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Стаття надійшла до редакції
22.12.2021



UDC 616.31-084:618.2

<https://doi.org/10.26641/2307-0404.2022.2.260293>

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OPTIMIZATION OF PREVENTION OF DENTAL DISEASES IN PREGNANT WOMEN

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Цитування: Медичні перспективи. 2022. Т. 27, № 2. С. 152-158

Cited: Medicni perspektivi. 2022;27(2):152-158

Key words: *pregnant women, prevention, dental caries, periodontal diseases, gingival bleeding index, oral hygiene index*
Ключові слова: *вагітні, профілактика, карієс зубів, захворювання пародонта, індекс кровоточивості, індекс гігієни*
Ключевые слова: *беременные, профилактика, кариес зубов, заболевания пародонта, индекс кровоточивости, индекс гигиены*

Abstract. *Optimization of prevention of dental diseases in pregnant women. Gadzhula N.G., Cherepakha O.L. Effective prevention of dental diseases during pregnancy, as well as the correct tactics of a dentist and obstetrician-gynecologist is important factors in improving the level of dental health in pregnant women. The aim of research was to increase the effectiveness of the prevention of dental caries and periodontal diseases by introducing a complex of*

prophylactic and therapeutic measures in pregnant women. The implementation of the prophylaxis scheme is performed in 136 women aged 18-35 years. In the main group (70 women) prophylaxis was carried out using the complex of prophylactic and therapeutic measures developed by us, which includes: professional oral hygiene, oral health treatment, nutrition correction, prescribing the medicines of systemic and local action, training in proper teeth brushing, active sanitary and educational work. In the control group (66 women), the generally accepted prophylaxis scheme was used. Evaluation of the effectiveness of prophylactic and therapeutic measures was determined by indicators of caries incidence during pregnancy, reduction of caries, the dynamics of Papillary-Marginal-Attached Index and Papillary Bleeding Index. The effectiveness of the proposed algorithm of dental diseases prevention for pregnant women was confirmed by 3.45 times lower incidence of dental caries in women of the main group compared to the control group (0.44 ± 0.06 versus 1.52 ± 0.13 tooth, respectively); significant decrease ($p < 0.001$) of Papillary-Marginal-Attached Index values (14.01 ± 1.17 versus $49.25 \pm 1.86\%$), as well as bleeding indices (0.32 ± 0.08 versus 1.82 ± 0.13) and Green-Vermilion (0.89 ± 0.08 versus 1.71 ± 0.12 scores). Regular prophylactic and therapeutic examinations of pregnant women by a dentist, hygienic education and training of expectant mothers, active motivation of women to carry out individual oral hygiene with a constant monitoring of its implementation, correction of nutrition and mineral metabolism, influence on cariogenic and periodontal microbiota of the oral cavity, improvement of physiological enamel mineralization and increasing of hard tooth tissues resistance contributed to the reduction of caries incidence by $71.05 \pm 5.42\%$ and the effectiveness of periodontal diseases treatment by $88.46 \pm 3.81\%$ in the main group versus $36.84 \pm 5.94\%$ in the control group ($p < 0.001$).

Реферат. Оптимізація профілактики стоматологічних захворювань у вагітних. Гаджула Н.Г., Черпаха О.Л. *Ефективна профілактика стоматологічних захворювань під час вагітності, а також правильна тактика лікаря-стоматолога та акушера-гінеколога є важливими факторами покращення рівня стоматологічного здоров'я у вагітних. Метою дослідження було підвищити ефективність профілактики карієсу зубів та захворювань пародонта за допомогою впровадження комплексу профілактично-лікувальних заходів у вагітних. Упровадження схеми профілактики здійснено в 136 жінок віком 18-35 років. В основній групі (70 жінок) профілактику проводили із застосуванням розробленого нами комплексу профілактично-лікувальних заходів, який включає: проведення професійної гігієни та санації порожнини рота, корекцію харчування, призначення засобів системного та місцевого впливу, навчання правильній чистці зубів, активну санітарно-просвітницьку роботу. У контрольній групі (66 жінок) застосовувалась загальноприйнята схема профілактики. Оцінку ефективності лікувально-профілактичних заходів визначали за показниками приросту інтенсивності карієсу за період вагітності, редукції карієсу, динаміки папілярно-маргінально-альвеолярного індексу та індексу кровоточивості. Ефективність запропонованого алгоритму профілактики стоматологічних захворювань для вагітних підтверджена нижчим у 3,45 рази приростом інтенсивності карієсу зубів у вагітних основної групи порівняно з контрольною ($0,44 \pm 0,06$ і $1,52 \pm 0,13$ зуба відповідно); достовірним зниженням ($p < 0,001$) показників значень папілярно-маргінально-альвеолярного індексу ($14,01 \pm 1,17$ і $49,25 \pm 1,86\%$), а також індексів кровоточивості ($0,32 \pm 0,08$ і $1,82 \pm 0,13$) та Грін-Вермільйона ($0,89 \pm 0,08$ і $1,71 \pm 0,12$ бала). Регулярні профілактично-лікувальні огляди вагітних у лікаря-стоматолога, гігієнічне навчання та виховання майбутніх матерів, активна мотивація жінок до проведення індивідуальної гігієни порожнини рота із постійним контролем її виконання, корекція харчування та мінерального обміну, вплив на карієсогенну та пародонтогенну мікробіоту порожнини рота, покращення фізіологічної мінералізації емалі та підвищення резистентності твердих тканин зубів сприяло редукції приросту карієсу на $71,05 \pm 5,42\%$ та ефективності лікування захворювань пародонт на $88,46 \pm 3,81\%$ в основній групі проти $36,84 \pm 5,94\%$ у контрольній ($p < 0,001$).*

In pregnant women the dental caries intensity increases, the periodontal status deteriorates: the intensity and prevalence of periodontal diseases enhance, various forms of gingivitis and periodontitis occur, or the course of already existing periodontal diseases exacerbates [2, 9, 13, 14]. These changes are caused by temporary physiological endocrine disharmony and neurohumoral shifts in the woman's body during pregnancy [4, 8].

A differentiated approach to the choice of methods for exogenous and endogenous prevention of caries and periodontal diseases is the main one in solving the problem of maintaining the health of a pregnant woman. When choosing drugs of local and systemic effect, it is necessary to take into account their safety on the fetus, the presence of somatic pathology, the nature of the diet, the activity of the carious process,

the condition of the periodontal tissues, risk factors of the occurrence of oral diseases, etc. [11, 12]. Therefore, the improvement of methods for the prophylaxis and treatment of caries and periodontal diseases in pregnant women is an urgent task of therapeutic dentistry.

The aim of the research was to increase the effectiveness of the prevention of caries and periodontal diseases by means of implementation a scheme of prophylactic and therapeutic measures in pregnant women.

MATERIALS AND METHODS OF RESEARCH

For the implementation of prophylactic and therapeutic scheme, 136 women with a physiological course of pregnancy, aged 18 to 35 years, who signed an informed consent for a dispensary examination, were taken under the observation. Pregnant women

were divided into 2 groups: the main one – 70 women, in whom prevention was carried out using the complex of prophylactic and therapeutic measures developed by us (Table) and the control group – 66 women in whom the generally accepted prevention scheme was used [5]. The sample was homogeneous, the women with significant pathology of the dentognathic region and severe somatic diseases were not included in the groups.

The developed scheme for the prevention of odontopathology and periodontal diseases was agreed between the dentist, obstetrician-gynecologist and therapist. The complex of prophylactic and therapeutic measures included: professional oral hygiene,

teaching to properly brushing the teeth, forming a stable positive motivation for individual oral hygiene and monitoring its proper level, treatment of oral cavity diseases, nutritional correction, healthy lifestyle, regular physical activity, appointment of medicines of systemic and local action, sanitary and educational work. Treatment of caries and its complications, gingivitis and periodontitis in pregnant women of both groups was carried out according to the protocols of dental care [7]. Dynamic examination of women was performed in each trimester of pregnancy, if necessary – more often.

Algorithm of clinical actions of a dentist in pregnant women

Caries prophylaxis	Prophylaxis of periodontal diseases
Professional oral hygiene; training of individual oral hygiene and its control	
every three months	every two months
toothpaste with bioavailable minerals ¹ of magnesium, calcium, phosphorus and silicon	toothpaste with sodium bicarbonate content ⁴ (67%) and a combination of extracts of ginger, eucalyptus, mint
Mouthwash with multimineral complex ² (Ca, P, Mg, xylitol, kelp extract)	
Remineralizing gel ³ applications daily for 15 days in each trimester of pregnancy	Antibacterial oral drug ⁵ based on lysozyme and pyridoxine; mouthwash with plant extracts ⁶ (lasting 8 days in each trimester of pregnancy)
Lactobacillus reuteri probiotic ⁷ (1 lozenge for resorption, 20 days in each trimester after professional oral hygiene)	
Treatment of the oral cavity diseases	
Nutrition correction, healthy lifestyle, regular moderate physical activity	
Calcium-containing drug ⁸ of the third generation three times (from 8-10th, 18-20th, 30th week of pregnancy) lasting 1 month	
Multivitamins ⁹ (according to the indications, separately from the calcium-containing drug) lasting 20 days in the first trimester	Multivitamins ⁹ (according to the indications, separately from the calcium-containing drug) lasting 30 days in each trimester of pregnancy

Notes: For example, 1 – toothpaste R.O.C.S.® “Active magnesium”; 2 – mouthwash R.O.C.S.® “Active calcium”; 3 – gel R.O.C.S.® Medical Minerals (“R.O.C.S.” Switzerland); 4 – toothpaste “Parodontax Extra Fresh Complete Protection (de Miklen, Slovak Republic); 5 – Lisobakt® (Bosnalijek, Bosnia and Herzegovina); 6 – Stomatophyte (Phytopharm Klenko SA, Poland); 7 – BioGaia Prodentis (BioGaia, Sweden); 8 – Biocalcevit 1 g per night (Helaplant Plus, Ukraine); 9 – AlphaVit® Mom 1 tablet of each type (No. 1, 2, 3) 1 time a day during meals (for breakfast, lunch and dinner) (LLC “Recordati” Ukraine).

In pregnant women of both groups an in-depth dental examination was performed taking into account additional obstetric history columns. It included: anamnesis, examination, probing, percussion, palpation, index assessment of the oral cavity; detection of diseases of the hard teeth tissues, periodontium, and oral mucosa. Hygienic skills, oral care, the presence of bad habits were clarified. The morbidity of dental caries was assessed by the intensity of dental caries as the Dental-Missing-

Filled-Teeth (DMF_T) scores and the intensity of surface caries as the Dental-Missing-Filled-Surfaces (DMF_S) scores. Hygienic index was calculated according to Simplified Oral Hygiene Index by J.C. Greene and J.R. Vermillion (OHI-S, 1964). The state of periodontal tissues was objectified based on the analysis of the Papillary-Marginal-Attachment Index (PMA) in the modification by C. Parma (1960) and the Papillary Bleeding Index (PBI) according to H.R. Muhlemann (1977).

Evaluation of the effectiveness of prophylactic and therapeutic measures was determined by indicators of incidence of the caries intensity during pregnancy, incidence of caries reduction, the dynamics of the PMA and PBI indices. The reduction of caries (a decrease of incidence of the caries intensity after preventive measures, compared with the control group) was determined in % by the formula:

$$\text{Reduction} = \text{Mc} - \text{M/Mc} \times 100\%,$$

where Mc – incidence of caries intensity in the control group, M – incidence of caries intensity in the prophylactic (main) group.

Statistical analysis of the study results was carried out using computer programs Microsoft® Excel 2017 for Mac (corporate license, Product ID: 02984-001-000001; Device Code: 86C36D0C-8F15-59CA-A81E-B1D889205F71) and the licensed package “Statistica 6.1” (serial number BXXR901E246022FA). Statistical data processing was performed by methods of variation statistics with the calculation of average arithmetic and relative values and errors ($M \pm m$), ($P \pm m$), standard deviation (t) and the significance of differences (p -value, the differences were considered statistically significant at $p < 0.05$). In the case of confirmation of the normal distribution law when comparing quantitative indicators between groups, we used parametric methods – Student’s t -test for independent variables, and to identify differences in dynamics during prophylactic and therapeutic measures, Student’s t -test for dependent variables [1].

The work is a fragment of the research project “Modern trends and latest technologies in the diagnosis and treatment of odontopathology, diseases of periodontal tissues and oral mucosa”, state registration No. 0118U005471.

The studies were carried out in compliance with the main provisions of the “Rules of ethical principles for performing the scientific medical researches with human participation”, approved by the declaration of Helsinki, ICH GCP, EEC Directive No. 609, orders of the Ministry of Health of Ukraine No. 690 dated 23.09.2009, No. 944 dated 14.12.2009, No. 616 dated 03.08.2012. The study protocol was approved by the biomedical ethics committee of National Pirogov Memorial Medical University, Vinnytsya.

RESULTS AND DISCUSSION

During the primary dental examination of pregnant women, the prevalence of caries in women was 100%, the intensity of tooth decay by the carious process according to the DMF_t scores was 6.24 ± 0.16 , and according to the DMF_s scores was 7.86 ± 0.25 . When analyzing the course of caries in the examined women, it was found that the activity of the carious process and the number of complications of dental

diseases in pregnant women are significantly higher than in non-pregnant women ($p < 0.05$). The appearance of new carious cavities at the beginning of pregnancy was noted in $30.75 \pm 3.96\%$ of women. At the initial examination of pregnant women in both groups, the average indicators of the PBI index were 0.92 ± 0.11 . The values of the PMA and OHI-S indices were quite high ($43.25 \pm 2.14\%$ and 2.08 ± 0.09 scores), which indicated a high degree of gum inflammation and a low level of oral hygiene.

The obtained results of examination of women with physiological course of pregnancy at the initial visit to the dentist confirmed the opinion of many authors [4, 8, 9, 10, 11, 13, 14] that pregnancy is a risk factor for women’s dental health, in particular, the most common diseases – dental caries and gingivitis.

The developed methods of prophylactic measures aimed at preventing the development of odontopathology and periodontal diseases in pregnant women included dispensary examination of women in each trimester of gestation, professional oral hygiene, nutrition correction of the pregnant woman, and the appointment of local and systemic agents.

Individual prophylaxis included professional oral hygiene using instruments and special tools. Every pregnant woman was taught how to properly brush her teeth, use individual means and hygiene items. Dynamic examination of the condition of the oral cavity organs, professional hygiene was carried out 1 time per trimester, in the presence of risk factors for periodontal diseases – every 2 months.

The oral cavity diseases were treated in the shortest and most optimal time of pregnancy. It is better to treat and extract the decayed teeth before pregnancy, if this did not happen for the planned treatment of the oral cavity of the pregnant woman, a time period between 15 and 22 weeks of gestation was chosen [9]. In these terms, the organogenesis of the fetus has already completed, the placenta has formed, the fetoplacental circulation is functioning, hemodynamics has stabilized to a certain extent, and the indicators of the mother’s immunological status has improved [11]. When carrying out oral cavity treatment, limitations in the volume of dental care were adhered to: physiotherapeutic methods of treatment were avoided; prosthetics were postponed until the postpartum period.

The modern approach in the prevention and treatment of diseases of the hard tooth tissues is the influence on the processes of mineralization and remineralization of enamel. Due to the reduced mineralizing function of saliva during pregnancy, in women of the main group the remineralizing gel was applied, the active components of which are calcium glycerophosphate, magnesium chloride and xylitol

(promote the formation of enamel hydroxyapatite crystals, increase the remineralizing properties and reduce the activity of cariogenic microorganisms). The polysaccharide complex provides long exposure of the gel on the teeth surface and the gradual penetration of the active components into the hard tooth tissues.

At the end of pregnancy, the caries intensity in women of the main group was 6.68 ± 0.22 (by the DMF_t scores) and 8.36 ± 0.24 (by the DMF_s scores); in the control group, respectively – 7.76 ± 0.29 and 9.83 ± 0.30 ($p < 0.001$). At the same time, in women of the control group mostly acute course of carious process (in $71.21 \pm 5.57\%$ of cases versus $24.28 \pm 5.12\%$ in the main group) was revealed, as well as a high frequency of complicated caries ($27.27 \pm 5.48\%$ versus $13.85 \pm 4.12\%$, $p < 0.001$).

The application of the developed complex of preventive measures contributed to a significant improvement of the hygienic condition of the oral cavity in the II and III periods of gestation. In the main group of women, a significant decrease of the indicators of the OHI-S index was revealed – to 1.30 ± 0.10 scores in the II and to 1.26 ± 0.09 scores in the III trimester relative to pregnant women of the control group (1.60 ± 0.10 and 1.71 ± 0.12 scores, $p_1 < 0.001$). This quantitative value of the hygienic index corresponds to a qualitative assessment of the hygienic condition: “satisfactory” in women of the main group and “unsatisfactory” in the control group.

The incidence of the caries intensity during the gestation period in the main group of women, where the prophylaxis scheme was introduced, was 0.44 ± 0.06 teeth (by the DMF_t scores) and 0.50 ± 0.07 teeth (by the DMF_s scores). In the group of women who underwent the generally accepted course of prophylaxis, the rate of caries incidence during the entire gestation period was significantly higher and amounted to 1.52 ± 0.13 and 1.97 ± 0.14 teeth ($p < 0.001$), respectively.

The key local factors in the development of periodontal diseases in pregnant women are the colonization of the periodontal microbiota due to the increased proliferation of opportunistic microorganisms. Antibacterial agents used for periodontal diseases treatment are quite strong dysbiotic factors that further contribute to the artificial reproduction of pathogenic bacteria with a multiple resistance to them [8]. That is why, in case of inflammatory processes in the periodontium for the purpose of antibacterial action and elimination of changes in the system of local immunity of the oral cavity, mainly to improve the nonspecific resistance of the body, we chose a drug that contains lysozyme and pyridoxine (vitamin B_6). It is known that lysozyme (muramidase) is a

natural antibacterial enzyme for the human body, which plays an important role in the biosystems of antimicrobial defense, is able to activate leukocyte phagocytosis, and has an immunomodulatory effect; pyridoxine is an active regenerating agent. In case of severe inflammatory processes in the oral cavity, an additional herbal preparation was prescribed in the form of a solution enriched with a high concentration of plant extracts: chamomile, sage, arnica, oak bark, thyme, calamus, mint.

In order to restore the state of colonization resistance of the oral biofilm and prevention of periodontal diseases recurrences, the probiotic *L. reuteri* Prodentis was prescribed. In addition to affecting the microbiome by destroying or inhibiting the growth of cariogenic and periodontal bacteria, probiotics contribute to the formation of a biofilm, stimulate and modulate a mucosal immunity, increase the activity of anti-inflammatory cytokines and, accordingly, reduce the production of pro-inflammatory cytokines by converting histidine into histamine, which suppresses the pro-inflammatory production of TNF [3, 6].

After the complex of prophylactic and therapeutic measures, an improvement of the oral hygienic condition was observed in the examined groups in the first trimester of pregnancy. In women of the main group, there was a tendency for a significant decrease ($p < 0.001$) in the values of PMA ($14.78 \pm 1.34\%$), PBI (0.32 ± 0.08) and OHI-S (0.89 ± 0.08 scores). In the II and III trimesters of pregnancy in the main group of the examined women, inflammation in the gums significantly reduced, as indicated by a decrease (in 2.7 times) of values of the PMA index: in the II trimester to $15.02 \pm 1.34\%$, in the III – in accordance with $14.01 \pm 1.17\%$ ($p < 0.001$). The mucosa of the gums acquired a pale pink color; the swelling of the gums and interdental papillae disappeared. The bleeding index was zero. Only $11.43 \pm 3.80\%$ of women in this group had signs of mild inflammation.

In the control group of women, as the gestation age increased, the severity of gingivitis enhanced and the condition of oral hygiene deteriorated. If in the first trimester of pregnancy in $31.82 \pm 5.73\%$ of women in this group there were signs of mild inflammation in the form of a markedly pronounced hyperemia, edema and painfulness, the presence of linear-point bleeding, then in the third trimester of pregnancy the process became even more active: the value of the PBI index was 1.82 ± 0.13 ($p < 0.001$), which corresponds to the average degree of gum inflammation; PMA index scores – $49.25 \pm 1.86\%$ ($p < 0.001$).

A healthy lifestyle is an integral part of somatic and dental health. Periodontal diseases have been associated with physical inactivity and obesity: the

prevalence of the disease decreases with the maintenance of a normal weight, regular exercise (moderate physical activity 5 times a week) and a balanced diet [13]. For a favorable course of pregnancy, childbirth, growth and development of the fetus, full-fledged mineralization of temporary and permanent teeth during the period of jaw development, the nutritional correction of the pregnant woman was carried out according to the WHO principles and the Order of the Ministry of Health of Ukraine dated 07/15/2011 No. 417 [5].

Women, who had direct indications for restoring the vitamin balance, eliminating the lack of macro- and microelements were prescribed a combined multivitamin complex. With a significant activity of the carious process and the development of periodontal diseases, correction of mineral metabolism was carried out using calcium drugs of a natural origin of II-III generation in each trimester (from 8-10th, 18-20th, 30th weeks of pregnancy for 1 month). The endogenous use of a calcium-containing drug at a certain time is due to the following factors. The 10th week of pregnancy is the period of fetal bone tissue formation, which is characterized by the highest calcium release from the mother's body. In the body of a pregnant woman, metabolic processes are enhanced due to the formation of the placenta and the active deposition of calcium in it [2, 4, 11]. The 18-20th week of gestation is characterized by intense mineralization of the deciduous teeth, start of the formation of the rudiments of the first permanent molars. From the 30th week of pregnancy, intensive mineralization of the crowns of the temporary teeth of the fetus continues [6, 9].

Thus, the scheme of prophylactic and therapeutic measures for women during pregnancy includes the simultaneous implementation of a complex of self prophylaxis (strengthening of somatic health, rational and balanced nutrition, individual oral hygiene and its control, motivation and training in hygienic oral care) and medical prophylaxis (professional oral hygiene, dental treatment, local remotherapy, controlled prescription of calcium, multivitamins and probiotics).

The effectiveness of preventive measures by reduction of caries incidence parameter in women of the main group during pregnancy was $71.05 \pm 5.42\%$ according to the DMF_t scores and $74.62 \pm 5.20\%$ according to the

DMF_s scores, which indicates the high efficiency of timely prevention of diseases of hard tissues.

In women of the main group during pregnancy, the PMA index had a tendency to decrease and amounted $14.01 \pm 1.17\%$, while in the control group of pregnant women, on the contrary, there was a tendency to increase to $49.25 \pm 1.86\%$ ($p < 0.001$). The PBI index is 5.7 times lower compared to the control group (0.32 ± 0.08 and 1.82 ± 0.13 , respectively), the OHI-S index is 1.9 times lower (0.89 ± 0.08 and 1.71 ± 0.12 scores). Thus, the use of the proposed complex of prophylactic and therapeutic measures contributed to the elimination of the inflammatory process in the periodontal tissues, stopped the progression of existing diseases, prevented the emergence of new nosological forms, and improved the state of oral hygiene in women of this decreed population group.

CONCLUSIONS

1. Thus, regular prophylactic and therapeutic examinations of pregnant women by a dentist, hygienic education and training of expectant mothers, active motivation of women to carry out individual oral hygiene with a constant monitoring of its implementation, correction of nutrition and mineral metabolism, influence on cariogenic and periodontal microbiota of the oral cavity, improvement the physiological mineralization of enamel and increasing the hard tooth tissues resistance contributed to the reduction of caries incidence by $71.05 \pm 5.42\%$ and the efficiency of periodontal diseases treatment by $88.46 \pm 3.81\%$ in the main group versus $36.84 \pm 5.94\%$ in the control group ($p < 0.001$).

2. The use of the developed complex of prophylactic and therapeutic measures requires widespread implementation in the practice of dental institutions and antenatal clinics.

Contributors:

Gadzhula N.G. – conceptualization, validation, investigation, resources, data curation, writing – original draft, writing – review & editing;

Cherepakha O.L. – methodology, formal analysis, visualization.

Funding. This research received no external funding.

Conflict of interests. The authors declare no conflict of interest.

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Стаття надійшла до редакції
16.12.2020

