BORIC ACID AS A PROMISING ANTIBACTERIAL AGENT FOR CLINICAL USAGE

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BACKGROUND AND AIMS: Antibacterial properties of boric acid were revealed by using 12% solution by screening for minimum inhibitory concentration (MIC) against Gram-positive and Gram-negative bacteria including *Streptococcus mutans* RSHM 06029, *Staphylococcus aureus* ATCC 25923, *Enterococcus faecium* (Vancomycin resistant clinical isolate), *Enterococcus faecalis* ATCC 29212, *Escherichia coli* ATCC 25922, *Klebsiella pneumoniae* ATCC 700603, *Pseudomonas aeruginosa* ATCC 27853. MATERIAL AND METHODS: Standard methods, recommended by the Clinical and Laboratory Standards Institute (CLSI), were used. Gram positive colonies were selected from a Blood Agar plate culture and Gram negative colonies were selected from an Eosin Methylen Blue Agar plate to prepare the inoculum of the test organisms. Susceptibilities against boric acid were determined by broth dilution method using 200 µl volumes. Microorganism suspension of 100 µl which was adjusted to 0.5 McFarland was used as inoculum for each well containing 100 µl broth plus Boric acid solution and then incubated approximately for 18h at 37°C. MIC is defined as the lowest concentration (µg/ml) of antimicrobial that can completely inhibit the growth of the test organism. RESULTS: *S. mutans* was the most inhibited microorganism (MIC 3.125 µg/ml) whereas *S. aureus, E. faecium* (Vancomycin resistant clinical isolate) and *E. faecalis* were the microorganisms that were least inhibited by boric acid, with a MIC of 12.5 µg/ml. MIC values for *Escherichia coli, K. pneumoniae* and *P. aeruginosa* were identical (6.25 µg/ml). CONCLUSION: These results demonstrated that boric acid may be a promising agent in the treatment of infectious diseases. Further research is required to clarify the effects of boric acid on the microorganisms both i*n vitro* and *in vivo*.

CLINICAL EFFICIENCY OF ACIZOL IN COMPLEX TREATMENT OF PERIODONTAL DISEASES

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BACKGROUND AND OBJECTIVE: The role of zinc in the aetiology and pathogenesis of inflammatory periodontal diseases is well known. Periodontal pathology according to diseases having system hypoxia character, such as a diabetes mellitus, high blood pressure, ischemic heart diseases is the most widespread, aggressive and difficultly giving in to treatment. The aim of our research was to increase the efficiency of treatment of periodontal diseases associated with diabetes mellitus by inclusion acizol in complex therapy. MATERIAL AND METHODS: 87 patients with chronic periodontitis, according to diabetes mellitus were included in the study. Registration of periodontal status includes estimate of oral hygiene index (OHI-S), periodontal index (PI), gums bleeding (SBI), periodontal pockets depth, Ultrasonic Doppler inspection of periodontal tissues microcirculation, jaw bones X-ray diagnostic, glycaemia level. In control group (C) we apply traditional scheme of periodontal treatment; in group (AI) patients along with traditional treatment receive acizol (medicine containing zinc acetate) per os; in group (AII) patients use acizol inside and locally; in group (AG) in a complex with acizol therapy use tooth paste and mouth rinse containing hexetidine. RESULTS: At repeated survey in 3 months in control group marked increase of values hygienic and periodontal indexes to 17% from the indicators reached directly after treatment. Values of indexes have increased in group (AI) on the average on 3—6% mainly at patients with several chronic periodontitis. In group (AII) growth of indexes on 1.5—3% is revealed. In group

(AG) a condition of periodontal tissues by index criteria essentially did not differ from reached directly after treatment. In 6 months at survey of patients we revealed that 45% of patients of control group require in complex treatment. The analysis of the remote results of treatment has shown stabilization in group AG in 6 months at 94.7% of patients. The found out changes of hemodynamics were characterized by decrease in indicators of linear and volume speeds of a blood-groove that is caused by the stasis in microvessels and sharp decrease of periodontal tissues blood perfusion. In the course of treatment positive shifts of periodontal tissues microcirculation dynamics are revealed. In the remote terms after treatment positive dynamics according to clinical and X-ray researches (consolidation of bone structure, stabilization of bone resorbtion) remained. We note glycaemia level decrease on the average on 20% in a month after an initiation of treatment (group AI, AII, AG). CONCLUSIONS: Thus, our scheme of using various acizol combinations and antibacterial medicine hexetidine has shown high efficiency at treatment of inflammation periodontal diseases according with a diabetes mellitus. We observed longer period of remission that was a stubborn problem for practical dentistry.

THE EFFECT OF FINAL POLISIHING PROCEDURE AND SURFACE ROUGHNESS ON THE ION RELEASE FROM THE CO·CR·MO DENTAL ALLOY

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OBJECTIVES: To assess the release of the principal metal ions from the Co·Cr·Ni dental alloy after electropolishing procedure (EP) with or without additional mechanical polishing (MP). METHODS: Co·Cr·Mo alloy was casted and polished [sandblasted and electropolished (EP samples)]; some samples had been additionally mechanically polished using rotating rubbers and brushes with polishing paste (MP). The roughness and other morphological features of the EP and MP surfaces were assessed by atomic force microscope (AFM). The EP and MP samples were soaked in pH 6.0 phosphate buffer (Saliva), 3.5 pH phosphate buffer (acid) and pH 3.5 mixture of lactic, formic and acetic acid (dentobacterial plaque), and incubated at 37°C for 7 days. Six samples of every solution were prepared. AAS-GF was used for analysis of the released Co, Cr and Ni.

RESULTS: Results demonstrated release of only Co and Cr whereas Ni was not detected. AFM revealed different morphological features in EP and MP samples where Z range was significantly higher in EP samples ($p < 0.05$); the root mean square roughness (RMS) and mean roughness (Ra) values were slightly reduced in MP, without statistical significance ($p > 0.05$). There was also no significant difference in ion release between EP and MP polishing treatments ($p > 0.05$). CONCLUSIONS: Although there were morphologically different features between the respective standard EP and additional MP surfaces, they did not significantly affect the difference in Co and Cr ion release from the Co·Cr·Mo dental alloy. Additional mechanical polishing does not influence ion release and does not reduce the risk of possible metal toxicity.

MULTIELEMENT PROFILES OF SALIVA, WHOLE BLOOD AND HAIR IN PATIENTS, SUFFERED FROM ODONTOGENIC PHLEGMON

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Twenty patients (11 males, 9 females), suffered from odontogenic phlegmons, and 50 healthy subjects (25 males, 25 females) were investigated. Hair samples were taken during 1st day of hospitalization, and mixed saliva, whole blood samples were taken in 1st, 7th, 14th and 24th day of hospitalization. Totally, 280 specimens of biosubstrates were collected for multielement analysis by ICP-AES/ICP-MS in the laboratory of ANO CBM (Moscow, Russia). Absolute majority of the observed patients were homeless (15), and 5 of them were poor and undernourished. Before treatment, in hair of patients elevated levels of Al, Pb, Cd, Be, As, B, Ni, V, Na, and low levels of Ca, Se, Si were detected. In blood the decreased concentrations of K, Cr, Se (p < 0.01) and Fe, Zn (p < 0.1) were found, and only Cu level was higher than in controls (Cu/Zn imbalance). In saliva decreased concentration of Ca, K, Mg, Mn, P, Sr, and increased Cu were observed. During routine antibacterial and anti-inflammatory treatment, the concentrations of osteogenic elements such as Ca, P in saliva were normalized, but Cu level was higher than in control group, and after the 24-day treatment course. In whole blood the normalization of Se, Cr levels and Cu concentrations were observed only in the end of treatment. So, the 24-day routine treatment of odontogenic phlegmons in poor and undernourished patients restores their general elemental status. Additional using of Ca, P, Mg and Se, Zn containing food supplements or complexes can be very useful in restoration of patients with odontogenic phlegmons because such patients are lack of these macro and trace elements in the organism.

INFLUENCE OF MINERAL CONTENT ON *LEGIONELLA* AND BACTERIA CONTAMINATION IN HOT WATER DISTRIBUTION SYSTEMS

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OBJECTIVES: To establish the relationship between mineral content of a representative number of hot water samples and microbial contamination with specific reference to *Legionella spp*. World-wide *Legionella* is responsible for severe pneumonia in persons inhaling contaminated aerosols at home, in touristic accommodations and health structures. METHODS: Fe, Mn, Cu, Zn, Mg and Ca were measured by flame-AAS in 408 hot water samples collected from different public and private structures. *Legionella spp., Pseudomonas spp.*, total counts at 37°C and 22°C were measured by specific cultural methods. RESULTS: Higher levels of Mn, Fe and Zn were associated with increased risk of contamination by legionellae (OR = 2.6, 2.5 and 2.7, respectively), whereas Cu > 50 µg/L prevented *Legionella spp*. colonisation (OR = 0.34, 95% CI = 0.15-0.74). When all the three metals were higher (Mn > 20, Fe > 300, Zn > 500 µg/L), 73.5% of water were contaminated by *Legionella spp*. and 72.0% of these showed contamination levels exceeding 104 CFU/L. Furthermore, Fe > 300 µg/L significantly affected total counts at 22 and 37°C, whereas mineral content did not influence *Pseudomonas spp*. However these bacteria were more frequently isolated at total hardness between 10 and 40°F compared with softener and/or hardener water samples (OR = 1.95, 95% CI = 1.18—3.22, p < 0.01). Lastly, water with lowest/highest hardness interval were more frequently contaminated by *L. pneumophila* serogroup 1 (20/45, 44.4% of isolates) compared to serogroups 2—14 (12/134, 9% of isolates). DISCUSSION: This study shows that hot waters rich in Fe, Mn and Zn are at higher risk for *Legionella* colonization and growth, and the effect was specific not observed for the other microbial parameters. Copper was confirmed as a protective factor justifying the use of this trace element for controlling *Legionella* in hot water distribution systems. Water hardness appears to modulate the type of contaminating *Legionella*, a result that deserves further investigation due to possible difference in strain virulence.

SEASONAL VARIATIONS OF CHEMICAL ELEMENTS IN HUMAN SALIVA

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The mixed saliva samples of 44 healthy men and 63 patients with chronic gingivitis aged 18-40 years were investigated during different seasons. Concentration of the following 14 chemical elements in the samples was determined: K, Na, Ca, Mg, P, Cr, Cu, Fe, Mn, Zn, Se, Si, Ni, Al. Analytical determination has been carried out using ICP-AES and ICP-MS methods. It was found, that in the mixed saliva in the healthy men has shown, the maximal concentration of Cu, Cr, Fe, Mn, Zn was observed during summer season, Se, Ca, Na, P — in autumn, K, Mg, Si, Ni — in spring, and Al — in winter. Thus the minimal values of Ca, Na, P, Mn, Zn, Cr were observed in the spring, K, Fe, Mg, Si, Ni — in autumn, Al — in summer and Cu, Se — in winter. The seasonal variations are statistically significant ($p < 0.05$). It is established, that the current chronic gingivitis is accompanied by significant increase ($p < 0.05$) in the circannual mean salivary concentration of Ca, Cu, Mn, Fe, Cr, Ni, Al and decrease in K, Na, Mg, P, Se, Si, Zn. The shift of acrophases seasonal rhythms concentration Na, Mg, P, Cu, Mn, Cr for the autumn season, Ca, Se, Zn — winter, Fe, Al — spring and K, Si — summer in the patients was observed in comparison with healthy. The increased salivary level of Cu in connection with Zn deficiency in patients promotes increase of gum epithelium permeability for bacteria, stimulates inflammatory processes; that is more actively shown in the spring season. Thus, the received data show presence of statistically significant seasonal rhythms concentration chemical elements in the mixed saliva in healthy and patients with chronic gingivitis men.

TRACE ELEMENTS IN NANOTECHNOLOGICAL APPROACH OF BIOPLASTIC MATERIAL «HYAMATRIX» PRODUCTION

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Production of bioplastic materials is progressively developing in the world. The aim of this work was to improve the clinical effectiveness of bioplastic materials by nanotechnological approach with using of TE. During 2000—2005 the new bioplastic material «Hyamatrix» was developed. The new nanostructural matrix with < 100 nm cellulars provides the increased adhesion and optimal conditions for cell migration in wound. «Hyamatrix» have some significant advantages in comparison to best world's analogue «HYAFF» (Bristol Meyers Squibb) due to specific nanostructure of the material. High hydrophility of «Hyamatrix» leads to decreasing of treatment period and better healing effect. Nanostructurized bioplastic material is a unique carrier of transplanted cell elements, because of optimal hyaluronic acid and other trophic components content, including trace elements, the cells in «Hyamatrix» structure can not only to live but also have the mitotic activity. It also provides the natural drainage in wound surface and the optimal conditions for epithelial cells migration.

CALCIUM REGULATIVE HORMONES, CALCIUM CONTENT IN HAIR AND BONE TISSUE DENSITY INDEX IN GENDER-AGE ASPECT

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Serum levels of parathyroid hormone (PTH) and calcitonin (CT) were determined in inhabitants of Belarus aged 11—17 (n=113) and 65—70 (n=130) using immunoradiometric method. Calcium levels in hair were detected using inductively coupled plasma atomic spectrometry (spectrometer Vista PRO, «Varian», USA). Bone tissue stiffness index stf (left heel bone) was determined using ultrasound densitometer Achilles InSight («General Electric Medical Systems», USA). PTH median in girls was 17.02 against 56.24 pg/ml in women; CT median was 1.73 and 0.15 pg/ml respectively. In man group this index was 13.85 and 48.20 pg/ml; for PTH, 0.71 and 0.52 pg/ml for CT according to the age. That is in elderly subjects independently of gender activity of PTH increased positively and activity of CT decreased in comparison with adolescents. In the time hormone level was physiological in all examined people. In old men correlation PTH: CT was 93:1 over against 8:1 in young men. In female group this correlation increased significantly (375:1 against 10:1 in girls). Calcium level positively decreased from 2044.1 μg/g in girls to 1215.0 μg/g in women. In man groups calcium median was 518.2 and 274.6 μg/g. Bone tissue density index decreased in women (stf = 101.0 against stf = 59.0) and in men (stf = 98.0 and 63.0). Thus expressed imbalance in calcium regulative hormones with PTH dominance is typical for old people, especially in female group. Increased PTH activity is accompanied with statistically significant decreasing stf and calcium level in hair decreasing.

TRACE ELEMENTS IN TOTAL HIP ARTHROPLASTY

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BACKGROUND: The incessant search for an increase in the total hip arthroplasty survival rate has led to the permanent investigation of new materials to allow improving results over time. However, the disadvantage of the Metal-Metal (MoM) pair is the present lack of knowledge of the possible consequences of metallic particles and ions. The objectives of this study are to determine serum chromium and cobalt in metal-metal total hip arthroplasties versus the metal-polythene (MoP) pair and pre- and post-operatory and one month post-surgery serum levels of copper, zinc and selenium. MATERIAL AND METHODS: We performed a prospective study of cases. Thirty patients with total hip replacements were studied: 15 had prosthesis with MoM friction and in the other 15 the pair was a MoP. Serum chromium (μg/L), cobalt (μg/L) and selenium (μg/L) concentrations were determined by electrothermal atomic absorption spectrometry with Zeeman background correction. Serum copper (μg/dL) and zinc (μg/dL) were measured by flame absorption spectrometry. Statistical package SPSS 15.0 was used for data analysis. RESULTS: Mean selenium: pre-operatory: 76.63 (SD: 11.48); post-operatory: 46.63 (SD: 8.14); month: 75.33 (SD: 17.89). Mean zinc: pre-operatory: 118.7 (SD: 34.1); post-operatory: 70.5 (SD: 21.1); month: 100.6 (SD: 17.5). Mean copper: pre-operatory: 115.3 (SD: 38.8); post-operatory: 92.1 (SD: 33.3); month: 122.5 (SD: 16.1). Patients with MoM arthroplasties had higher mean cobalt in the post-operatory (2.53) and at one month (2.33) of surgery than patients with MoP (0.33 and 0.38 respectively). In addition, MoM patients also had higher mean chromium in the post-operatory (0.74) and at month (1.97) of surgery than patients with MoP (0.47 and 0.97 respectively). CONCLUSIONS: Patients with metal on metal total hip arthroplasties seem to have a serum level increase of chromium and cobalt. The consequences of this increase are still uncertain.