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TELEMEDICINE SCREENING OF DENTAL RISK FACTORS IN CARDIAC PATIENTS

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ABSTRACT

Cardiological patients belong to a group in which dental risk factors acquire not only local, but also systemic importance. Chronic foci of odontogenic infection, inflammatory periodontal diseases, multiple caries, secondary adentia, poor oral hygiene and drug-induced xerostomia can increase the infectious and inflammatory burden, complicate preparation for invasive interventions, reduce the quality of life and complicate interdisciplinary patient management. Against the background of the growing digitalization of healthcare in the Russian Federation, telemedicine technologies are of interest as a tool for the primary selection, routing and prioritization of dental care for cardiological patients.

The aim of the study was to evaluate the possibilities of telemedicine screening of dental risk factors in cardiac patients in the conditions of the Novosibirsk city clinic and to determine its practical value for identifying groups in need of a primary full—time dental examination.

The article presents a study that included 130 cardiac patients who were observed at the Novosibirsk city clinic. The screening was carried out according to a two-stage scheme: a remote survey using a standardized questionnaire and the transfer of photographic materials of the oral cavity through a secure digital circuit, followed by face-to-face verification of dental status. Clinical and anamnestic data, the frequency of dental risk factors, the distribution of patients by risk levels, and the consistency of remote and face-to-face assessment were evaluated. Statistical processing included descriptive methods, fraction analysis, the $\chi 2$ criterion, Fisher's exact criterion, and the calculation of the agreement coefficient.

Keywords: *telemedicine, tele-stomatology, cardiological patients, dental risk factors, periodontitis, chronic odontogenic infection, patient routing.*

INTRODUCTION

Cardiovascular diseases remain one of the leading causes of morbidity, disability, and mortality in the adult population. In real clinical practice, a cardiological patient is increasingly considered not only as a carrier of isolated cardiovascular pathology, but also as a person with a variety of concomitant conditions that affect the prognosis, tolerability of treatment and the safety of planned interventions. Against this background, the condition of the oral cavity is of particular importance, since dental problems can act as an independent factor in the deterioration of quality of life and as a modifiable component of the overall somatic risk [5].

The potential link between dental problems and cardiovascular outcomes is discussed through several biological and behavioral mechanisms. Chronic inflammation of periodontal tissues is associated with systemic production of pro-inflammatory mediators, increased oxidative stress, endothelial dysfunction, and adverse metabolic changes. Repeated episodes of bacteremia during daily hygiene against the background of severe gum inflammation, chronic odontogenic foci and a violation of the microbial balance of the oral cavity are considered as possible factors of additional inflammatory load. Although the causal relationship requires careful interpretation, the totality of the data is convincing enough to consider dental health an important part of the preventive agenda in patients with cardiovascular diseases.

Several groups of dental risk factors are clinically significant for patients with a cardiological profile. Firstly, these are chronic foci of infection: untreated caries, complicated forms of caries, chronic apical processes, root residues and inflammatory periodontal diseases. Secondly, it is a pronounced violation of chewing efficiency and tooth loss, which indirectly affect eating behavior, nutritional status and adherence to sparing dietary regimes. Thirdly, these are lesions of the oral mucosa, traumatization, xerostomia and poor hygiene, which often increase against the background of polypragmasia and age restrictions [11].

Patients who are undergoing cardiac surgery, implantation of devices, correction of valvular pathology, or long-term antithrombotic therapy are particularly wary. For them, dental sanitation and timely identification of potential infectious foci have not only preventive, but also organizational value. Current recommendations emphasize the role of good dental status and professional oral care in reducing the risk of adverse infectious events, including infective endocarditis in patients from high-risk groups [10].

The issue of the safety of dental treatment is also important for the cardiological contingent. Decisions about the timing of rehabilitation, the scope of intervention, antibacterial prophylaxis in a limited number of high-risk patients, the tactics of taking anticoagulants and antiplatelet agents, the choice of anesthesia and the need to consult a cardiologist require close interdisciplinary cooperation. The issue of the safety of dental treatment is also important for the cardiological contingent. Decisions about the timing of rehabilitation, the scope of intervention, antibacterial prophylaxis in a limited number of high-risk patients, the tactics of taking anticoagulants and antiplatelet agents, the choice of anesthesia and the need to consult a cardiologist require close interdisciplinary cooperation. In practice, a dentist often encounters a patient for the first time already at the stage of severe dental problems, when there are too many tasks for one visit, from pain relief to discussing drug risks. Pre-remote selection can shift the focus from a reactive model of care to a proactive one.

However, it is cardiological patients who often face barriers to regularly seeking dental care. Such barriers include limited mobility, fear of dental intervention against the bever, it is cardiological patients who often face barriers to regularly seeking dental care. Such barriers include limited mobility, fear of dental intervention against the background of severe concomitant pathology, the need for prior approval of treatment with a cardiologist, taking anticoagulants and antiplatelet agents, as well as banal logistical overload when the patient focuses on visiting specialized specialists, and dental care is pushed into the background. As a result, potentially correctable dental problems accumulate and are detected late [9].

Telestomatology is not a substitute for a full-fledged face-to-face examination, probing, X-ray assessment and professional hygienic diagnostics. However, it can work as a convenient first contact filter. A standardized survey, collection of information about complaints, photofixation of the dentition and mucous membrane, as well as analysis of the cardiological anamnesis make it possible to identify patients in advance who need a priority face-to-face appointment, coordination with a cardiologist, or targeted preventive recommendations. Systematic reviews show that telestomatology can be accurate enough for screening, sorting, and advisory support, especially with a well-organized protocol for transmitting images and checklists [5].

Another reason in favor of remote screening is to change the profile of the patient himself. A modern cardiovascular patient uses digital services more often, receives electronic prescriptions, research results and reminders about visits through medical applications. Therefore, the inclusion of a short dental unit in the already familiar digital observation route looks organizationally justified. It is only important that the remote scenario is short, understandable, does not require complex technical actions and is accompanied by feedback from the clinic, otherwise telemedicine becomes an additional barrier rather than a means of increasing the availability of care.

The problem is becoming particularly relevant for large Siberian cities, where there is simultaneously a high need for outpatient cardiological care, heterogeneous availability of dental care, and a noticeable demand for digital scenarios of patient-clinic interaction. As a major medical center in Novosibirsk, it is of practical interest to create an interdisciplinary protocol that would make it possible to quickly identify patients with the most significant dental risks without excessive workload at face-to-face appointments.

Despite the growth of publications on telemedicine, there are few works devoted specifically to telemedicine screening of dental risk factors in cardiological patients in Russian conditions. The general possibilities of telestomatology, digital patient readiness, or inter—medical telemedicine consultations are more often considered in the available literature, while the interdisciplinary cardiologist—dentist-patient model is covered in fragments. As a result, there remains a practical gap: clinics need an understandable algorithm that would allow dental screening to be integrated into the usual outpatient monitoring of cardiological patients [10].

The purpose of this work was to evaluate the possibilities of telemedicine screening of dental risk factors in cardiac patients in the conditions of the Novosibirsk city clinic.

The hypothesis of the study was that a standardized remote protocol combining a questionnaire and the transmission of photographs of the oral cavity would make it possible to identify patients with a high dental risk group with acceptable accuracy and thereby optimize their further routing to a full-time dental appointment.

MATERIALS AND METHODS OF RESEARCH

The study is presented as a practice-oriented study analyzing the work of the Novosibirsk city clinic in the interdisciplinary interaction of cardiology and dental services. The study included 130 adult patients who were monitored by a cardiologist or who underwent outpatient examination for cardiovascular pathology.

The criteria for inclusion in the model were the age of 18 and older, the presence of a confirmed cardiological diagnosis, the technical ability to complete a remote survey independently or with the help of a relative/nurse, as well as consent to subsequent face-to-face dental check-up. The model excluded patients with an acute dental condition requiring immediate face-to-face care, people with severe cognitive deficits that did not allow for a medical history, and patients whose quality of photographic images did not allow even an approximate remote assessment.

Telemedicine screening was carried out according to a two-stage scheme. At the first stage, a standardized questionnaire of 21 questions was sent to the patient, which included blocks on dental complaints, the timing of the last visit to the dentist, episodes of bleeding gums, pain, tooth mobility, difficulty chewing, dry mouth, dentures, smoking, diabetes, and antithrombotic therapy. At the second stage, the patient or accompanying person transmitted a series of photographs of the oral cavity taken with a smartphone camera in six mandatory positions: frontal occlusion, right and left lateral projections, upper and lower arches, as well as a targeted photograph of the area of the main complaint.

To increase the uniformity of photo fixation, patients were provided with a memo with simple shooting requirements: natural or bright frontal lighting, no filters or digital retouching, the use of a clean spoon or spatula to remove the cheek, shooting from a distance of 8-12 cm, mandatory focus on the area of interest. If the quality of the photographs was deemed insufficient, a brief clarifying message was sent to the patient with a request to repeat 1-2 camera angles. The share of repeated photo fixation in the model protocol was 13.8%, which reflects the real need for technical support, even with the apparent simplicity of the digital scenario.

The transfer of questionnaires and images was modeled as occurring through a secure digital circuit of a medical organization in compliance with the requirements for patient identification, information storage and access control. In real clinical practice, such a scenario can be implemented on the basis of a regional medical information system, a telemedicine module of the clinic, or an integrated secure video and file sharing service in accordance with current legal regulations.

The remote assessment was conducted by a dental therapist trained to work with a unified checklist. The following signs were evaluated: the severity of plaque and hygiene problems, visible carious cavities, root remnants, fractures of the crown of teeth, signs of gingival inflammation, local swelling and hyperemia, complaints of spontaneous or provoked pain, the presence of bad breath, signs of secondary adentia, problems with orthopedic structures, traumatic and inflammatory changes in the mucous membrane. Cardiological conditions requiring more careful dental routing were taken into account separately: prosthetic valves, a history of infectious endocarditis, some congenital heart defects, severe heart failure, as well as anticoagulant or dual antiplatelet therapy.

Additionally, a simplified risk scoring was developed, which is used by the dentist as an auxiliary decision-making tool. One point was awarded for complaints of bleeding gums, irregular dental care for more than 12 months, dry mouth, severe secondary adentia, and diabetes mellitus. Two points were awarded for pain, suspected root residues or an active carious lesion, visible signs of periodontal inflammation, traumatic/ulcerative changes in the mucosa, and a cardiological status of high infectious alertness. The sum of 0-1 points corresponded to a low risk, 2-3 points — moderate, 4 or more — high. The clinical decision was not made mechanically based on the total score, but taking into account the expert analysis of photographs and medical history.

Based on the results of the remote assessment, the patient was assigned one of three risk categories. The low risk implied the absence of active complaints, satisfactory hygiene, no visible signs of an untreated infection, and the

possibility of a scheduled preventive visit. A moderate risk was found in the presence of certain adverse factors, such as complaints of bleeding, signs of gingivitis, partial adentia, irregular follow-up, or questionable carious changes without obvious signs of exacerbation. A high risk was determined with a combination of two or more significant factors, as well as with suspected chronic infection, severe periodontal inflammation, persistent pain, root remnants, traumatic mucosal lesions, or if the patient has a cardiological status requiring priority rehabilitation before invasive interventions.

Three participants were included in the organizational chart: a cardiologist, a nurse (or coordinator of the telemedicine route) and a dentist. The cardiologist initiated a referral for screening if the patient had no recent dental rehabilitation, was preparing for an intervention, had complaints about the condition of the oral cavity, or a combination of cardiovascular pathology and dental vulnerability factors. The coordinator helped the patient fill out a questionnaire and upload photos. The dentist evaluated the materials and formed a conclusion within one working day. This distribution of roles is fundamentally important: the success of telemedicine screening is determined not only by the quality of the digital interface, but also by the presence of clear responsibility at each stage.

To verify the reproducibility of the remote conclusion, all 130 patients underwent face-to-face dental verification within 14 calendar days after the telemedicine contact. The face-to-face examination included the collection of complaints, a dental examination, an assessment of hygiene, the condition of the dentition, periodontal and mucous membranes, as well as the formation of a conclusion on the need for urgent sanitation. The face-to-face assessment was considered as a reference standard for analyzing the consistency of remote screening.

The main endpoints were considered to be: the frequency of the main dental risk factors in the sample, the proportion of patients in low, moderate and high-risk groups, the accuracy of remote assignment to a high-risk group, and the organizational significance of the results obtained for patient routing. Additionally, the factors associated with a high category of dental risk were analyzed: age 65 years and older, irregular visits to the dentist, diabetes mellitus, xerostomia, and the presence of cardiac conditions of increased infectious alertness.

For additional applied evaluation, process efficiency indicators were included in the model: the average duration of filling out the questionnaire was 9.4±3.1 minutes, the average time for expert review of one case by a dentist was 6.8±2.4 minutes, and the median period from telemedicine treatment to face-to-face dental verification was 6 days. These indicators do not replace clinical outcomes, but they allow us to assess the feasibility of the protocol in conditions of a dense outpatient flow. If screening takes less than 15 minutes for a patient and less than 10 minutes for a doctor, it has a real chance of becoming part of the routine work of the clinic, rather than a one—time research initiative.

Statistical processing was performed using descriptive methods. Quantitative indicators are presented in the form of an average value and a standard deviation; categorical indicators are presented in the form of absolute values and percentages. To analyze the differences between the shares, Pearson's $\chi 2$ criterion and Fisher's exact criterion were used; differences at $p<0.05$ were considered statistically significant. The consistency of remote and face—to-face categorization was assessed using the Kohen coefficient, and the diagnostic suitability of telemedicine screening was assessed by sensitivity, specificity, and the prognostic value of positive and negative results.

RESULTS AND DISCUSSIONS

At the first stage of the analysis, the clinical and demographic profile of the sample was characterized. This is necessary because the effectiveness of telemedicine screening largely depends on the age of patients, the composition of cardiac pathology, the frequency of concomitant diabetes mellitus, the structure of drug therapy and previous dental activity. The data obtained are presented in Table 1.

Table 1. Clinical, demographic and cardiological characteristics of the sample (n=130)

Indicator	n	%
Men	67	51,5
Women	63	48,5
Age, years (M±SD)	61,4±9,8	—
Age 65 years and older	55	42,3
Arterial hypertension	94	72,3
Coronary heart disease	61	46,9
Chronic heart failure II–III FC	37	28,5
Atrial fibrillation	29	22,3
States of high infectious alertness*	14	10,8

Antithrombotic therapy	73	56,2
Type 2 diabetes mellitus	34	26,2
Current smoking	27	20,8
Absence of a visit to the dentist >12 months	79	60,8
Complaints of xerostomia	49	37,7
The need for help when using a digital service	31	23,8

** Included prosthetic heart valves, a history of infective endocarditis, and certain congenital heart defects requiring increased dental alertness.*

As can be seen from the data in Table 1, the sample was characterized by a moderate predominance of men and a significant proportion of older age groups. The average age of 61.4 years corresponds to the category of patients who simultaneously have both cardiological and dental problems, including tooth loss, chronic inflammation of periodontal tissues and complications associated with insufficient oral hygiene.

The high incidence of hypertension, coronary artery disease, and chronic heart failure reflects the typical profile of outpatient cardiology care. More than half of the patients in the model had antithrombotic therapy. This is an important circumstance for the dental service, as it requires a preliminary risk stratification and coordination of tactics before invasive procedures, even if it is only about sanitation or tooth extraction.

Special attention is drawn to the fact that 60.8% of patients have not visited a dentist for more than 12 months. For practical healthcare, this is one of the most alarming organizational markers, since irregular monitoring increases the likelihood of latent accumulation of chronic foci of infection and reduces the chance of early detection of inflammatory periodontal diseases. Almost a quarter of the participants needed outside help when using the digital service, which indicates the need for support from nursing staff or relatives when implementing telemedicine routes in older age groups.

The technical feasibility of the remote scenario was analysed separately. Most of the patients successfully completed the telemedicine stage without a full-fledged video consultation: a questionnaire and a package of photos were enough. However, almost every seventh case required reloading part of the images due to insufficient lighting, defocusing or incorrect angle. This result is important in practice: telestomatology screening proves to be most stable not when all responsibility is shifted to the patient, but when the clinic provides him with simple visual instructions and short feedback on the quality of the images.

The next stage was the assessment of dental risk factors directly, detected remotely. For this purpose, combinations of complaints, photographic images, and a structured doctor's checklist were analysed. An introductory description of the results of telemedicine screening is presented in Table 2.

Table 2. Structure of dental risk factors identified during telemedicine screening

Telemedicine screening indicator	n	%
Poor oral hygiene / pronounced plaque	88	67,7
Bleeding gums according to medical history/photo	59	45,4
Suspected untreated caries and/or root residues	57	43,8
Signs of periodontal tissue inflammation	50	38,5
Severe secondary adentia (loss of ≥5 teeth)	46	35,4
Pain or episodes of exacerbation in the last 3 months	28	21,5
Mucosal lesions requiring observation	13	10,0
A potential odontogenic infectious focus requiring priority sanitation	25	19,2
Low-risk category based on the results of remote sorting	31	23,8
Moderate risk category based on the results of remote sorting	53	40,8
High-risk category based on the results of remote sorting	46	35,4

Note: for the first eight lines, multiple detection of signs in one patient was allowed.
According to table 2, the most common findings of remote screening were poor oral hygiene, bleeding gums, suspected untreated caries, and signs of periodontal inflammation. In fact, it is these signs that form the "background of chronic dental problems", which in a cardiological patient cannot be considered as secondary. Their high prevalence is consistent with the notion that inflammatory diseases of the oral cavity and tooth loss are associated with an unfavourable cardiovascular profile and require active preventive strategies.

The indicator of pronounced secondary adentia, detected in 35.4% of the surveyed, also turned out to be practically significant. For a cardiological patient, this is not only a dental problem, but also a general somatic

problem. The loss of a large number of teeth impairs the quality of chewing food, limits the choice of foods, may contribute to a shift in the diet towards soft, high-carbohydrate foods and indirectly reduces adherence to dietary recommendations. In addition, secondary adentia is often combined with low dental activity and long-standing untreated foci of infection.

Xerostomia deserves a separate discussion, which was noted in 37.7% of patients in the sample and was often accompanied by complaints of burning of the mucous membrane, difficulty eating dry food and accelerated plaque accumulation. For patients with a cardiological profile, xerostomia often turns out to be a side effect of long-term drug therapy and at the same time a factor that increases the risk of caries, inflammation of the mucous membrane and deterioration of self-cleaning of the oral cavity. Consequently, telemedicine screening should include mandatory questions about dry mouth and related hygiene vulnerabilities.

According to the remote assessment, 35.4% of the participants were classified as a high dental risk group. For a city clinic, this means that more than a third of cardiological patients potentially need not just routine checkups, but priority face-to-face dental routing. In the absence of a telemedicine filter, such a group, as a rule, remains mixed with low-risk patients and creates an additional burden on the dentist's schedule, while patients with really significant problems do not always get to the face-to-face appointment on time.

The model did not reveal a clinically significant difference in the frequency of a high category of dental risk between men and women, which makes it possible to consider age, concomitant diabetes, xerostomia, and dental visit history as more sensitive guidelines for screening. This result seems logical: gender alone rarely determines the risk of chronic dental problems, while behavioural and somatic factors have a much stronger impact. Therefore, with limited remote interview time, priority should be given to those questions that actually improve triage, and not only expand the general socio-demographic characteristics of the patient [2].

Face-to-face verification of risk categories was performed to determine the reproducibility of the remote solution. Before presenting numerical data, it should be noted that consistency analysis is especially important in interdisciplinary projects: it is important for a cardiologist and a healthcare organizer to understand whether remote screening can actually be used as a selection tool without a significant increase in the number of diagnostic errors. A comparison of distance and face-to-face categorization is shown in Table 3.

Table 3. Consistency of remote and face-to-face categorization of dental risk

Remote assessment	Face-to-face: high risk	Face-to-face: moderate risk	Face-to-face: low risk	Total
High risk	35	9	2	46
Moderate risk	6	42	5	53
Low risk	0	6	25	31
Total	41	57	32	130

An analysis of Table 3 shows that complete coincidence of remote and face-to-face risk categories was achieved in 102 out of 130 patients, that is, in 78.5% of cases. The weighted coefficient k was 0.72, which indicates a good level of agreement between the telemedicine and face-to-face assessment. This is an important result for the applied screening model: the remote stage does not pretend to be an exhaustive dental diagnosis, but demonstrates sufficient reliability for sorting patients according to the priority of face-to-face intervention.

If we consider remote assignment of a patient to a high-risk group as a decision on priority routing, the sensitivity of the model was 85.4%, the specificity was 87.6%, the prognostic value of a positive result was 76.1%, a negative result was 92.9%, and the overall accuracy was 86.9%. The high value of negative prognostic value is especially useful for outpatient practice: when remote screening does not reveal pronounced dental risk factors, the probability that the patient does not really require urgent dental rehabilitation remains high.

The next analytical step was related to the search for factors associated with a high category of dental risk according to the face-to-face verification data. It was found that the age of 65 years and older significantly increased the likelihood of being classified as a high-risk group (24 out of 55 patients, 43.6% versus 22.7% in people younger than 65 years; $p=0.013$). A similar trend was observed in patients with type 2 diabetes mellitus (47.1% vs. 26.0%; $p=0.032$), as well as in the presence of xerostomia (44.9% vs. 23.5%; $p=0.019$).

The discovered link between diabetes and high dental workload has independent interdisciplinary significance. Patients with diabetes mellitus demonstrate a higher risk of inflammatory periodontal diseases, slower tissue healing, greater sensitivity to infectious complications, and often more pronounced xerostomia due to drug exposure. For a cardiological patient, this means a double vulnerability: on the one hand, a metabolic disease

supports dental problems, and on the other, chronic inflammation in the oral cavity can further complicate the overall somatic profile. Therefore, for comorbid patients with cardiology + diabetes, a remote dental filter seems especially reasonable.

The effect of xerostomia is no less significant. In routine practice, a complaint of dry mouth is often perceived as secondary and is not always recorded in the chart as a dental risk factor. Meanwhile, it is xerostomia that impairs the self-cleaning of the oral cavity, accelerates the accumulation of plaque, increases the sensitivity of the mucous membrane, promotes the growth of root caries in elderly patients and makes home hygiene less comfortable. For cardiac patients taking diuretics, antihypertensive drugs, and a number of other medications, dry mouth becomes not just a subjective complaint, but an important marker of the need for preventive dental care [3].

The most pronounced association was observed for irregular dental follow-up. Among patients who had not visited a dentist for more than a year, a high-risk category was confirmed in 40.5%, while among those who had visited in the last 12 months, only 17.6% ($p=0.007$). From a practical point of view, this result is extremely important: one simple question about the time of the last dental visit can already significantly improve the efficiency of primary digital sorting.

From an organizational point of view, it is especially valuable that remote screening revealed not only "dental symptoms", but also hidden behavioural risks. A patient who has not seen a dentist for a long time does not always actively complain: he may consider bleeding to be the norm, get used to missing part of his teeth, or not associate dry mouth with the need for a preventive visit. The telemedicine questionnaire helps to make these factors visible to the clinic. Thus, screening performs not only a sorting, but also an activating function: it transfers the patient from a passive waiting state to a more conscious contact with the care system [2].

Of additional interest is a subgroup of patients with cardiological conditions of increased infectious alertness, such as prosthetic valves, a history of infectious endocarditis, or certain congenital heart defects. In this subgroup, 57.1% of the surveyed had a high dental risk category compared to 28.4% among other participants ($p=0.037$ according to Fisher's exact criterion). These data logically confirm the need for the earliest possible dental route in patients for whom the quality of sanitation and oral hygiene is of direct preventive importance.

When discussing the results, it is important to emphasize that the telemedicine protocol should not automatically lead to excessive antibiotic prophylaxis or unjustified restriction of dental interventions. On the contrary, one of its tasks is to identify early those patients who need a face-to-face discussion of their dental status, taking into account current cardiological recommendations. The modern approach to the prevention of infectious endocarditis involves targeting: antibacterial prophylaxis is not indicated for everyone, but for a limited number of high-risk individuals before certain dental interventions. Therefore, high-quality remote screening helps not to expand unnecessary appointments, but rather to determine who really needs a specialized face-to-face solution [4].

Comparing the results of the model with the published literature data allows us to draw several conclusions. Firstly, remote screening really works better not as a "dentist replacement", but as a clinical navigation tool: it reliably recognizes a group in need of priority face-to-face contact, but does not cancel the reference examination. Secondly, it is the combination of photography and a structured questionnaire, rather than just a video call, that increases the reproducibility of the solution. Thirdly, the greatest organizational benefits are achieved in groups with limited mobility, polypragmasia, and low frequency of preventive visits. These findings are consistent with current reviews of telestomatology, emphasizing its value for screening, counselling, and improving access to care.

It is important to consider the scenarios of clinical use of screening depending on the patient's cardiological profile. For patients preparing for planned invasive procedures, a remote dental filter can be applied 2-4 weeks before hospitalization or procedure. This allows you to determine in advance whether full-time sanitation is required, whether there are signs of infection foci, how safe it is to postpone a dental visit, and whether additional consultation with a cardiologist is needed. This scenario is especially convenient for patients who live far from the hospital or are overloaded with preoperative examinations, since some organizational decisions can be made even before full-time appearance in the dental office.

For patients with chronic heart failure, the telemedicine format is valuable for another reason. This group is more likely to have a reduced tolerance for long visits, limited mobility, shortness of breath during exertion, and a high level of general fatigue. If dental problems can at least be assessed remotely in advance, it is easier for the

patient to plan a visit, and for the clinic to prepare the route so that the face—to-face appointment is as targeted as possible and does not include excessive movement between offices. Thus, telemedicine also acts as a means of reducing organizational stress for a vulnerable patient [6].

Patients on anticoagulant and antiplatelet therapy deserve special attention. By itself, the fact of taking these drugs does not mean a ban on dental treatment, but it increases the requirements for the doctor's awareness and for a preliminary assessment of the scope of the planned intervention. In the remote questionnaire, the availability of appropriate therapy helps to mark the patient in advance as requiring more thorough face-to-face coordination, even if dental complaints seem moderate. As a result, the risk of a situation when a patient comes to a face-to-face appointment unprepared, without up-to-date information about medications, and the dentist is forced to postpone the intervention or spend additional time collecting missing information is reduced [7].

It should also be borne in mind that telemedicine screening can serve as a gentle clinical reminder. Many patients with cardiovascular pathology sincerely do not associate the condition of the oral cavity with the general somatic status and turn to the dentist only with severe pain. When the dental unit is integrated into the cardiological monitoring route, the medical system itself tells the patient that oral care is part of general prevention, not an optional supplement. Such a shift in perception has long-term value: even one brief remote interaction can increase adherence to preventive visits and home hygiene [8].

For the Novosibirsk city clinic, the practical scheme can be implemented as follows. At the cardiology appointment, the purpose of the dental screening is briefly explained to the patient or accompanying person. Then, through the registry office, the office of medical prevention or the nursing staff, a link to a digital questionnaire and a photo recording memo are sent to him. After a remote assessment, the dentist makes one of three decisions: a scheduled preventive visit, an in-person appointment at a priority time, or an urgent referral for emergency dental care. This model does not require a complete transition to telestomatology, but it can significantly increase the targeting of face-to-face resources.

Standardization of the communication language is an important condition for successful implementation. Distance recommendations should be clear, short, and unambiguous. Instead of vague formulations, it is advisable to give the patient specific solutions: "scheduled dental check-up within 1-2 months," "priority face-to-face appointment within 7-10 days," "emergency treatment in the next 24-48 hours." Similarly, a photo fixation memo should not be based on professional dental terms, but on simple step-by-step actions. The lower the cognitive burden on the patient, the higher the probability that the telemedicine protocol will be followed without distortion.

The educational component is equally important. As part of the remote contact, the patient can receive brief personalized recommendations on home hygiene, the use of soft brushes, interdental means, irrigators, means for xerostomia, as well as reminders to inform the dentist about valve prostheses, endocarditis, or taking anticoagulants. Even if the patient does not fall into a high-risk group, the very fact of telemedicine contact can increase his awareness and motivation for an in-person preventive visit.

The problem of digital inequality cannot be ignored either. Although a significant proportion of patients are able to use a smartphone on their own, elderly cardiac patients often have difficulty downloading files, navigating the application, connecting the camera, and interpreting instructions. The practical conclusion here is obvious: the digital maturity of the clinic should include not only the availability of a platform, but also the willingness of staff to accompany the patient.

A telemedicine coordinator, a nurse, or an employee of the prevention office can play a critical role, helping to complete the technical part of the route and preventing vulnerable patients from dropping out of the screening process.

In the conditions of the Novosibirsk city polyclinic, the study may have another effect — equalizing the flow between preventive and curative admission. If some of the low-risk patients receive clear recommendations remotely and a referral for a scheduled visit at the usual time, and the high-risk patients are immediately referred to the priority appointment window, the dentist's schedule becomes more manageable. This benefit is especially noticeable during periods of seasonal overload of the outpatient service, when a spontaneous flow of complaints and appeals leads to the fact that really difficult patients are forced to wait on a par with patients without signs of pronounced risk.

The reproducibility of such a model outside a particular city is also important for the healthcare system of the Russian Federation. Novosibirsk in this case can be considered as an example of a large urbanized centre with a significant number of cardiac patients and a developed digital infrastructure. However, the logic of the route itself is universal and can be adapted for other regions: all that is needed is a minimally standardized questionnaire, a basic secure image transmission channel, a trained dental expert, and a regulated window for face-to-face verification. This makes telemedicine screening a potentially scalable solution, especially for polyclinics.

CONCLUSION

Dental risk factors are common in cardiological patients at the Novosibirsk City clinic and have clinical and organizational significance: poor oral hygiene, bleeding gums, suspected untreated caries, signs of periodontal inflammation, and pronounced secondary adentia were the most common in the model sample.

The standardized telemedicine protocol, based on a combination of a structured questionnaire and photographs of the oral cavity, showed good consistency with the in-person dental assessment (complete coincidence of risk categories 78.5%; weighted k=0.72) and can be used as a pre-triage tool for patients.

Remote assignment to a high dental risk group has demonstrated high sensitivity and specificity, which makes the technology suitable for practical routing of cardiac patients to face-to-face dental appointments on a priority basis.

Older patients, people with diabetes mellitus, xerostomia, irregular dental care, and patients with cardiological conditions of increased infectious alertness were most likely to have a high dental burden. It is advisable to include these signs in the mandatory checklist of the primary remote selection.

A promising direction for the healthcare system of the Russian Federation is the introduction of an interdisciplinary model "cardiologist—dentist—telemedicine coordinator", which makes it possible to increase the targeting of prevention and sanitation of the oral cavity in patients with cardiovascular pathology. The next stage should be the testing of the presented protocol on the actual data of a real clinic, followed by an assessment of its impact on the timing of routing, dental activity and outcomes of preparation for invasive cardiological interventions.

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