

*ELENE SAKVARELIDZE¹, MARINE NIKOLAISHVILI², MAMUKA MARGVELASHVILI³,
ZURAB SAKVARELIDZE¹, SESILI BERIASHVILI⁴*

**EFFECTS OF SMALL DOSES OF RADON DURING THE USE OF REMOVABLE ORTHOPEDIC
STRUCTURES IN DENTAL PRACTICE**

¹Dental clinic Ellen, ²I.Beritashvili Experimental Biomedicine Center, ²Grigol Robakidze University,

³Ivane Javakhishvili Tbilisi State University, ⁴European University

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*ელენე საყვარელიძე¹, მარინე ნიკოლაიშვილი², მამუკა მარგველაშვილი³,
ზურაბ საყვარელიძე¹, სესილი ბერიაშვილი⁴*

**რადონის მცირე დოზების გავლენა მოსახსნელი ორთოპედიული კონსტრუქციების
გამოყენების დროს სტომატოლოგიურ პრაქტიკაში**

¹სტომატოლოგიური კლინიკა ელენე; ²ი.ბერიტაშვილის სახ. ბიომედიცინის ცენტრი; ²გრიგოლ რობაქიძის უნივერსიტეტი; ³ივანე ჯავახიშვილის სახ. თბილისის სახელმწიფო უნივერსიტეტი, ⁴ევროპული უნივერსიტეტი

რეზიუმე

მიღებული შედეგებიდან შეიძლება გავაკეთოთ დასკვნა, რომ რადონის მცირე დოზები, ანუ რადონის ჰორმების დადებით გავლენას ახდენს, რაც ნათლად გამოჩნდა წყალტუბოში მცხოვრებ პაციენტებზე, რომლებიც იყენებდნენ წყალტუბოს წყალს სავლებად, სადაც უკვე 1 კვირის შემდეგ ჩანდა შეგუებულობა მოსახსნელ პროთეზებთან მიმართებაში, რასაც ვერ ვიტყვით თბილისში მცხოვრებ პაციენტებზე, სადაც შეგუებულობა დაიწყო 4 კვირის შემდეგ, მაგ. 28.9%-ს არ მოერგო პროთეზი 2 თვის შემდეგაც და მდგომარეობა კიდევ უფრო გართულდა შემდეგ პერიოდში, განსაკუთრებით ზედა ყბის და სახის მიდამოებში.

ჩვენს მიერ მიღებული მონაცემებით შეიძლება დავასკვნათ, რომ წყალტუბოს რადონმცველ წყალს აქვს ჰორმებისული ეფექტი და უკვე ორი კვირისა და შემდგომ პერიოდშიც შესამჩნევი ხდება მისი დადებითი მოქმედება მოსახსნელი პროთეზის ზეწოლის ადგილებში, რაც პაციენტებში შეგუების მაღალი ხარისხით დაფიქსირდა.

INTRODUCTION. The use of orthopedic constructions in dental practice is widespread, this is due to the fact that there is a large demand of patients for orthopedic constructions, and therefore they set more demands on the quality of treatment and results, however, the percentage of complications that arise at the stage of orthopedic treatment is quite high.

Orthopedic therapy involves not only examination, preparation and implementation of clinical procedures related to prosthetics, but also observation of the patient after using the prosthesis.

The principle of completion of treatment requires that the doctor does not release the patient under observation until he is sure that the observation period has been successfully completed, until it is ensured that the observation period has been successfully completed, since the patient uses a prosthesis, which can cause speech disorders and damage to the mucous membrane, when all causes are studied, then the resulting damage is also eliminated [1,4,7]

In many cases, as a result of the pressure of the prosthesis, there is the development of such pathology as decubitus ulcer and prosthetic stomatitis.

Decubitus ulcers, which almost all patients have on the second day after using the prosthesis, and are manifested by damage to the mucous membrane in the form of catarrhal inflammation or ulcers. Ulcers are painful, often accompanied by abundant salivation, the bottom of the ulcer is covered with gray and sometimes yellowish fibrillar plaques, the edges are hyperemic and swollen, there is bleeding from the bottom of the ulcer, which makes it difficult for the patient to eat and speak, and in many cases the patient refuses to use a prosthesis. This is a rather big problem, which is the most common reason for refusing a prosthesis. Also, in many patients, the formation of decubitus ulcers is observed after long-term use of the prosthesis, which is due to the deformation of the prosthesis or bone atrophy.

Based on the mentioned problem, the goal of our research is to search for ways to prevent prosthetic stomatitis developed as a result of orthopedic treatment, timely treatment with modern

methods adopted in dental practice, as well as with a new balneotherapy method, in particular with the use of radonotherapy, which means the use of radon-containing mineral waters of Tskaltubo as rinses and inhalation in the dental clinic "Khatuna Bzikadze".

Development of a side effect monitoring system project, implementation of the mentioned method in dental practice and justification of the need to introduce radonotherapy in balneotherapy companies.

METHODS. The use of removable prostheses in old age is often the reason for the development of the inflammatory process on the mucous membrane, based on the problem, a study of the adaptation process of removable lamellar prostheses was carried out. At the same time, one of the main tasks was to study the dynamics of the spread and development of the inflammatory process developed as a result of the pressure of the prosthesis and, accordingly, to determine the time of adaptation of the removable lamellar prosthesis [3,5,9]. Therefore, a study was conducted to assess the incidence of prosthesis-related injuries and to identify the main risk factors associated with this process.

We examined 271 patients aged 50-74, of which 138 were first-time users of prosthetics, removable prostheses (73 with full prostheses, 65 with partial removable prostheses) and 23 patients with long-term use of prostheses. In most cases, plastic is used in the production of prostheses. Polymerization method - injection molding. 133 patients lived in Tbilisi, and 138 patients lived in Tskaltubo. 238 of the investigated patients developed inflammatory changes after the prosthesis, which resolved dynamically as a result of observation and after adjustment of the prosthesis. A two-month examination showed that only 29% of 92 patients developed denture stomatitis, which did not heal even after denture adjustment. Of these, 49 patients who lived in Tskaltubo and had prosthetic stomatitis were treated at the "Khatuna Bzikadze" dental clinic in Tskaltubo. The mentioned patients used Tskaltubo water for rinse and inhalation [2,6]. We also examined 132 patients living in Tbilisi, of which 43 patients developed prosthetic stomatitis, who were treated with modern methods in dental practice in "Dental Clinic 2000" in Tbilisi. We compared the obtained results with the patients of the Tskaltubo dental clinic, who used Tskaltubo water for treatment, in the form of swabs and inhalation 2 times a day. As a result of these studies, Table 2 shows the results of both therapeutic treatment and radon water treatment. To evaluate the condition of the periodontal tissues, we used the papillary-marginal-alveolar index (PMA) - proposed by Maser (1948) and modified by Parma (1960).

The index is proposed to evaluate the inflammatory process of the gums. During the clinical assessment of the condition of the periodontal tissues, first of all, attention is paid to the condition of the mucous membrane of the gums:

1. presence of inflammation;
2. Intensity of inflammation;
3. Spread of inflammation.

Gums in all teeth are stained with Schiller-Pisarev solution (intravital glycogen staining) and its condition is determined by a 4-point system:

- 0 points - no inflammation;
- 1 point - inflammation of the gum papilla (P);
- 2 points - marginal gingival inflammation (M);
- 3 points - inflammation of alveolar gums (A).

The PMA index is calculated by the formula.

The Schiller-Pisarev test is based on the fact that in the presence of inflammation, the gums are stained with an iodine solution from light brown to dark brown. Most often, iodine-potassium solution is used for staining (1 g of crystalline iodine and 2 g of potassium iodide are dissolved in 1 ml of 96% ethanol and 40 ml of distilled water is added) or Lugol's solution. The intensity of the staining of the gums depends on the severity of the inflammatory process, which is accompanied by the accumulation of glycogen in the cells of the mucous membrane of the gums. It is known that the content of glycogen increases sharply during inflammation, due to the presence of keratinization of the epithelium. In healthy gingival epithelium, glycogen is absent or only traces are observed. Depending on the intensity of the inflammation, the color of the gum changes from light brown to dark color during the application of Schiller Pisarev solution. Gum color does not change during healthy periodontal disease.

Informed consent was obtained from all voluntary participants. Standardized questionnaires were used for demographic data (age, sex, education level), medical history (pre-existing diseases and medications) and information about the prosthesis: hygiene of the prosthesis (immersion in a clean solution), the same period of use of the prosthesis.

RESULTS. According to the literature, the most likely adaptation time for removable prostheses is 2 months for complete adaptation. If, after 2 months, the patient still experiences or shows changes in the mucous membrane, the removable prosthesis remaining in the oral cavity is considered as a pathological process, which represents a serious problem that must be solved. It is also necessary to determine the main reason for delayed adaptation [8].

The inflammatory process developed as a result of the pressure of the prosthesis was evaluated by the patient's subjective feelings and as a result of the examination of the inflamed mucous membrane [10].

Table 1. The results of determining the time of adaptation to removable prostheses are presented

	Usable prostheses 143				
	partially (n=67)	partially (n=67)	completely 76	Completely 76	Everyone who gets used to the prosthesis
adaptation period	n=31	n=36	n=33	n=43	
during 1 week	2 (6,5%)	4 (12.1%)	0	0	6 (4.2%)
during 2 week	11 (35,5%)	12 (33.3%)	5 (15.1%)	6 (13,95%)	33 (23%)
during 3 week	6 (19.4%)	5 (14%)	15 (45,4)	19 (44.2%)	45 (31,4%)
during 4 week	4 (12.9%)	6 (18.1)	4 (12.1%)	5 (11.6%)	19 (13.3%)
during 2 months	4 (12.9%)	6 (18.1)	5 (15.1%)	9 (21%)	24 (16.8%)
all	27 (87%)	33 (91.6%)	29 (87.8%)	35 (81,3%)	127 (89%)

Note: * -calculations are in % of the total number of examined persons (out of 143 patients)

The results of the studies showed that during the first week only a small number of patients (4.2%) adapt to the removable prosthesis, and this number includes only patients with a partial removable prosthesis. In the 2nd week already 23% have adjusted to the prostheses, most of the patients are also with partially removable prostheses. At the end of the 3rd week, another 31.4% got used to it. In the 4th week, the number of people adjusted increased by 13.3%, and at the end of the 2nd month, another 16.8% got used to the prosthesis.

28.9% of the patients could not get used to the prosthesis within 2 months. In most cases, they had an inflammatory process in the pressure areas of the prosthesis, which did not disappear even after the correction of the prosthesis. The dynamics of the development of inflammation of the mucous membrane of the oral cavity and during the period of the removable prosthesis are also given in the table2.

This table includes the results of the objective research of the mucous membrane, including the indicators of the Schiller-Pisarev test. More than 68% of prosthesis wearers had an inflammatory process in the pressure areas of the prosthesis. After the correction of the prosthesis (on average, in 2-4 visits), the majority of patients (80.2% of the recorded inflammation patients) had their symptoms of inflammation and irritation disappear. In 19 patients (19.8% of all examined persons), the inflammatory process did not disappear even after the prosthesis was corrected, and therefore it was established that the inflammation was not caused only by the traumatic action of the prosthetic elements. The majority of patients had similar complaints: burning, pain in the mucous membrane of unknown localization, paresthesia, often accompanied by dry mouth, sometimes - glossalgia phenomena. All patients had a positive Schiller-Pisarev test [14,17].

By analyzing the obtained results, it was determined that the period of adaptation to removable prostheses is significantly longer and the main conclusion of this fragment of the paper is that true prosthetic stomatitis is the one in which the inflammatory process in the pressure area of the prosthesis does not disappear after the correction of the prosthesis, develops mainly after 1 or more months. It has severe clinical symptoms and regresses only after removing the prosthesis from the oral cavity.

However, the following established facts should be noted: Patients with partial lamellar prosthesis in most cases get used to the prosthesis in the 2nd week, complete adaptation occurs only in the 3rd-4th

week. 20% of patients did not fit the prosthesis within 2 months, and as the analysis showed, most of them (19.8%) developed prosthetic stomatitis. In many cases, inflammatory events were observed in patients wearing fully removable prostheses. The inflammatory process on the upper jaw was mainly observed in the area of the tip of the alveolar bone, and in the case of partial dentures, mainly in the area of the hard palate.

As mentioned, patients develop prosthetic stomatitis, despite significant advances in the materials used, removable prostheses often become the cause of such complications in patients [4]. The development of prosthetic stomatitis symptoms depends on different reasons. These causes mainly depend on local factors, which are directly caused by the pressure of the removable prosthesis or the material from which the given prosthesis is made. It is a mechanical, thermal, mucosal reaction to a removable prosthesis and it is completely dependent on the individual pressure characteristics of the prosthesis [2].

As we have already mentioned, the treatment was carried out by modern methods adopted in dental practice and also by a new balneotherapy method, in particular by using radonotherapy, which involves the use of radon-containing mineral waters of the Tskaltubo as rinses and inhalation in the dental clinic "Khatuna Bzikadze".

It should be noted that Tskaltubo water contains a very small amount of radon (1 nc or 37 Becquerel). It is mineralized. What is meant by these words: it means that micro and macro elements are found in it, and at the same time it is hard water, because these elements are in it in a certain amount and increase its debit. Salts containing chlorine carbonates are also found in them, and magnesium, calcium and sodium carbonates are found in the same form. Also, iodine, bromine, magnesium, lithium, zinc, copper. Although the content of these elements in water is very small, their activity increases significantly when inhaled. Because of containing radon, Tskaltubo water is used both for the treatment of the peripheral nervous system of the oral cavity, as well as in the case of chronic and inflammatory processes, it is also used for the treatment of such processes as pain in the joints, pain during fractures, etc. Therefore, one of the important features of Tskaltubo water is not only the destruction of microflora, but also its pain-relieving value is very important. Water has a hormetic effect, which reduces the above-mentioned swelling of the gum tissue, as well as cyanosis of the gum and its hyperemia.

Table 2. The results of determining the time of adaptation to removable prostheses and the results of the treatment of Tskaltubo are presented

	Usable prostheses 143				
	partial (n=67)	partial (n=67)	completely 76	Completely 76	Everyone who gets used to the prosthesis
Adaptation Period	n=31	n=36	n=33	n=43	
during 1 week Treatment of Tskaltubo Water	1 (3,2%)	2 (5,5%)	0	0	3 (4.6%)
therapeutic treatment	2 (6,5%)	3 (8,3%)			5 (7,5%)
During 2 weeks After Tskaltubo Waters	1 (3,2%)	2 (5,5%)	2 (6,0%)	2 (4,6%)	7 (4,9%)
therapeutic treatment	2 (6,4%)	4 (11,1%)	4 (12,1%)	5 (11,6%)	15 (10,5%)
During 3 weeks After Tskaltubo Waters	2 (6,5%)	0	0	0	2 (1,4%)
therapeutic treatment	2 (6,5%)	3 (8,3%)	3 (9%)	3 (6,9%)	11 (7,6%)
During 4 weeks after Tskaltubo Waters	0	0	0	0	0
therapeutic treatment	2 (6,5%)	2 (5,5%)	2 (6%)	2 (4,6%)	8 (5,6%)
During 2 months After Tskaltubo Waters	1 (3,2%)	2 (5,5%)	1 (3,03%)	1 (2,3%)	5 (3,5%)
therapeutic treatment	2 (6,45%)	3 (8,3%)	3 (9%)	8 (5,6%)	16 (11,1%)

Note: * - calculations are made in % of the total number of examined persons (out of 143 patients)

Observation showed that prosthetic stomatitis developed only in 29% of patients, 92 of which did not resolve even as a result of prosthesis adjustment.

Patients living in Tskaltubo who had prosthetic stomatitis were treated at the "Khatuna Bzikadze" dental clinic in Tskaltubo. The mentioned patients used Tskaltubo water for inhalation and rinsing. We also examined 132 patients living in Tbilisi, of which 43 patients developed prosthetic stomatitis, who were treated with modern methods used in dental practice in dental clinic: "Dental Clinic 2000" in Tbilisi. We compared the obtained results with the patients of the Tskaltubo dental clinic, who used Tskaltubo water for treatment, in the form of rinse and inhalation 2 times a day. As a result of these studies, Table 2 shows the results of both therapeutic treatment and radon water treatment.

Analyzing the obtained results, it was determined that the process developed as a result of the pressure of the prosthesis continues even more during the period of adaptation of the removable prosthesis [16]. The main conclusion from the study is that true denture stomatitis is inflammation at the denture pressure areas and does not disappear after the denture is corrected, resulting in severe clinical symptoms that may develop 2 or more months after the denture pressure areas, which is treated only after the denture is removed [13-14]. But as a result of studies, it was found that using Tskaltubo water as swab quickly extinguished the inflammatory process and removed the pain in the pressure areas of the prosthesis and disappeared the red color on the gum, and patients began to get used to the prosthesis in 2 weeks and subsequent weeks after using the compresses and lasted until the end of 2 months [11,15].

CONCLUSIONS: From the obtained results, we can conclude that small doses of radon or radon hormesis have a positive effect even in the following weeks, which was clearly seen on patients living in Tskaltubo who use Tskaltubo water for swab, where adaptation to removable prostheses was seen already after 1 week and completely in 2 weeks and following weeks, which we could not say about the patients living in Tbilisi where adaptation started after 4 weeks, e.g. 28.9% did not fit the prosthesis even after 2 months and it became even more difficult in the following period and it was mostly found in the upper jaw and palate areas.

Thus, it can be concluded that Tskaltubo's radon-containing water has a hormetic effect, and its positive effect is noticeable in the pressure areas of the removable prosthesis after two weeks, which was observed in patients with a high degree of adaptation.

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*ЭЛЕНЕ САКВАРЕЛИДЗЕ¹, МАРИНЕ НИКОЛАИШВИЛИ², МАМУКА МАРГВЕЛАШВИЛИ³,
ЗУРАБ САКВАРЕЛИДЗЕ¹, СЕСИЛИ БЕРИАШВИЛИ⁴*

**ВЛИЯНИЕ МАЛЫХ ДОЗ РАДОНА ПРИ ИСПОЛЬЗОВАНИИ СЪЕМНЫХ ОРТОПЕДИЧЕСКИХ
КОНСТРУКЦИЙ В СТОМАТОЛОГИЧЕСКОЙ ПРАКТИКЕ**

¹Стоматологическая клиника Эллен, ²Центр экспериментальной биомедицины И.Бериташвили,
³Университет Григола Робакидзе, ⁴Университет Джавахишвили, ⁴Европейский университет

РЕЗЮМЕ

Из полученных результатов можно сделать вывод, что малые дозы радона или радонового гормезиса оказывают положительный эффект даже в последующие недели, что было хорошо видно на больных, проживающих в г. Цхалтубо, использующих цхалтубскую воду для тампонирования, где адаптация к съемным протезам уже наблюдалась. через 1 неделю и полностью через 2 недели и последующие недели, чего нельзя было сказать о больных, проживающих в Тбилиси, у которых адаптация началась через 4 недели, т.е. 28,9% не подошли к протезу даже через 2 месяца, а в последующий период стало еще труднее и в основном встречались в области верхней челюсти и неба. Таким образом, можно сделать вывод, что цхалтубская радоносодержащая вода обладает горметическим действием, а ее положительный эффект заметен в зонах давления съемного протеза через две недели, что наблюдалось у больных с высокой степенью адаптации.

*ELENE SAKVARELIDZE¹, MARINE NIKOLAISHVILI², MAMUKA MARGVELASHVILI³,
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SUMMARY

From the obtained results, we can conclude that small doses of radon or radon hormesis have a positive effect even in the following weeks, which was clearly seen on patients living in Tskaltubo who use Tskaltubo water for swab, where adaptation to removable prostheses was seen already after 1 week and completely in 2 weeks and following weeks, which we could not say about the patients living in Tbilisi where adaptation started after 4 weeks, e.g. 28.9% did not fit the prosthesis even after 2 months and it became even more difficult in the following period and it was mostly found in the upper jaw and palate areas.

Thus, it can be concluded that Tskaltubo's radon-containing water has a hormetic effect, and its positive effect is noticeable in the pressure areas of the removable prosthesis after two weeks, which was observed in patients with a high degree of adaptation.

Keywords: Radon, orthopedic, dental practice