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Research Article

The Possible Role of LENR in Dentistry (Reasons, Effects and Prevention)

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Abstract

The possibility of the influence of nuclear effects on the destruction of the tooth surface using dental implants made of titanium is considered. It has been shown for the first time that this process is associated with LENR occurring between selective titanium and calcium isotopes and leading to the formation of a molybdenum isotope. This reaction is stimulated by the growth of natural microbiological cultures located in the oral cavity. The mechanism of such reactions is associated with the formation of coherent correlated states, which are formed due to the topological features of growing microcultures.
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1. Introduction

The traditional areas of research and application of LENR related effects are limited, as a rule, by a simple model of physical systems. A more detailed analysis has shown that such effects can successfully occur in microbiological systems [1–4]. The next obvious step is to search for LENR effects in a human body. This is a completely new field of research.

In this article we present only the preliminary results related to dentistry studies. In the practice of dentistry, it is well known that dental implants made of titanium often have a negative effect on teeth. This is manifested in the form of "leaching" of calcium from the composition of teeth and leads to their destruction. This very unpleasant effect is

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well known, but it does not have a clear biophysical explanation, and its specific reason is still incomprehensible to medical experts. In the following analysis, we have shown for the first time that these critical processes connected with the installation of dental implants can be directly related to LENR effects in the human oral cavity.

2. Microbiological and Biophysical Aspects of Dentistry-related Processes

It is well known that the installation of dental implants is an effective method of tooth restoration. The main element of any implant is a metal base with a thread that is twisted into the bone tissue. The effectiveness of implant ingrowth depends on a number of factors:

- the state of the bone,
- the requirements for mechanical stabilization,
- the structure and properties of implant material.

The basic requirements are, as a rule, hardness, chemical inertness and non-toxicity of the implant material. It should not enter into different chemical reactions, taking into account the fact that among the products may be those that contain a large amount of sodium chloride NaCl, have a high acidity or alkalinity, and also a high alcohol content. Based on these parameters, the most popular material at present is titanium (Ti).

It can be seen that all these requirements apply only to chemical processes and chemical reactions. The practice of experimental dentistry shows that, despite the fulfillment of these conditions, processes leading to catastrophic destruct on of the area of the installed implant, embrittlement of a tooth adjacent to the implant, and other local tooth destruction are often observed. On the other hand, the oral cavity is a complex object that contains not only the listed objects, but also many microbiological cultures and their associations.

In fact, this system is very similar to those working cells in which we have conducted experiments on isotope transmutation using stimulating action of growing microbiological systems [1–4]. Similar nuclear effects could be expected in such a system. It is obvious that these experiments should include such main “objects” of operative dentistry as titanium and calcium (the first is the “standard” strength element of all implants, and the second is the basis of the tooth material).

No one has discussed these important problems before and no one has analyzed the possible consequences of such processes. The human oral cavity is a unique ecological system for a wide variety of microorganisms that form a constant microflora. The richness of food resources, constant humidity, optimal pH and temperature create favorable conditions for adhesion, colonization and reproduction of various microbial species. The microflora of the oral cavity takes part in the primary processes of digesting food, assimilation of nutrients and the synthesis of vitamins. It is also necessary to maintain the proper functioning of the immune system, to protect the body from fungal, viral and bacterial infections.

(a) About 50% of all bacteria in the mouth are streptococci of the *Streptococcaceae family. Streptococcus mutans* bacteria form a film on the surface of teeth and can corrode tooth enamel and dentin, which leads to caries and gum infections,
(b) Bacteria *Solobacterium moorei* and *Lactobacillus casei* are responsible for bad breath
(c) The bacteria *Porphyromonas gingivalis* is the cause of periodontal disease, and is also “responsible” for the body’s resistance to antibiotics.

This list can be supplemented by many other microbiological cultures and their associations. It should also be noted that all these microorganisms are not mutual antagonists, but form a syntrophic community, which, according to our previous studies [3–6], is one of the prerequisites for effective nuclear transmutation.

Figure 1. From Left to right. Photo of an implants made of pure titanium (*left*) and titanium with Zr protective coating (*right*) before the experiment; the appearance of tubes with implants, nutrient medium and biomass at the beginning and at the end of the experiment (in 12 days).

3. Experiments and Results

We have conducted experiments to study the effect of standard titanium implants on the state of calcium in the laboratory liquid medium, representing a solution of natural saliva, which fully corresponds to the human oral cavity. For the experiment, we have used the anaerobic syntrophic association (anSA) of bacteria inhabiting the human oral cavity and digestive tract. The composition of the association includes more than 500 strains. As a nutrient medium, human saliva with the addition of an iron salt ($FeSO_4 \cdot 7H_2O$) was used, which simulates the possible presence of trace amounts of blood from the gums on the dental implant, as well as the consumption of iron-containing products.

The volume of the nutrient medium was 8 ml, the weight of the moist concentrated biomass of anSA was about 0.5 g. As a substrate for anSA, glucose was added to the bioreactors (0.1 g / l per day). At the end of the experiment implants were removed from the bioreactor tubes, washed and dried in a desiccator.

The photos of both types of implants (made of pure Ti and Ti with Zr protective coating) are shown in Fig. 1. The appearance of the implants after the experiment remained unchanged.

Figure 1 also shows photos of test tubes with the studied objects before the start of the experiment and after its completion (in 12 days).

The study of the nutrient medium, microcultures and the surface of the implants after the end of the experiment has shown that the total calcium content in these components in the presence of Ti implant decreased. At the same time, the results of X-ray fluorescence analysis have shown the presence of molybdenum on the surface of titanium implants after the experiments (see Fig. 2). Before the experiment, molybdenum was absent in the volume and on the surface of the implants and in the composition of the nutrient medium.

In an alternative experiment it was found that during the cultivation of anSA in the presence of a Ti implant with a Zr coating, the situation was fundamentally different – the calcium concentration did not change and molybdenum was not detected on the implant surface!

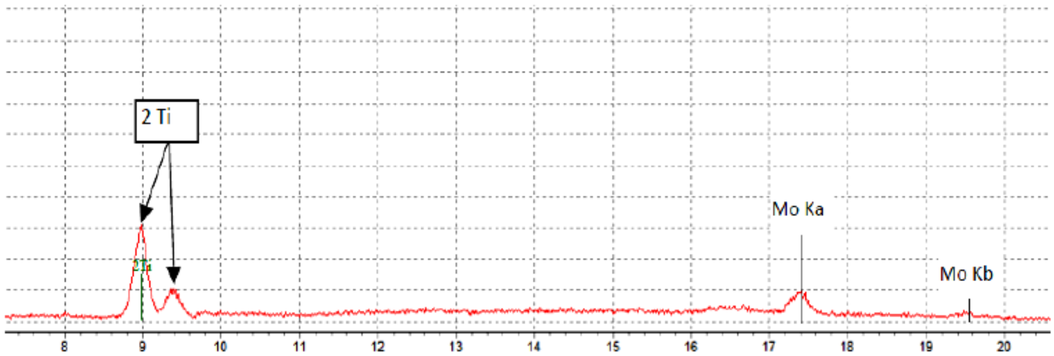

Figure 2. X-ray fluorescence analysis of Ti implant after a 12-day experiment.

4. Analysis and Conclusions

It is well known that calcium is the main chemical element (~36%) in the structure of the tooth. It is the important part of the tooth in the form of a crystal of hydroxy apatite $Ca_{10}(PO_4)_6(OH)_2$. The process of creating a foreign element molybdenum (foreign to original system), is connected with possible transmutation reactions:

$$\mathrm{Ti}^x + \mathrm{Ca}^y = \mathrm{Mo}^A + Q, \quad A = x + y \tag{1}$$

stimulated by active microbiological associations, which are present in laboratory test tubes and are similar in composition to those microorganisms that are present in saliva and are located on the surface of teeth. Two basic requirements are necessary to produce these reactions at low energy:

- these reactions must be exoenergetic with positive energy $Q > 0$ of reactions,
- the reaction should lead to the formation of stable (non-radioactive) Mo isotopes [7].

The first condition is obvious for any exoenergetic reaction.

The second condition relates to LENR specifics. It has been proved on the basis of the laws of quantum mechanics and nuclear physics [7] that such a feature (the absence of radioactive daughter isotopes) is an obligatory feature of LENR, and it is due to the fact that these reactions are based on the use of fluctuations of energy

$$\delta E_{G\gg 1} \geq \hbar^2 G^2 / 8ma^2 \tag{2}$$

repeatedly amplified (by G^2 times) compared with fluctuations determined by expression

$$\delta E_{G=1} \geq (\delta p)^2 / 2m \approx \hbar^2 / 8ma^2 \tag{3}$$

immediately following from the "standard" Heisenberg uncertainty relations

$$\delta E\, \delta t \geq \hbar/2, \quad \delta p\, \delta q \geq \hbar/2 \tag{4}$$

for, respectively, energy, time, momentum and coordinate.

Here

$$G \equiv 1/\sqrt{1 - r^2} \geq 10^3 - 10^4$$

is the coefficient of correlation efficiency [8–18], which corresponds to the Schrödinger–Robertson uncertainty relation

$$\delta p\, \delta q \geq \hbar/2\sqrt{1-r^2} \tag{5}$$

with a correlation coefficient $|r| \leq 1$.

Generation of these giant fluctuations $\delta E_{G\gg 1}$ takes place during the formation of coherent correlated states of interacting particles in a natural non-stationary potential nanowells with a size about $a \approx 0.2-1$ nm, which continuously appear and disappear in areas of microculture growth (during cell division, at DNA replication, etc.).

An important feature of these states is a very significant (by many orders of magnitude) increase of the duration δt of these fluctuations to values sufficient to stimulate nuclear reactions [7].

On the other hand, even such increased duration of the existence of these fluctuations is a small value at the level of several picoseconds or femtoseconds, limiting the duration of the corresponding fusion reactions. It is easy to see that reactions with a longer duration (including reactions that form radioactive daughter isotopes) cannot be generated due to these very short fluctuations [7].

In fact, this rule forbids the generation of nuclear reactions that are stimulated by virtual energy in any reaction channels that are characterized by a large duration of the first stage of nuclear transformations after the formation of the initial compound nucleus.

This conclusion explains the absence of radioactive daughter isotopes in any experiments that are stimulated by the virtual energy (including LENR experiments in biological systems).

A direct calculation has shown that among all possible nuclear reactions of molybdenum fusion (1) with participation of all stable isotopes of titanium, calcium and molybdenum
(Ti^{46}, Ti^{47}, Ti^{48}, Ti^{49}, Ti^{50}, Na^{40}, Ca^{42}, Ca^{43}, Ca^{44}, Ca^{46}, Ca^{48}, Mo^{92}, Mo^{94}, Mo^{95}, Mo^{96}, Mo^{97}, Mo^{98}, Mo^{100}), only one fusion reaction

$$\mathrm{Ti}^{46} + \mathrm{Ca}^{48} = \mathrm{Mo}^{94} + Q, \qquad Q = 64\,\mathrm{keV}, \tag{6}$$

involving three "key" isotopes (Ti^{46} (natural abundance is 8.25%), Ca^{48} (0.187%), Mo^{94} (9.15%)) satisfies the both necessary requirements!

Other potentially possible reactions (1) result in the formation of daughter radioactive Mo^{A*} isotopes or are endoenergic reactions with negative energies of reactions (Q<0) and for their realization, a sufficiently large additional energies $\Delta E \geq |Q|$ (in the interval 0.2–7 MeV) are necessary. The sources of such real (not virtual) and very great energy ΔE are absent in any realistic biological system and such reactions are fundamentally impossible!

There are many biophysical reasons for the synthesis of molybdenum in growing biological systems. Molybdenum significantly increases the effectiveness of antioxidants, including vitamin C. It is also an important component of the tissue respiration system. Molybdenum enhances the synthesis of amino acids, improves the accumulation of nitrogen. Molybdenum also is a part of a number of enzymes (aldehyde oxidase, sulfite oxidase, xanthine oxidase, etc.) that perform important physiological functions, in particular, the regulation of uric acid metabolism. Molybdenum and its chemical compounds play an important role in certain biochemical processes (including effective biochemical replacement). It should be noted that although the natural abundance of the "key" calcium isotope Ca^{48} (0.187%) is small, the consequences of reaction (6) with its participation can be very significant. There are several important factors for the possible effect of this reaction on the condition of teeth and implants, including three most likely:

- violation of the monolithic structure of a small tooth due to a local replacement of calcium with molybdenum,
- possible influence of the positive reaction energy $Q > 0$ on the structure of the bone tissue of the tooth,
- development of microbiological infections in nano-regions adjacent to the site of the destructive local nuclear reaction.

These processes can be connected, e.g., with the phonon mechanism of LENR energy transfer proposed by Hagelstein [19,20]. The THz frequency of such high-frequency phonons is close to the Debye frequency (about 10^{13} Hz). These phonons are characterized by a short mean free path and transfer their energy to the nearest atoms. In this case, there is a small-sized zone around each nucleus of the synthesized molybdenum, inside which the atoms receive energy of about 10–20 eV, which leads to the destruction of the crystal structure of the tooth. Based on these (not yet completed) studies, many useful recommendations can be made.

One of the main ones is to use titanium as the basis for the implant, from which the "key" and most "potentially dangerous" Ti^{46}, isotope must be removed. In this case, we can completely eliminate the nuclear reaction between titanium and calcium and prevent possible catastrophic tooth destruction after implantation!

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