DISserTATION
ABSTRACT

research ON THE ROLE OF CERTAIN BIVALENT CATIONS IN CHRONIC PERIODONTITIS

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# Abstract

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Dosage of bivalent cations in patients with chronic periodontitis

Introduction

Calcium

Distribution in the human body

Calcium intake

Physiological role of calcium in teeth and periodontium

Hypocalcemia

Hypercalcemia

Magnesium

Distribution in the human body

Magnesium intake

Physiological roles of magnesium

Magnesium in dental and periodontal tissues

Hypomagnesemia

Hypermagnesemia

Copper

Distribution in the human body

Copper intake

Copper elimination

Physiological roles of copper

Hypocupremia

Hypercupremia

Zinc

Distribution in the human body

Zinc intake

Physiological roles of zinc

Zinc in the periodontal tissues

Zinc depletion

Aims of the research

Patients and methods

Results

Discussions and conclusions

Research on the influence of fixed dental restorations with metal structure on the salivary bivalent cations

Introduction

Patients and method

Results

Discussions and conclusions

Research on the influence of smoking of salivary bivalent cation concentration

Introduction

Patients and method

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Influence of periodontal treatment on the bivalent cations

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Current knowledge

The periodontal tissues are a complex role to protect and support the dental tissues, consisting of gums, periodontal ligament, cementum and alveolar bone (1). The main chemical constituents of the periodontal tissue are found in all the support (2). Although bacteria and their products are the main factors that initiate periodontal disease, chronic infection, maintenance and propagation in the deeper periodontal bone resorption followed by an immunity appears as a result of which tainted individual is in a sustained release of inflammatory mediators by cells host organism (3). Periodontal microbiota is a complex community of microorganisms, many of which are still difficult or impossible to isolate in the laboratory (4). Chronic nature of periodontal disease complicated tracking and identification of bacterial pathogens (5). The growth of bacteria as biofilms leads to an increase in resistance to antimicrobial agents, the sensitivity decreases relative to the time available until 1000 (6) (7). Biofilms the distinct mechanisms of resistance and pathogenicity (8) (9) (10).

Among the most common risk factors, with a genetic predisposition to periodontal, indicate poor oral hygiene, diet and unilateral Deficiency, smoking and male sex and age under 50 years (11). The main function of calcium is to be combined with phosphorus to the correct development of bones and teeth, maintain the health of the periodontal tissue (12). The increase in the incidence of periodontal disease in individuals who consume large amounts of phosphorus than calcium phenomenon is based on a pseudo-hyperparathyroidism. The main role of calcium is the constituent of bone structure, i.e. the prevention of osteoporosis (13). Magnesium alone does not affect visible plaque, but coadministration of magnesium and fluoride affects enamel hardness and significantly reduce caries (14). It focuses on the interaction of fluoride with calcium and magnesium. Copper plays a role in the formation of collagen and elastin fibers in the periodontal ligaments. Copper participates in the synthesis of collagen and elastin, collagen is involved in creating links (cross-linkage) as cofactor for the activity of lysyl hydroxylase, an enzyme involved in the formation of bundles of collagen fibers (15). Periodontal tissue, zinc is found in a higher proportion of gingival epithelial poții nea. He performs many functions at this level (16). In addition to boron, copper, magnesium and silicon, zinc is an important element in the development of the metabolism of collagen and wound healing (17). Tissue zinc levels are not always correlated with plasma levels, red blood cells, urinary follicle (18). Antibacterial antibiotics administered prophylactically or therapeutically, to restore the bacterial flora consistent with healthy periodontal status (19). Systemic antibiotic therapy (19) (20), but is output (21). Systemic antibiotics administered in single scheme (22) (23) or combined (24). In the treatment of chronic periodontitis as an adjunct to surgical antiseptic widely used (25). When inflammation of the soft wall of the periodontal pocket is pronounced clinically manifested by painful swelling, discomfort in chewing and swallowing, bleeding when brushing to mastication or spontaneous, indicate treatment of inflammatory target (26).
Motivation of the research

Source is inorganic constituents of supragingival plaque saliva; As the mineral content increases, the mass becomes calcified plaque to form tartar. Tartar is commonly found in areas of the teeth adjacent to the salivary ducts (e.g., lingual surface of the mandibular anterior and buccal surface of the first molars), reflecting the high concentration of minerals available in the saliva in these regions. Subgingival plaque inorganic component is derived from the crevicular fluid, which is a serum transudate. Calcification peace scaling also leads to the formation of tartar. Research divalent cations other than calcium, has become a concern to use the information obtained to elucidate the answers to several questions. The research topic was chosen for the following reasons: • Follow calcium ion concentration to detect the existence of possible sources of calcium in periodontitis patients, represented by sub-and supragingival calculus; • Monitoring the concentration of magnesium ions, especially as the inflammatory marker, and identifying extrinsic pro-inflammatory factors, e.g., smoking represented; • Follow zinc ion concentration to identify differences caused by the inflammatory status or existence of extrinsic sources of metal ions (represented dentures with metal parts); • Monitoring of the concentration of copper ions as a marker of no corrosion of the alloys used in the manufacture of electrochemical dental prosthesis fixed or mobile metal part. I tried to trace the existence of factors modulating this phenomenon, represented essentially by the presence of periodontal inflammation and aggressors exogenous factors - smoking. • We considered both the presence and absence of differentiation between chronic periodontitis between the presence and absence of smoking and the existence of different types of prosthetic restorations disorders. In literature there are few data on electrochemical corrosion phenomena in vivo, a phenomenon widely unfortunately met us, due to very low cost price, process ¬¬ bi¬¬ity are smooth and shiny appearance of yellow metal alloys bronze and brass type, which although not intended for use in the treatment of dental prostheses have been widely used since decades. Smoking is a bad habit, with a spread ever wider, and learned from the age of increasing age. As elsewhere in our smoking is closely related with alcohol consumption and adverse consequences of these flaws are so incompletely elucidated and incomplete publicized and awareness of current and potential consumers. I tried to induce patients and awareness that chronic periodontitis is not necessarily an attribute inexorable age, but rather a consequence of prolonged action of various factors on periodontal abusers will allow better compliance of patients to periodontal treatment, with positive consequences regarding quality of life and investment in expensive prosthetic treatments.
Patients and methods

Method and patients three research directions that I started exploring this theme were: 1. Dosage divalent cations in patients with chronic periodontitis compared to patients without chronic periodontitis, regardless of the presence or absence of smoking, and regardless of the presence or absence conjunct with metallic prosthetic restorations and their type. Two. Research the influence of denture conjunction with metal parts for various types of salivary divalent cations. Three. Research the influence of smoking on salivary concentrations of divalent cations. Technique of the following steps:

— Patients' informed consent to participate in the study; awareness of the risks they run.
— The history focuses on the general conditions which may influence the cation concentration in the blood watch (the general parameters), and risk factors for periodontal disease (toxic consumption - alcohol, tobacco, ethnobotanical, bruxism, malocclusion developed or iatrogenic etc.);
— Thorough clinical examination, including parodontograma, followed by radiological examination locally;
— Grouping of patients in a control group and one treatment group;
— Making a first set of measurements;
— The working group was divided into two groups: one which originally received individualized treatment, and one that has not first received treatment. Patients were given the option to be part of one of these subgroups. Members of the sub-group that did not receive treatment were then treated, when the two sub-groups were significant differences; — mechanical treatment was followed by anti-inflammatory and antimicrobial treatment locally. Patients in group work treatment subgroup were monitored periodically being harvested the same sets of biological samples at 4 weeks, 3 months and 6 months after starting treatment. On these occasions, repeated thorough clinical examination, developing new parodontogram.
— The resulting data were transferred into individual files, then pooled and processed statistically, at each stage of the investigation, and at the end of the research phase. Conceiving observation sheet written for retaining data considered important in order to present research was designed a clinical observation form to have sufficient identification data for each patient, so the sheet can remain that form dental cabinet, but to include all the information needed for research (27).

Patient selection criteria include generally:
• Patient of age, able to express consent following information;
• Patient dentate or partially edentulous lower;
• Patient cooperating with general medical issues outstanding;
• Availability for dental examination appointments.
Inclusion criteria specific lot of work:
• Patients with chronic periodontitis diagnosed clinically and radiologically.
Non-inclusion criteria:
• Subtotal or total edentulous patients;
• Patients with occlusal overload index above 50%;
• Patients with general medical issues outstanding;
• Patients being treated with supplements or medicines containing calcium, magnesium, copper and zinc;
• Patients with repeated counseling appointment availability;
• Patients with other forms of periodontal disease;
• Bruxers.

Exclusion Criteria:
• Patients who, during the course of the study, became unavailable for further appointments, because of work or other;
• Patients with extracted teeth subsequently declared irrecoverable phenomenon resulting in changed class edentulous or significantly altered occlusal overload index;
• Uncooperative patients.

Clinical and paraclinical examination
To assess clinical periodontal support loss (clinical attachment loss), we used the arithmetic sum of retraction clinic (clinical retraction) and the depth of the survey (probing pocket depth) (CAL = CR + PPD).

Orthopantomography is a radiological investigation allows an overall assessment, consistent and clear of periodontal hard structures (28) (29).

After determining the precise diagnosis of periodontal disease, patients underwent a pretreatment program that followed:
• Informing patients about oral hygiene role in the onset and evolution of periodontal diseases, and motivating them towards the most stringent hygiene;
• Create professional cleaning sessions to determine the effectiveness of biostimulation periodontal treatment.
Where the situation required, occlusal equilibration was performed by selective grinding (30).

In more severe cases, initiated a treatment regimen with a combination of antibiotic (Rovamicină) and inflammatory (Ibuprofen) dose systemic variables which gave the expected clinical outcomes and subjective.

All patients received local irrigation in periodontal pockets adânci and productive, with a combination of antibiotic (tetracycline) and inflammatory (dexamethasone) every 5-7 days, controlled rinse chlorhexidine mouthwash (Clorhexamed).

Patients with a disorganized work program, which declared unable to meet the rigorous schedules, application received periodontal pockets with metronidazole gel (Metrodent).

Biological sampling
The samples of saliva were collected from the patients prior training in this regard. After the initial consultation, the patients were given disposable polypropylene syringe, and 10 mL 5 in sterile packaging.

Processing of biological samples:
For analysis by atomic absorption spectrometry, samples were processed as follows:
• The samples were cântârite capsules porcelain or platinum.
• The capsules were numbered trecându the sample number and the number of the capsule.
• The capsules were then subjected to dehydration in the furnace at 400 °C for 24 hours, after which they were cooled slowly.
• capsules residue was taken up in dilute nitric acid (5 ml nitric acid, 5%), and distilled water brought to a volume of 50 ml.
• The containers were numbered after the order capsules origin.
• Keep refrigerated containers made with the lid closed.

**Analysis and data processing**
The content of zinc, magnesium and copper was determined by the method of direct extraction in a flame atomic absorption spectrophotometer fitted with a vacuum generating multi-cathode-ray (31).

Regarding the analysis of magnesium, it was performed by ion chromatography.
The results were recorded in tables. Tables values were merged so that all the target values for each sample. It made such a pivot table, in another spreadsheet, which were subsequently extracted and processed information.

**The research results**

The dosage of the divalent cations in patients with chronic periodontitis

**Calcium**
There is a statistically significant difference between the healthy group and the group periodontal Patiala. There was a significantly smaller value of salivary calcium in patients suffering from periodontal (54.39 mg / L, σ = 7.65) than patients clinically healthy (86 mg / L, σ = 2.79). The difference proves statistically significant (p <0.001).

Serum calcium levels did not show a statistically significant group if your damage. Large differences presented step values salivary have no correlation with plasma levels.

**Magnesium**
In the control group, the mean salivary magnesium is 0.809 mg / L, σ = 0.01, while the group with chronic periodontitis average concentration of magnesium is 1.07 mg / L, σ = 0.187. Here, the difference is statistically significant (p <0.001).

Magnesiumemia centralization led to the following values: control group, magneziemia average was 2.05 mg / L, σ = 0.08, while the group with chronic periodontitis magneziemia average was 1.87 mg / L, σ = 0.12. The difference between the two groups is significant (p <0.005).

**Copper**
In the control group, the mean salivary copper concentration was 0.83 mg / L, σ = 0.18, while the group with chronic periodontitis, the average was 1.20 mg / L, σ = 0, 19. Although statistical significance seems to be (p <0.02) values are heavily affected by the presence of copper alloys containing copper, and their degree of corrodibility (see the next line of research).
**Zinc**

In the control group, the mean salivary zinc was 0.27 mg / L, $\sigma = 0.12$, compared to group work, with an average concentration of 0.9 mg / L, $\sigma = 0.61$. Between the two groups there is a statistically significant difference ($p < 0.002$). Blood zinc, although it was determined not differ statistically significant.

**Researching the influence of denture conjunction with divalent metal component on salivary cations**

**Calcium**

Global assessment between prostheses and no-prostheses, salivary calcium concentration led to the following results: the average value is 52.07 prostheses mg / L, with $\sigma = 14.67$, while the average value is 82 no-prostheses, 94 mg / L, with $\sigma = 17.81$. The difference is statistically significant $p < 0.001$. With reference to the class of materials which have been made the prosthetic restorations were not significantly different.

With regard to serum calcium, no significant differences were found statistically.

**Magnesium**

In patients unworn metal alloys, magnesium concentration in saliva is lower (0.808 mg / L, $\sigma = 0.017$) than those carriers (1.018 mg / L, $\sigma = 0.16$). The correlation coefficient was sufficient to establish statistical significance ($p < 0.001$).

Regarding magnesium, no differences were found statistically significant.

**Copper**

Between the prosthesized group and the unprosthesized there are significant differences, namely an average concentration of 1.21 mg / L for prosthesis ($\sigma = 0.18$) to 0.79 mg / L for the unprosthesized($\sigma = 0.09$), with a statistical correlation coefficient $p < 0.001$.

**Zinc**

Strengthening groups led to the following values: for the prostheses media salivary zinc is 0.85 mg / L with $\sigma = 0.66$, compared to the non-prostheses with an average value of 0.73 mg / L and $\sigma = 0.57$. Differences are not statistically significant, $p > 0.05$, where we could conclude that the presence of prosthetic restorations with metal component does not significantly influence salivary zinc concentration.
Researching the influence of smoking on salivary concentrations of divalent cations

**Calcium**
A value of salivary calcium was found in patients smokers prostheses and 50.67 mg / L, $\sigma = 13.55$ and the non-smoking prosthesis 57.33 mg / L, $\sigma = 19.7$. But statistically speaking, the difference cannot be considered significant. In patients without prostheses smokers mean concentration of salivary calcium is 84.28 mg / L, with $\sigma = 3.94$. Unprosthesized patients, the mean value of the concentrations Smoking is 66.64, $\sigma = 32.46$. This difference is statistically significant, $p <0.05$.

**Magnesium**
Smoking prostheses patients, the mean salivary magnesium is 1.09 mg / L, with $\sigma = 0.13$, while the smoking prosthesis have an average value of 0.86 mg / L, with $\sigma = 0.02$. The difference is statistically significant, $p <0.001$.

In patients with no prostheses smokers average salivary magnesium concentration is 1.01 mg / L, with $\sigma = 0.11$, while the average concentration unprosthesized Smoking is 0.82 mg / L, with $\sigma = 0.04$. The difference is statistically significant, $p <0.01$.

**Copper**
Smoking Patients prostheses showed an average concentration of copper in saliva of 1.24 mg / L, $\sigma = 0.19$, the prostheses to smoking an average of 1.16 mg / L and $\sigma = 0.22$. Correlation is not statistically significant.

Smoking unprosthesized patients showed a salivary copper concentration of 1.07 mg / L with $\sigma = 0.15$, compared to an average of Smoking unprosthesized of 0.85 mg / L with $\sigma = 0.07$. The difference in this case is statistically significant, $p <0.02$.

**Zinc**
Smoking prostheses in patients, the mean of salivary zinc was 0.96 mg / L to $\sigma = 0.68$ versus non-smoking prosthesis, with an average of 0.35 mg / L and $\sigma = 0.21$. The difference is significant, $p <0.02$.

In unprosthesized patients smokers have an average concentration of 0.91 mg salivary zinc / L with $\sigma = 0.73$, compared to non-smokers, with an average of 0.67 mg / L and $\sigma = 0.53$. The difference is not statistically significant.

Influence of divalent cations on treatment of chronic periodontitis

To conclude, we can say the following:
- The appropriate treatment of chronic periodontitis without calcium concentration to values similar to those of patients with healthy periodontal whether the person continued to smoke, to quit smoking or not smoking at the outset.
• salivary magnesium concentration returned to normal after treatment only if heavy smokers who give up smoking, which leads to the conclusion that smoking worsens massive local inflammatory status of the patient of chronic periodontitis.

• salivary copper concentration returns to normal after treatment in people who have quit smoking or not smoking at the outset. In the remaining smokers, the values decreased, but the differences are not statistically significant. This leads us to the conclusion that tobacco smoke or bring a load of copper or aggravate sensitive electrochemical corrosion phenomena that would be the only mechanism for local copper poisoning. This second idea is invalidated by small differences in the concentration of copper in individuals carrying dentures conjunction with metal parts susceptible to electrochemical corrosion between smokers and nonsmokers.

• salivary zinc concentration did not change significantly in any of the three situations described by the vice of smoking. No overall there were no significant differences, which leads to the idea that the initial differences found lies in what is called "pitch factor" essential element of the pathogenesis of chronic periodontitis.

Discussions

Notable differences in the salivary calcium concentration were attributed to the presence of tartar, and continue its deposit once primed phenomenon, implying insolubilisation a high proportion of calcium in saliva. The mechanisms for the insolubilisation of calcium ions probably most intense during the night, when significantly reduced salivary secretion may result in an increase in the concentration of the cation saliva. The results we have obtained are competing with those present in the literature (32).

From differences in salivary calcium concentrations in unprosthesized patients, smokers and nonsmokers, we can conclude that smoking accelerates plaque deposition during practice vice, while during sleep deposition layer of partially regains solubility, calcium is not yet fixed structures plaque. The literature is not consistent in this regard, different results are probably the result of too many independent parameters that affect circuit of calcium ions in the mouth (33) (34).

Magnesium increased saliva may be a marker of local inflammatory status, as confirmed by the literature (35) (36) (37). Sulcusuri fluid derived from inflamed periodontal and a high bacterial load may contain significantly more magnesium than periodontal fluid derived from a healthy sulcus. In this respect it is also about quantity, pockets producing a quantity of fluid than a healthy sulcus.

Magnesemia changes can be attributed to the existence of chronic inflammation, partially confined bony structures. We note this reluctantly, because in the literature there are few data on magnesemia in such situations (38).

Differences for salivary magnesium concentration for research influenţei etched alloys can be attributed to electrochemical exchange between the wheels and
the saliva, but also on account of proven role of salivary magnesium detoxification of heavy metals (39).

In this case, it can keep track of the differences between the magnesium concentration and by the presence in saliva of smoking brings the body, among other contaminant, and heavy metals.

From the difference in salivary concentrations of magnesium patients prostheses, smokers and nonsmokers, it can be concluded that smoking, depending on the severity of the phenomenon (number of cigarettes per day) inducing an inflammatory response of the body, characterized by increasing the amount of salivary and magnesium.

Saliva Sampling time was chosen at a significant distance from the last act of smoking, tinted idea that this inflammatory response by a knock retard, that influence smoking is not limited to a short period of time after the aggression of tobacco smoke, but takes time. Recent research shows that smoking induces increased salivary magnesium as a secondary mechanism of detoxification of other divalent cations, which brings tobacco smoke in the body (40).

The influence of smoking on salivary magnesium concentration is visible in unprosthesized patients.

The correlation between the two sets of values (prostheses and non-prostheses) parameter to smoking indicates that smoking influence on salivary magnesium concentration does not depend on the presence or absence of prosthetic restorations (p = 0.16 vs. Smoking prostheses. Smokers unprosthesized).

Differences in salivary concentration of copper appear to be exclusive prerogative metal prosthesis because both groups included patients denture wearers conjunct type made of bronze or brass alloys and presumed inflammatory status can accelerate or exacerbate chronic periodontitis electrocorrosion phenomena (41 ). The author is based in this case on local evidence from the literature, this type of alloy are not available in other parts of the world research (42).

Copper insignificant differences by smoking in patients denture wearers conjunction with metal parts invalidates the idea that smoking would increase the solubility of copper. The small number of cases which would have accrued to each batch subgroups sharing the type of prosthetic construction and smoking not allowed differentiation between these subgroups, but appreciation is maintained.

Differences in concentration of copper in saliva smoking patients compared to non-smokers unprosthesized consistent with the literature that support the chronic intoxication with heavy metals, including copper, to heavy smokers (39). Roles are still incompletely understood salivary zinc.

Are described in the literature of zinc massive decline in immune depression, but none of our patients showed no such general conditions (43). Moreover, zincemie values were within normal limits for all patients included in the study. Changes in the concentration of zinc in saliva from periodontitis patients may be caused by cellular immune response caused by prolonged contact with aggressive factors accounted for subgingival plaque microorganisms or, in some cases, the presence of prosthetic restorations with metal on the origin and uncertain composition (44).

The difference between the salivary concentration of zinc in people with periodontal urge, between presence and absence of prosthetic restorations
conjunction with the metal component can be attributed to electrochemical exchange between the wheels and the salvia, with ion exchange. Apparently higher intensity compared to zinc ion exchange than can be relative to calcium (calcium being more abundant than zinc) or absolute (given the differences in electronegativity between calcium and zinc) (43). It stays established a working hypothesis relating to reverse the situation of periodontitis patients compared to healthy patients or by taking into account the pH of the periodontal exsudate, or by calculating the difference in electronegativity.

Insignificant differences in salivary concentrations of zinc in patients unprosthesized, smokers versus non-smokers, in conjunction with the significant differences of the same parameter in patients denture smokers against smoking leads to the idea that if smoking really causes type reactions of the immune response salivary secretory system, it is conditioned by the presence of prosthetic restorations, the role of the foreign body. Literature data are poor to make a comparison (31).
**General Conclusions**

The mean concentration of salivary calcium in chronic periodontitis patients is lower than in healthy subjects. This phenomenon was associated with a massive deposit of tartar, the trigger and maintenance of chronic periodontitis. Assume an active turnover of the surface layer of tartar, which leads to precipitation of salivary calcium in the night, until the time that I chose for the collection of saliva samples. The average concentration of magnesium in saliva increases in patients suffering from chronic periodontitis patients with periodontal urge to.

That has been on the rise in magnesium due to local inflammatory status. The research carried out has revealed a major role of smoking in terms of the intensity of the local inflammatory reaction alleged the existence of chronic periodontitis. The average copper concentration in saliva increases the overall suffering from chronic periodontitis patients compared with healthy subjects. This phenomenon was attributed to two important factors - smoking and there with metallic prosthetic components likely electrochemical corrosion.

The two mechanisms may exist at the same time exhibiting a phenomenon of synergism. Chronic Periodontitis itself in the absence of these factors does not cause increased Cu ++. The mean concentration of zinc in saliva is significantly increased in patients with chronic periodontitis compared to healthy subjects.

This was considered a consequence of a particular immune status, whether atypical reactivity against bacteria that normally make up the subgingival dental plaque, either as a compensatory mechanism for humoral immunity.
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