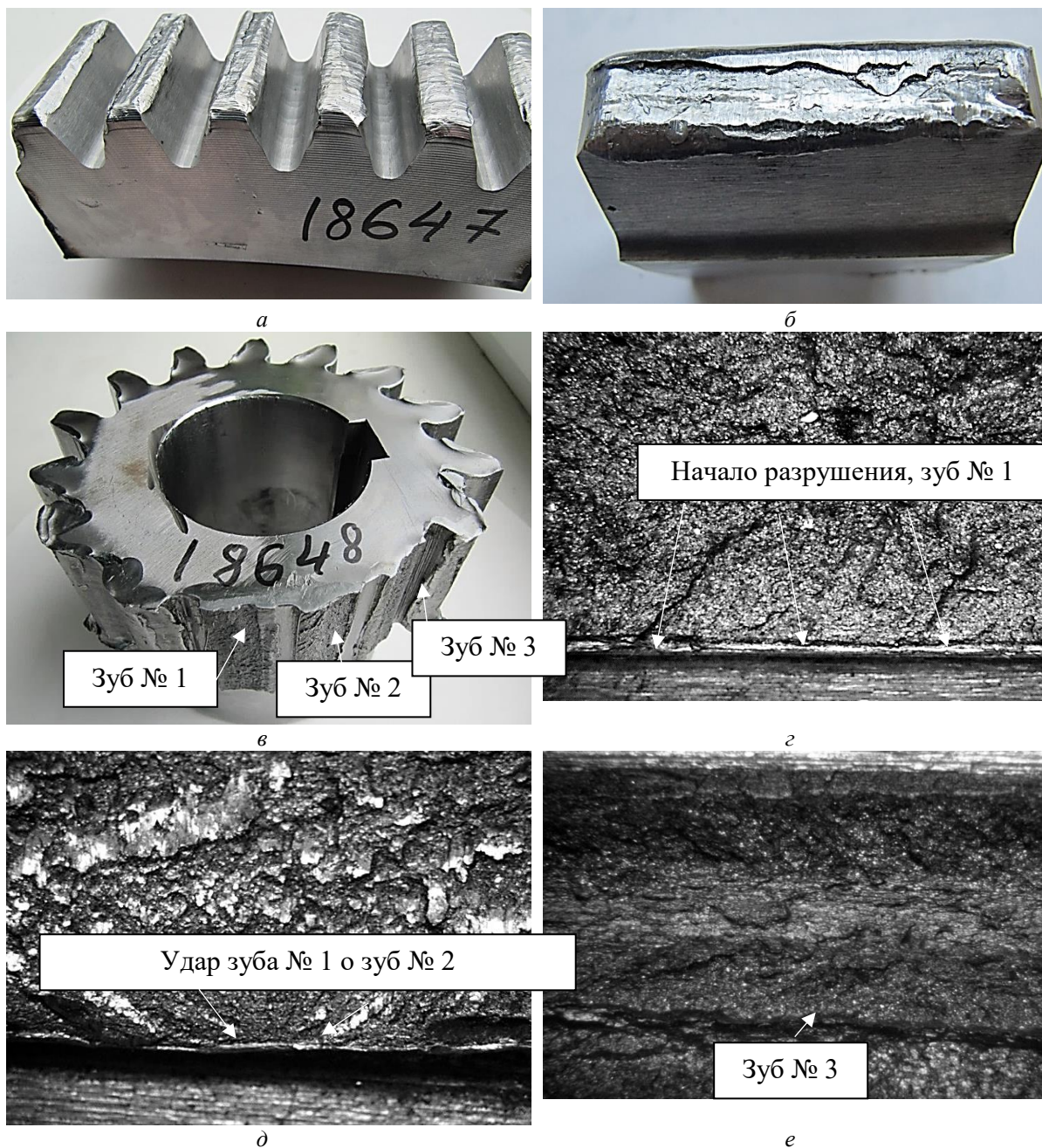


Рис. 2. Венец и шестерня: а – общий вид венца; б – смятый зуб венца; в – общий вид шестерни; г – морфология излома под разрушенным зубом № 1 шестерни (множественные очаги); д – морфология излома под разрушенным зубом № 2 шестерни (очаг удара зуба № 1 о зуб № 2); е – морфология излома зуба № 3 (катастрофическое разрушение)

Микроструктура венца и шестерни у края зуба и в сердцевине феррито-перлитная (рис. 3). Микроструктура получена в результате горячей прокатки или после нормализации. Упрочня-

ющая обработка поверхности (ТВЧ-закалка, химико-термическая обработка) и термообработка (закалка с отпуском) отсутствуют.

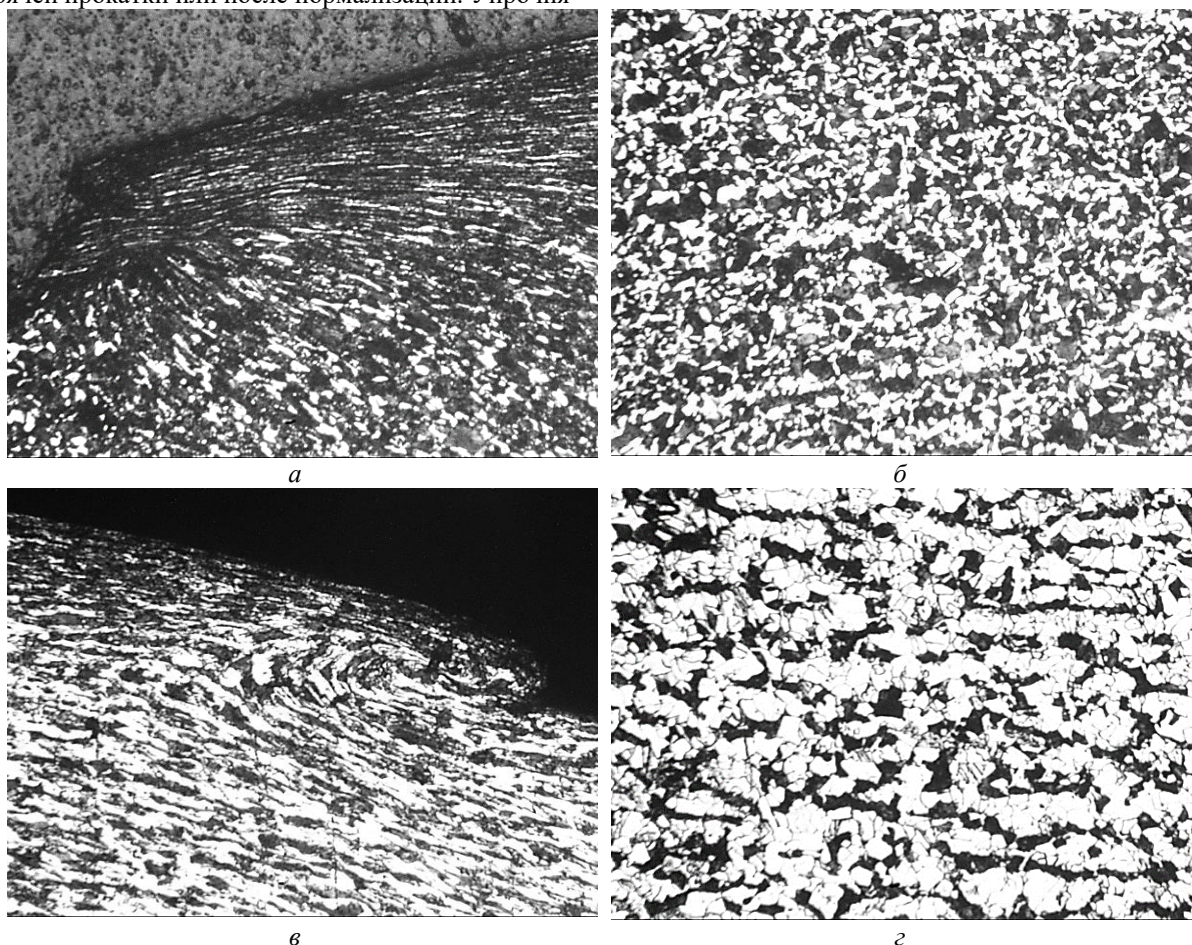


Рис. 3. Микроструктура венца и шестерни,  $\times 100$ : а – край смятого зуба венца; б – сердцевина венца; в – край смятого зуба шестерни; г – сердцевина шестерни

Твердость составляет 160-170 НВ. На участках смятия зубьев венца и шестерни наблюдается сильное течение материала, что подтверждает отсутствие термообработки. Это связано с заклиниванием шестерни 3-мя разрушенными зубьями. Проведенные исследования показали, что разрушение венца и шестерни произошло из-за отсутствия упрочняющей термообработки. Горячекатаное состояние и нормализация, в которых, предположительно, находятся венец и шестерня не могут обеспечить достаточный уровень прочностных свойств.

**Пятнистая твердость.** Недостаточная твердость закаленной детали может быть из-за недогрева (низкая температура в печи, недостаточная выдержка при правильной температуре в печи) или недостаточно интенсивного охлаждения [3]. В первом случае мартенсит не обладает достаточной твердостью (не содержит достаточно углерода); во втором - не переохлаждается до мартенситного превращения, и структура полностью или частично состоит из продуктов перлитного распада аустенита (троостит, сорбит). Повышение температуры печи или увеличение выдержки в первом случае устраняет пониженную твердость закаленных деталей.

Во втором случае следует применять более интенсивное охлаждение, т. е. во время закалки энергично перемещать деталь в закалочной жидкости или применять вместо простой воды соленую или подкисленную. Неоднородная, или, как ее еще называют, пятнистая твердость проявляется в том, что после закалки на отдельных участках детали твердость оказывается значительно сниженной (до HRC 35 – 45) по сравнению с другими участками, где величина ее нормальная и составляет HRC 60 – 62. Такого рода дефект может быть вызван в основном тремя причинами: неравномерным нагревом, неравномерной скоростью охлаждения, неудовлетворительной структурой стали перед закалкой.

Для установления причины образования пятнистой твердости и разрушения проведен анализ элементного состава, исследование микроструктуры, морфологии излома металлоизделия «Шкив тормозной 30M.2332.001». По элементному составу с учетом погрешности измерений образец шкива соответствует стали марки 65Г (ГОСТ 14959-79 «Сталь рессорно-пружинная углеродистая и легированная»).

Общий вид и морфология излома разрушенного тормозного шкива представлены на рис. 4.



Рис. 4. Образец «Шкив тормозной 30М.2332.001»: а – общий вид; б – морфология излома; в – долом

Изучение микроструктуры показало, что в образце тормозного шкива присутствуют неметаллические включения в виде оксидов строчечных 4 балла и силикатов хрупких 3 балла (рис.5).

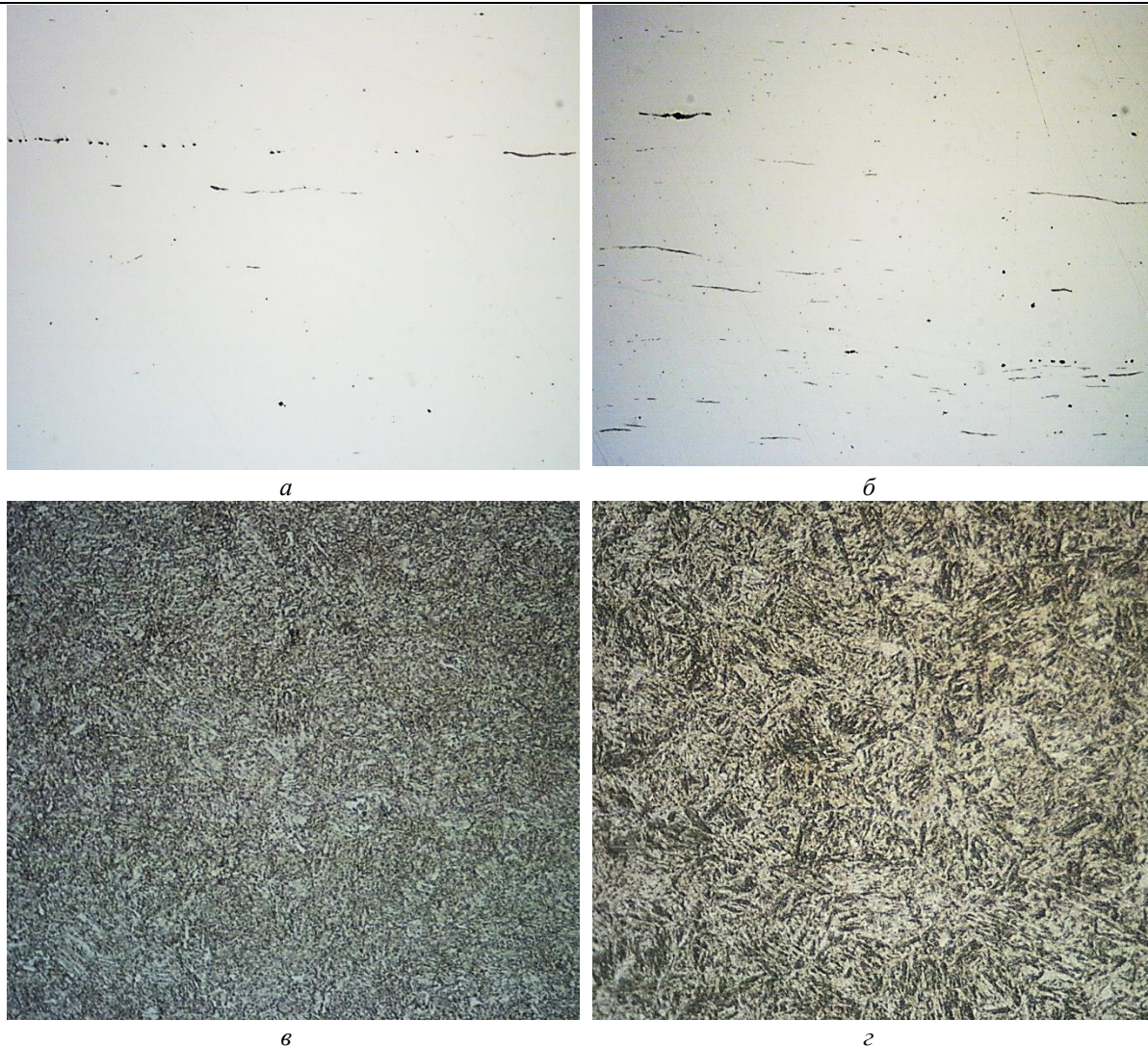


*Рис. 5. Микроструктура образца тормозного шкива,  $\times 100$ ,  $\times 500$ :*

*а, б – загрязненность неметаллическими включениями;*

*в – участок мелкоигольчатого мартенсита; г – пятнистость (мелкоигольчатый мартенсит + крупноигольчатый троостит (бейнит))*

Наблюдается пятнистая микроструктура мелкоигольчатого мартенсита с участками крупноигольчатого троостита (бейнита). Твердость образца находится в диапазоне 47 – 55 HRC, что не соответствует требованиям чертежа. По чертежу твердость должна составлять 36 – 43 HRC.

Результаты исследования показали, что причиной разрушения шкива тормозного является превышение требуемой температуры заковки образца, вызвавшее повышенную твердость, пятнистую структуру мелкоигольчатого мартенсита с участками крупноигольчатого троостита (бейнита).

На основании практического опыта установлено, что неравномерный нагрев различных участков детали возникает при подстуживании со стороны заслонки печи, при неудачной укладке деталей в печи и при неоднородном распределении температуры в различных зонах ее рабочего пространства. В результате отдельные участки детали не нагреваются до требуемой температуры, и твердость их после заковки оказывается пониженной.

Неравномерное охлаждение возникает при покрытии детали неравномерным толстым слоем окалины, которая затрудняет теплоотвод при заковке или при образовании паровых мешков в углублениях, имеющихся на деталях, иногда при касании деталей во время охлаждения в баке. Образование мягких пятен также является следствием недостаточного прогрева или недостаточно интенсивного охлаждения. Иногда мягкие пятна появляются из-за неоднородности исходной структуры, например скоплений феррита. В этих местах при нагреве до температуры заковки может сохраниться феррит или получиться аустенит с недостаточной концентрацией углерода. Естественно, что в этих местах даже при правильно проведенной заковке твердость недостаточная. Предварительная термическая обработка (нормализация), создающая более однородную структуру, устраняет этот дефект [3]. Образование мягких пятен (пятнистая твердость) характерно для углеродистых сталей, охлаждаемых при заковке в воде. Это вызвано образованием паровой рубашки при кипении воды. От участков кон-

такта детали и пузырьков пара отвод тепла замедляется, так как теплопроводность пара значительно меньше, чем жидкости - воды. Мартенсит при этом не образуется из-за пониженной скорости охлаждения. Кроме того, пятнистая твердость может образоваться при наличии окалины, в местах захвата закалочными клещами и т.д.

Для предотвращения этого дефекта необходимо подводить закалочную жидкость к деталям под давлением или энергично перемещать деталь в закалочной жидкости, сбивая паровую рубашку; перед закалкой следует удалять окалину; закалочные клещи должны иметь острые губки, чтобы не препятствовать охлаждению детали в месте захвата. Пятнистая твердость предотвращается при охлаждении в растворах солей или щелочей (8...12%-ные водные растворы NaCl и NaOH), однако при этом возрастает скорость охлаждения и вероятность коробления заготовки или появления трещин.

Причиной пятнистой твердости может быть неоднородность структуры стали перед закалкой. Например, если в структуре имеются крупные обособленные участки феррита, то при нагреве до закалочной температуры аустенит, образующийся в этих участках, будет обеднен углеродом. Требуется слишком большое время выдержки при закалочной температуре, чтобы углерод из обогащенных участков (где раньше были зерна перлита) смог переместиться к обедненным участкам. В связи с этим в местах, обедненных углеродом, при закалке получится не мартенсит, а структура типа сорбита

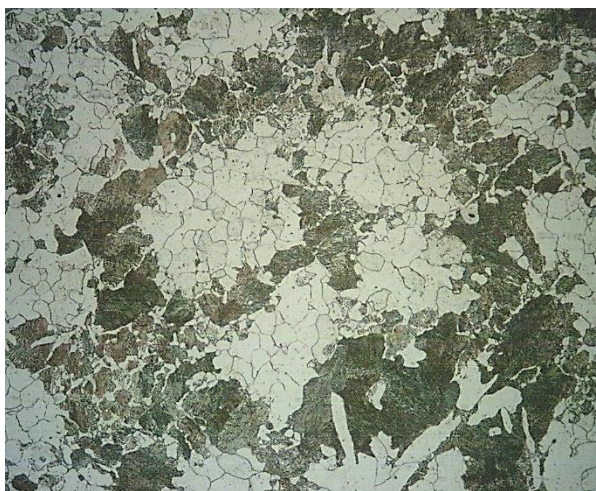
или троостита, которая имеет более низкую твердость. Неоднородность структуры перед закалкой можно устранить путем отжига или нормализации.

Для определения причины отсутствия необходимой твердости после закалки, были проведены исследования структуры, измерение твердости образцов-свидетелей из стали 35Л, прошедших термическую обработку: отжиг (образец № 1), двойной отжиг (образец № 2), отжиг + закалка (образец № 3).

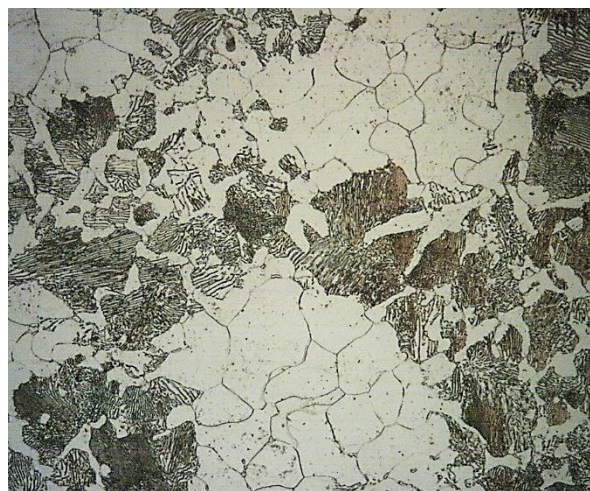
В образце-свидетеле с маркировкой № 1 после отжига наблюдается феррито-перлитная структура, представляющая ферритные ячейки, окруженные сеткой перлитных зерен. Ферритное зерно неравномерно по размеру и составляет 10 – 80 мкм. Присутствуют ферритные зерна игольчатой формы типа видманштетта (рис. 6, а, б). Твердость образца 160 НВ.

После двойного отжига (образец № 2) происходит выравнивание по размеру зерна феррито-перлитной структуры, с уменьшением ферритного зерна до 10 – 30 мкм (рис. 6, в, г). Ферритные зерна типа видманштетта сглажены и не имеют выраженной остроугольности. Твердость образца составляет 140-150 НВ.

После отжига и закалки (образец № 3) наблюдается неоднородная феррито-перлитная структура, представляющая зерна сорбитообразного перлита размером от 10 до 90 мкм, окруженные сеткой феррита. Присутствуют ферритные зерна типа видманштетта (рис. 6, д, е). Твердость образца составляет 210-220 НВ. Закалочная структура отсутствует.



а



б

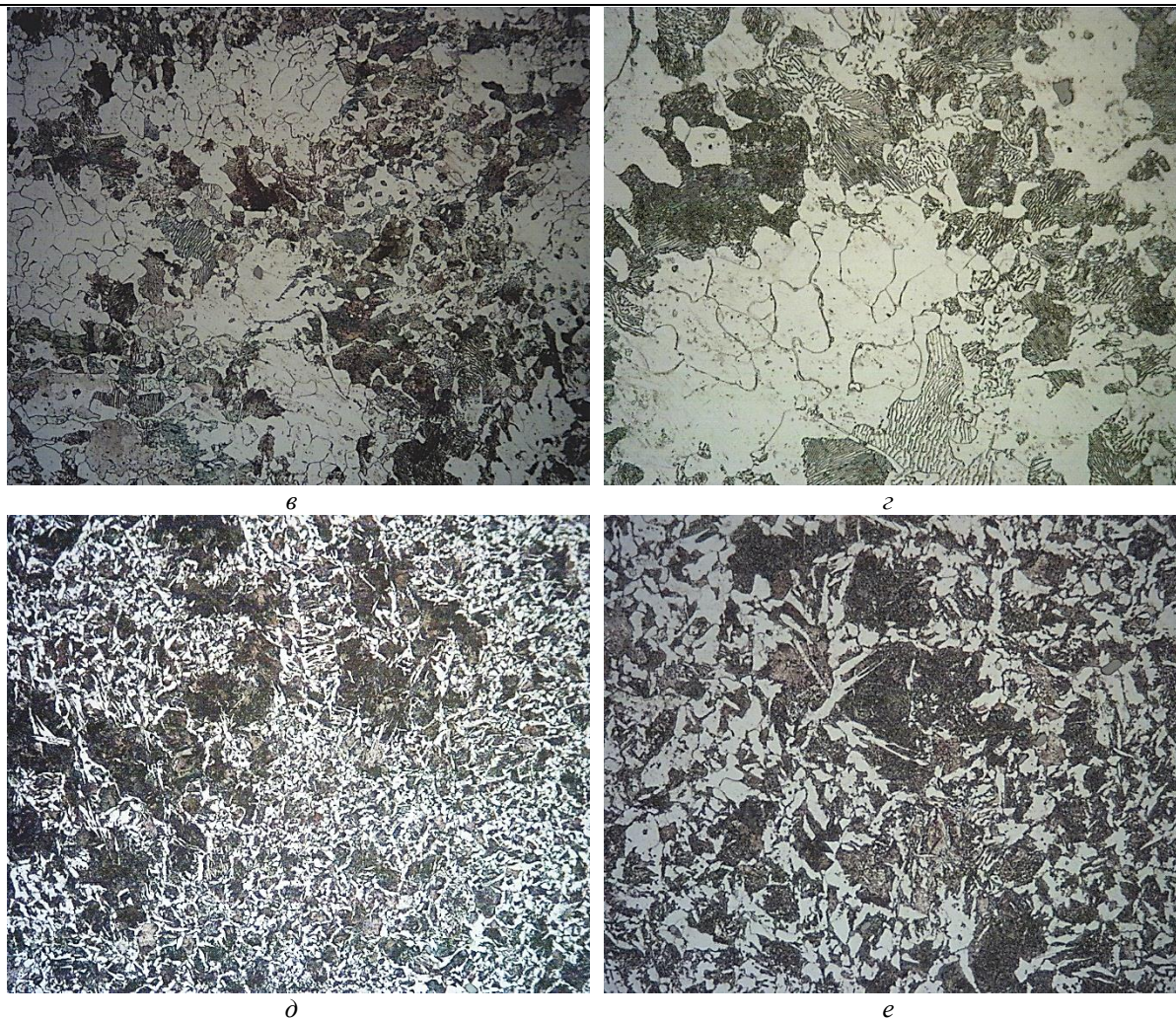


Рис. 6. Микроструктура образцов-свидетелей после термообработки, x200, x500:  
 а, б – образец № 1, отжиг; в, г – образец № 2, двойной отжиг;  
 д, е – образец № 3, отжиг + закалка

Результаты исследования показали, что проведение последующей закалки после отжига не привело к закалочным микроструктурам из-за большой неоднородности микроструктур отжига и присутствия крупных обособленных участков-ячеек феррита. Для получения закалочных структур необходимо проведение гомогенизирующего отжига или нормализации перед закалкой для выравнивания феррито-перлитной структуры.

Недостаточная твердость закаленного изделия появляется в результате неправильно выбранной температуры закалки или недостаточно интенсивного охлаждения. При закалке доэвтектоидных сталей недостаточная твердость может получиться в результате того, что температура закалки была ниже  $A_{C3}$  и в структуре стали сохранился феррит. Кроме того, в доэвтектоидной стали пониженная твердость может быть результатом перегрева. Образование при этом крупноиглочатой структуры мартенсита, помимо пониженной твердости, вызывает понижение ударной вязкости [4].

В заэвтектоидных сталях недостаточная твердость закаленного изделия может также являться результатом перегрева и образования крупноиглочатого мартенсита.

Образование мягких пятен может являться результатом неравномерного охлаждения, соприкосновения деталей друг с другом в процессе охлаждения, наличия жировых пятен на поверхности изделия и неоднородности структуры. Исправляется такой брак повторной закалкой изделия. Неоднородность структуры устраняется предварительной его нормализацией.

#### **Обезуглероживание или науглероживание поверхностных слоев.**

Обезуглероживание, как дефект термической обработки стали, проявляется в выгорании углерода в поверхностных слоях металла изделия при нагреве его в атмосферной среде, содержащей углекислый газ или водород, а также пары воды, и приводит к значительному снижению прочностных свойств и изменению химического состава материала поверхности изделия (несоответствию заявленной марке стали детали) [4]. Глубина обезуглероживленного слоя может достигать от 2 до 4 мм.

Поверхностные трещины (глубиной 1,2 – 2 мм), сопутствующие обезуглероживанию:

- могут проявляться в основном в изделиях, выполненных из сталей инструментального класса,

прокаливающихся полностью или на большую глубину и обладающих обезуглероженным слоем;

- возникают вследствие растягивающих напряжений, спровоцированных образованием в обезуглероженном слое меньшего объема низкоуглеродистого закалочного мартенсита, чем в сердцевине изделия.

Окисление и обезуглероживание – брак, характеризующийся образованием окалины на поверхности стальных изделий и выгоранием углерода в поверхностных слоях. Такой брак термической обработки неисправим, но если позволяет припуск на механическую обработку, то окисленный и обезуглероженный слой удаляют шлифовкой. Окисление и обезуглероживание поверхности часто происходит при нагреве в пламенных или электрических печах без контролируемой атмосферы. Поэтому дают припуск на шлифование, что удорожает и усложняет технологию изготовления термически обрабатываемых деталей. Контролируемая искусственная атмосфера в термических печах является радикальным способом устранения или уменьшения этого дефекта. Нагрев в солях также способствует уменьшению окисления и обезуглероживания. При термической обработке ответственных деталей и инструмента обезуглероживание вообще недопустимо; в таких случаях нагрев деталей ведут в специальных защитных атмосферах. Изменение

химического состава поверхностных слоев заготовок происходит при нагреве в воздушной атмосфере электропечей; в атмосфере сгорания газов в газовых печах. При нагреве в этих средах происходят реакции металла с печными атмосферами. Окисление стали начинается при 200 °С (при этом появляются цвета побежалости). Повышение температуры усиливает окисление и вызывает появление окалины – на стальных заготовках образуются рыхлые, слабо связанные с основным металлом оксиды железа. При температуре свыше 700 °С начинается обезуглероживание поверхности стальных заготовок. Эти процессы развиваются тем интенсивнее, чем выше температура и больше продолжительность выдержки. Предотвратить обезуглероживание при нагреве возможно применением специальных нагревательных защитных атмосфер. В промышленности используют защитные газовые, вакуумные и жидкие среды. Для нагрева инструмента наибольшее распространение получил нагрев в жидких средах и вакууме.

Для определения причины повышенного износа осей и катков с маркировками № 1 и 2, было проведено измерение твердости на изношенной и неизношенной частях и исследование микроструктуры осей. Общий вид осей и катков представлен на рис. 7.



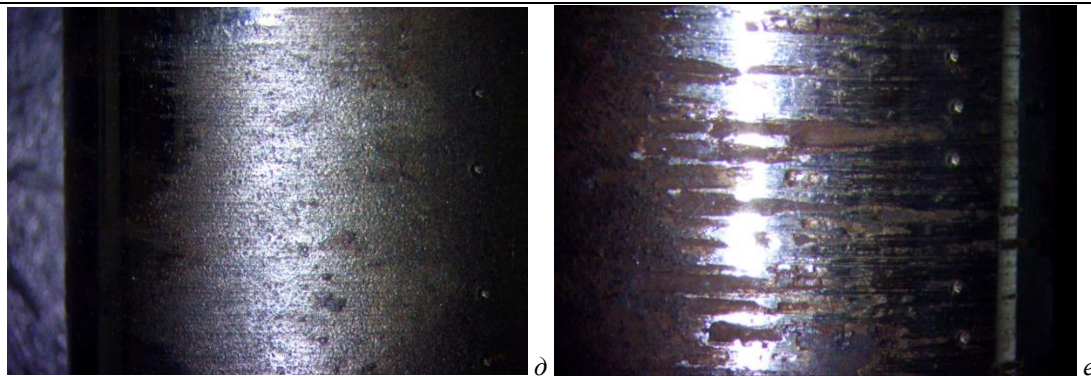


Рис. 7. Исследуемые оси и катки с маркировками № 1 (а-в) и № 2 (г-е):  
а, г – общий вид; б, е – морфология поверхности изношенных участков осей; в, д – морфология поверхности неизношенных участков осей

На рис. 7 показано, что на осях с маркировками № 1 и № 2 присутствуют участки износа. На оси с маркировкой № 1 наблюдается значительный износ в виде бороздок. На оси с маркировкой № 2 присутствует незначительный износ в виде затертостей поверхности с небольшими углублениями.

Твердость обезуглероженного слоя определялась на микротвердомере с последующим переводом чисел твердости в твердость по Роквеллу по таблице ASTM.

Результаты измерения твердости и определения глубины обезуглероженного слоя представлены в табл. 1.

Таблица 1.

**Результаты измерения твердости и глубины обезуглероживания**

| Маркировка образца                                                                                                                | Ось                |                                     |                                             |                                     | Каток          |
|-----------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------------|---------------------------------------------|-------------------------------------|----------------|
|                                                                                                                                   | Изношенный участок |                                     | Неизношенный участок                        |                                     | Поверхность    |
|                                                                                                                                   | Твердость HRC      | Глубина обезуглероженного слоя, мкм | Твердость, HRC                              | Глубина обезуглероженного слоя, мкм | Твердость, HRC |
| Ось № 1                                                                                                                           | 25-27              | *                                   | Край – <20 (190-220 Hv); Сердцевина – 25-27 | до 300                              | 37-42          |
| Ось № 2                                                                                                                           | 42-45              | *                                   | 45-47                                       | отсутствует                         | 38-43          |
| Примечание: *Износ края поверхности                                                                                               |                    |                                     |                                             |                                     |                |
| <b>Требования чертежа: твердость оси 42-47 HRC; твердость катка 35-45 HRC, глубина обезуглероженного слоя не регламентируется</b> |                    |                                     |                                             |                                     |                |

В результате исследований получены следующие результаты:

- в образце оси с маркировкой № 1 твердость на изношенном участке поверхности и в сердцевине неизношенного участка находится в одном диапазоне значений и составляет 25-27 HRC. Край неизношенного участка обезуглерожен на глубину до 300 мкм. Твердость обезуглероженного слоя составляет  $H_v = 190-220 \text{ кгс/мм}^2$ , что соответствует 90-95 HRB (менее 20 HRC). Микроструктура представляет собой сорбит. Твердость не соответствует требованиям чертежа;

- в образце катка с маркировкой № 1 твердость поверхности составляет 37-42 HRC и соответствует требованиям чертежа;

- в образце оси с маркировкой № 2 твердость на изношенном и на неизношенном участках поверхности находится в диапазоне требований чертежа (42-47 HRC). Обезуглероженный слой отсутствует. Микроструктура представляет собой троостсорбит, троостит;

- в образце катка с маркировкой № 2 твердость поверхности составляет 38-43 HRC и соответствует требованиям чертежа.

Было определено, что износ поверхности оси с маркировкой № 1 произошел в результате нарушения режима термообработки, которое привело к образованию на поверхности обезуглероженного слоя глубиной до 300 мкм и получению микроструктуры с твердостью, несоответствующей требованиям чертежа.

Проблемы науглероживания (цементации) материалов рассматриваются с учетом реализации метода упрочнения в промышленных условиях, предварительно уточнив существующие последовательности фазовых и структурных превращений в стали при осуществлении таких методов обработки поверхности. Особенно это относится к установлению причин появления в производственных условиях структурных дефектов, приводящих к снижению эксплуатационных свойств изделий.

Термин науглероживание означает диффузионное насыщение углеродом поверхностного слоя металла или сплава. Например, науглероживание (цементация) стальных изделий проводится для повышения их твердости и износостойкости. При этом существует острая необходимость в определении не только фазовых и структурных состояний диффузионного слоя, но и его геометрических размеров, соотношением между толщинами отдельных составляющих слоя (в первую очередь, диффу-

зионной зоны и зоны химических соединений), соотношением между твердостью слоя (его составляющих) и твердостью исходного материала.

Изучение проблемы науглероживания и получения пятнистой твердости проводилось на разрушенной детали «Звездочка». По элементному составу с учетом погрешности измерений образец соответствует стали марки 20Х2Н4А (ГОСТ 4543-71 «Прокат из легированной конструкционной стали»).

Фотографии микроструктуры цементованного слоя в районе разрушения представлены на рис. 8.

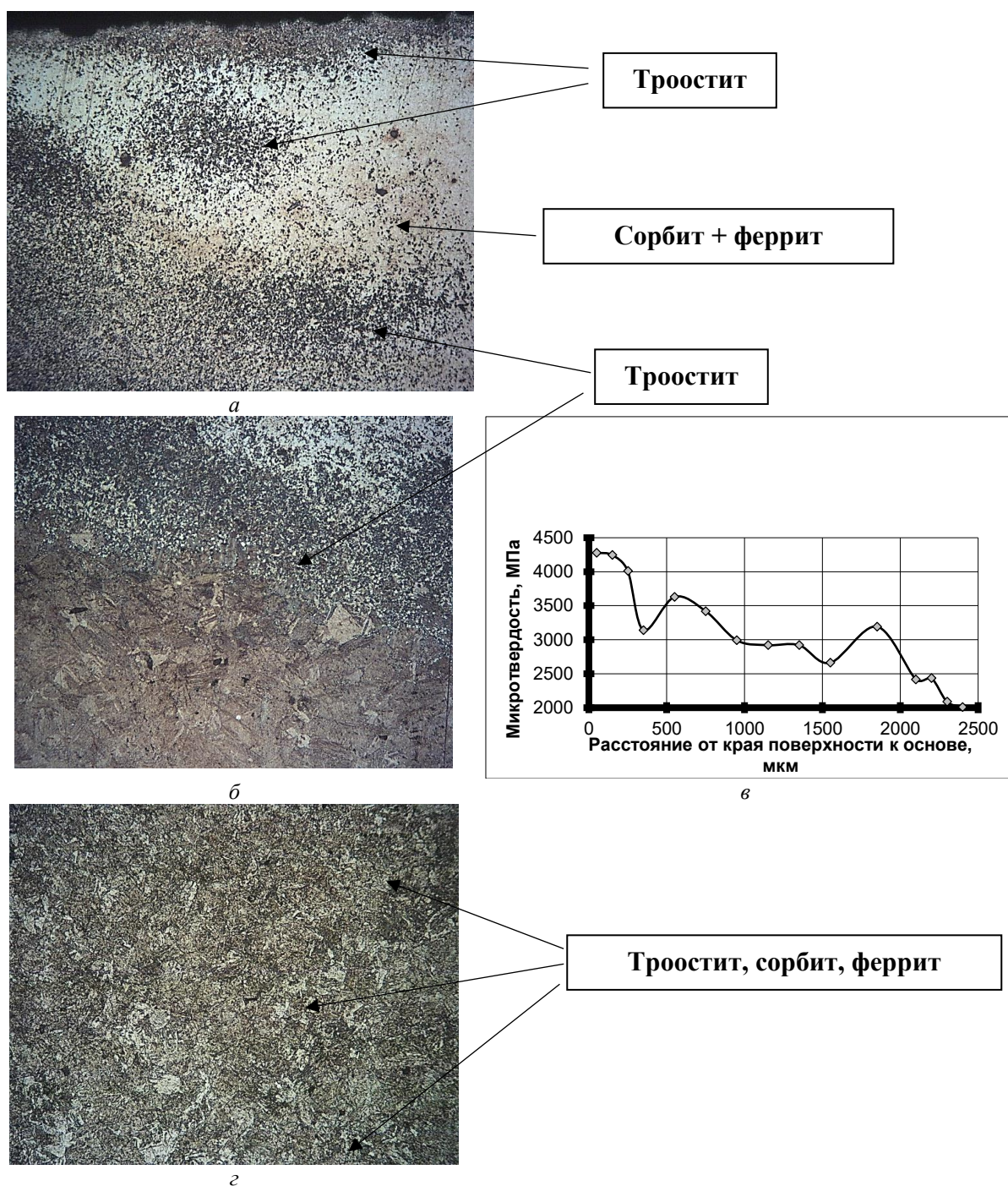


Рис. 8. Микроструктура детали «Звездочка» в районе разрушения,  $\times 100$ :  
 а – край цементованного слоя; б – переходная зона «цементованный слой – основа»;  
 в – график микротвердости; е – сердцевина

Определено, что глубина цементации составляет 2,0 – 2,5 мм, что больше значения, указанного в чертеже и соответствует ему по верхнему пределу (1,5 – 2 мм). Микротвердость цементованного слоя от края поверхности до переходного слоя в сердцевину находится в диапазоне 4200 – 2600 МПа (43 – 24 HRC).

Структура цементованного слоя пятнистая: присутствуют участки троостита с микротвердостью 4200 МПа и сорбита с ферритом с микротвердостью 2600 МПа. Структура сердцевины представляет собой троостит, сорбит, феррит со средней микротвердостью 2400 МПа. Средняя твердость сердцевины детали составляет 22 HRC. После цементации деталь подвергалась закалке с низким отпуском, о чем свидетельствуют закалочные структуры, однако твердость не соответствует твердости чертежа (по чертежу  $HRC \geq 50$ ).

Из проведенных исследований установлено, что разрушение детали «Звездочка» произошло из-за нарушения режима цементации, о чем свидетельствует присутствие "пятнистой цементации" с мягкими пятнами недостаточной твердости 43 – 24 HRC по сравнению с требованиями чертежа.

#### **Повышенная хрупкость.**

Повышенная хрупкость - дефект, обычно появляющийся в результате закалки от слишком высоких температур (более высоких, чем это требуется), при которых произошел значительный рост зерен аустенита. Дефект обнаруживается механическими испытаниями по излому или по микроструктуре. Устраняют дефект повторной закалкой от нормальных температур для данной стали. К основным дефектам, которые могут возникнуть при закалке сталей, относят трещины и деформацию.

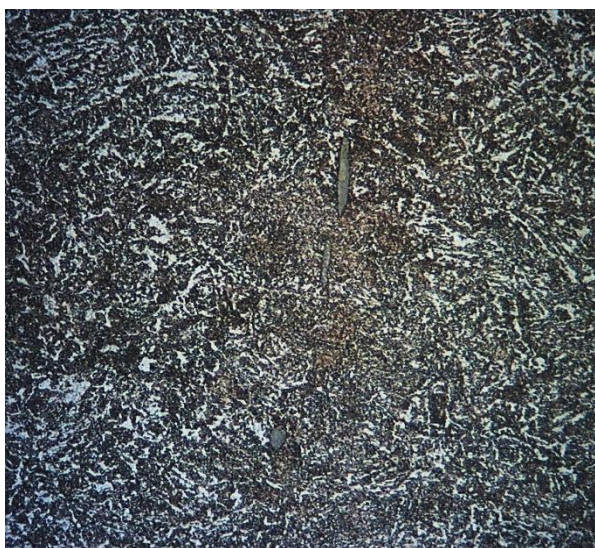
Деформация, коробление и трещины являются следствием внутренних напряжений. Медленное охлаждение при закалке в области мартенситного превращения – самый эффективный способ уменьшения напряжений и устранения дефектов этого

вида. Мелкие детали, также как и простые по форме, без острых углов и резких переходов, менее склонны к короблению. Более сложные по форме детали целесообразно изготавливать из легированных, закаливаемых в масле сталей, чем из углеродистых, закаливаемых в воде.

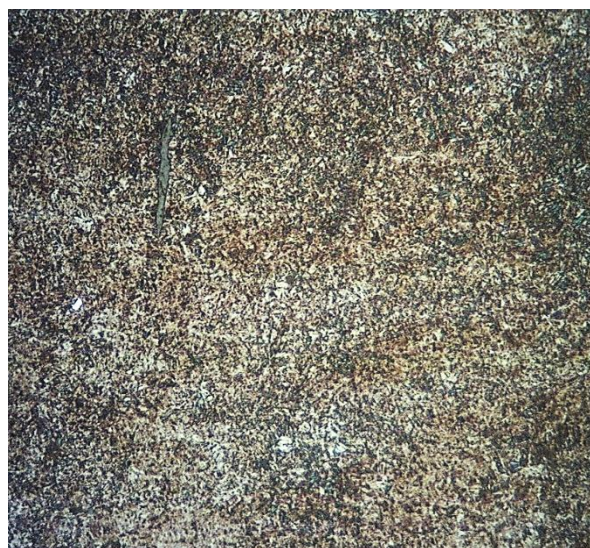
Перегрев стали можно устранить. Для этого применяют отжиг до температур, на 40...60 °С превышающих температуру начала аустенитного превращения. После некоторой выдержки заготовки медленно охлаждают вместе с печью. В теплое время года возможно охлаждение на спокойном воздухе (без сквозняков и искусственных воздушных потоков). В результате зерна становятся мельче, приобретают округлую форму, а металлу возвращаются его прежние физико-механические характеристики.

Необратимым дефектом термообработки является пережог. Он возникает при нагреве стали до температур ниже температуры начала плавления на 50...100 °С. При таких температурах неметаллические включения в стали, располагающиеся всегда по границам зёрен – сера и фосфор – плавятся. Этому сопутствует также интенсивное окисление, которое проходит по границам зерен. Пережженный металл полностью теряет свою пластичность, следствием чего является появление рваных трещин при последующей ковке или прокатке. Восстановить исходную структуру такой стали невозможно [4, 5].

Для определения причины ухудшения качества работы образца затвора, связанного с нарушением режима термической обработки, был проведен анализ элементного состава, исследование микроструктуры, измерение твердости. По элементному составу с учетом погрешности измерений ближайшим отечественным аналогом данного образца является сталь типа ХНЗА (ГОСТ 4543-71 «Прокат из легированной конструкционной стали»).



*a*



*б*

*Рис. 9. Микроструктура затвора, х500: а – крупноигльчатый троостит (бейнит); б – мелкоигльчатый троостомартенсит*

Исследования показали, что микроструктура образца затвора неоднородна по сечению: в широкой части присутствует крупноигльчатый троостит (бейнит) с твердостью 42 – 45 HRC, в узкой – мелкоигльчатый троостомартенсит с твердостью 45 – 50 HRC (рис. 9, а, б).

Результаты проведенных исследований показали, что ухудшение качества работы затвора вызвано нарушением режимов термообработки – закалки с отпуском, о чем свидетельствует неоднородность структуры и присутствие грубой структурной составляющей – крупноигльчатого троостита (бейнита), пониженной твердости.

#### Устранение дефектов термической обработки.

Исходя из систематизации и анализа проведенных исследований, можно сделать вывод, что характерной причиной дефектов при термообработке

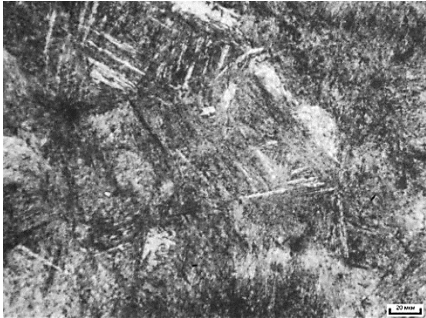
является несоблюдение режимов нагрева и охлаждения, в результате чего структура и свойства сплава не соответствуют заданным. Наиболее опасными дефектами термообработки являются трещины. Они возникают в результате резкого нагрева или охлаждения (микро- и макротрещины), насыщения поверхностного слоя водородом (водородные трещины).

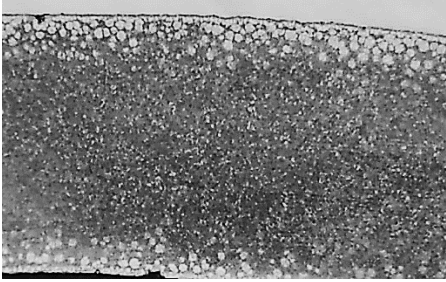
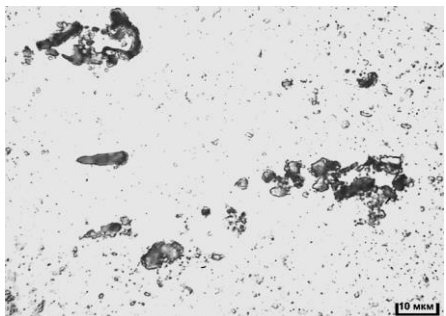
Неправильно проведенная закалка стали приводит к дефектам (браку изделия). Наиболее распространенные из них:

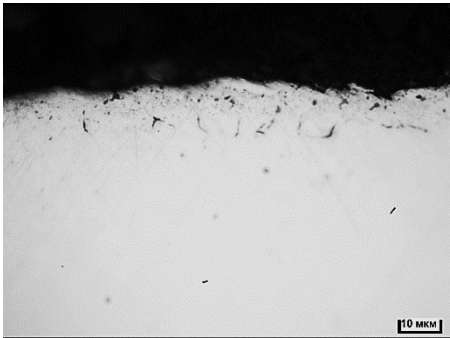
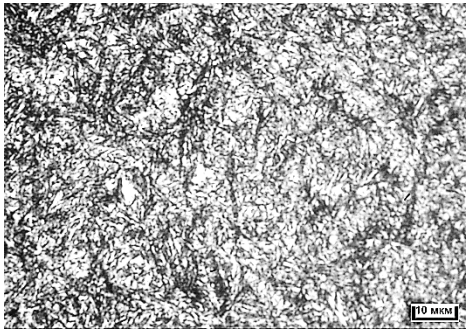
- недостаточная твердость закаленного изделия, мягкие пятна;
- пережог и закалочные трещины;
- обезуглероживание и окисление поверхности;
- коробление и деформация;

Дефекты термообработки, причина образования и способы их устранения приведены в табл.2.

Таблица 2. Дефекты термообработки, причина образования и способы их устранения

| Тип дефекта                                                                                                                                                                                                                                                                                                                             | Причина образования                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Способы устранения                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                       | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3                                                                                                                            |
| <p>Недостаточная твердость закаленного изделия, образование мягких пятен</p>    | <p>Неправильно выбранная температура закалки (температура закалки ниже <math>A_{C3}</math>) в структуре стали сохранился феррит или недостаточно интенсивное охлаждение при закалке доэвтектоидных сталей. В доэвтектоидной стали пониженная твердость может быть результатом перегрева. Образование при этом крупноигльчатой структуры мартенсита, помимо пониженной твердости, вызывает понижение ударной вязкости. В заэвтектоидных сталях недостаточная твердость закаленного изделия может являться результатом перегрева и образования крупноигльчатого мартенсита.</p> <p>Образование мягких пятен является результатом неравномерного охлаждения, соприкосновения деталей друг с другом в процессе охлаждения, наличия жировых пятен на поверхности изделия и неоднородности структуры.</p> | <p>Исправляется брак повторной закалкой изделия. Неоднородность структуры устраняется предварительной его нормализацией.</p> |

|                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Окисление и обезуглероживание</p>   | <p>Брак характеризуется образованием окалины на поверхности стальных изделий и выгоранием углерода в поверхностных слоях. Такой брак термической обработки не исправим, но если позволяет припуск на механическую обработку, то окисленный и обезуглероженный слой удаляют шлифовкой.</p>                                                                           | <p>Для предотвращения этого вида брака нагрев изделий рекомендуется проводить в печах с нейтральной атмосферой либо в жидких средах.</p> |
| <p>Пережог</p>                      | <p>Пережог наступает при весьма высоких температурах нагрева, близких к температуре плавления, поэтому имеет место проникновение кислорода внутрь металла и образование окислов, располагающихся по границам зерен, или даже оплавление металла по границам зерен. Это нарушает сплошность металла, и, как результат, он становится не пригодным для применения</p> | <p>Такой брак термической обработки также не исправим.</p>                                                                               |

|                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Закалочные трещины</p>   | <p>Результат слишком быстрого и неравномерного нагрева, либо слишком быстрого охлаждения, либо наличия на детали резких переходов сечений, где возникают большие внутренние напряжения, приводящие к растрескиванию. Могут получиться, если после закалки деталь сразу не подвергли отпуску для снятия внутренних напряжений.</p>                                                                                                                                                                                                                                  | <p>При закалке необходимо обеспечить равномерный и более медленный нагрев, использовать закалку с подстуживанием (в двух средах или ступенчатую), отпускать изделия непосредственно после закалки и т.д.</p> |
| <p>Деформация и коробление</p>                                                                                                                                                                | <p>Структурные изменения, происходящие в металле при термической обработке, вызывают изменение объема (деформацию), а неравномерность охлаждения — искажение внешней формы (коробление). Такие дефекты закаленной стали происходят в связи с тем, что структуры имеют различный удельный объем. Это следует учитывать при назначении допуска на шлифовку. Например, удельный объем мартенсита больше, чем удельный объем перлита. Также форма различных деталей под влиянием структурных напряжений изменяется иначе, чем под влиянием термических напряжений.</p> | <p>Для предотвращения деформаций и коробления необходимо обеспечить медленное охлаждение в интервале мартенситного превращения путем ступенчатой и изотермической заливок, закалки.</p>                      |

Рекомендации по устранению технологических дефектов термической обработки позволят повысить надежность и долговечность изделий из конструкционных сталей при эксплуатации.

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