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CORRELATION OF THE STATE OF THE ORAL CAVITY MUCOUS MEMBRANE AND THE DYNAMICS OF THE ANALGESIA-NOCICEPTION INDEX IN PATIENTS UNDER THE CONDITIONS OF THE DENTITIONS CORRECTION

Abstract. *The article represents the results of the study of the correlation of the state of the oral cavity mucous membrane (SOCMM) and the dynamics of the analgesic-nociception index (ANI) with the use of ANI-Monitor in patients in the dentition correction conditions. It was determined that the SOCMM state correlates with the data of the analgesia/nociception index. Indicator can be used as a predictor of dental pain, which allows to assess the probability of pain sensations formation in the preclinical stages of the development of trophic changes in the conditions of dentition correction.*
Keywords: *index of analgesia/nociception, heart rate variability, correction of dentitions, oral mucous membrane, physiological adaptation to dentures.*

Introduction. Physiological adaptation of patients to partial or complete loss of dentition and their correction remains topical for the physiology of the maxillofacial area. The prosthesis is an irritant that causes excitation in the cerebral cortex. The duration of habituation is influenced by the dental status and the degree of nociception. There are the following phases of adaptation to dentures: 1st – irritation, 2nd – partial brake action, 3rd – complete brake action [3]. Qualitative analgesia can significantly affect the course of these phases. It should be noted that dentures have an effect on the tissues of the prosthetic bed (are in direct contact with the prosthesis). For removable dentures, the tissues of exposure are the mucous membrane of the alveolar process, hard palate.

Material and methods of the study. To achieve the aim, there were examined 85 patients aged 25-80 years without concomitant pathology, who were divided into the following groups: 1st (n=11) – with intact dentitions (control group); 2nd – with the partial loss of teeth: 2nd-a (n=9) – without correction of dentitions, 2nd-b (n=12) – with the correction of dental bridges, 2nd-c (n=10) – with the correction of partial removable laminar prostheses (primary prosthetics), 2nd-d (n=11) – with the correction of partial removable laminar dentures (re- prosthetics), 3rd (n=12) – with the complete loss of dentitions: 3rd-a (n=5) – without correction of dentitions, 3rd-b (n=13) – with the correction using complete removable laminar dentures (primary prosthetics), 3rd-c (n=14) – with the correction using complete removable laminar dentures (re- prosthetics). Defect of dentition was classified according to Kennedy [2]. The condition of the mucous membrane of the oral cavity in patients of the 3rd experimental group was characterized according to Suple classification for the toothless jaws [4]. Examination of the patients was performed in a stationary dentist's office in the first half of the day using a standard set of dental instruments. To characterize the dental status, the index of caries intensity in constant bite was used. The evaluation of the condition of periodontal tissues was performed on the basis of clinical data, Schiller-Pisarev's test, periodontal indices: papillary-marginal-alveolar (PMA) and CPI index. To evaluate the gum inflammation, a simplified OHI-S oral cavity hygiene index and Sillness-Loe gingival index (GI) were determined [1]. Patients with dental correction were tested on the day of dentures' fixation, as well as during the 7th, 14th and 30th day after the dentures' correction. The assessment of the balance of nociception/anti-nociception was performed using ANI-Monitor apparatus (MetroDolores, France) with the calculation of the original index of analgesia/nociception ANI (Analgesia Nociception Index) [5]. Digital data is statistically processed using Microsoft Exel and Statistica 5.5 computer software.

Results of the research and their discussion. In the structure of the morbidity of periodontal tissues in the younger age gingivitis predominated, in some cases the generalized periodontitis of varying degrees of severity. With age, periodontosis was often found. In patients who use dentures, signs of injury of the mucous membrane of the prosthetic bed were observed. Such examined persons complained of chewing and tactile discomfort, frequent damage of the mucous membrane of the oral cavity (SOCMM). In some cases, allergic reactions that were manifested by hyperemia, edema, hemorrhage, paresthesia of SOCMM and tongue have been determined.

As a result of the study according to the Kennedy dentitions defects classification, the 3rd class dominated in patients of the 2nd-a group, the 3rd and 4th classes dominated in the 2nd-b group, 1st and 2nd classes dominated in the 2nd-c and 2nd-d groups. In general, the differences of defects in dentitions, mainly, depended on age. The effect of the prosthesis on the SOCMM (3rd experimental group) depended on the age, gender, state of the masticatory apparatus, the patient's occupational activity and physical status. The 1st class of the SOCMM according to Suple prevailed in persons under 50 years of age, in the persons from the age of 50 to 70 years – it was the 2nd one, at the age of 70 and older – the 3rd and 4th classes alternated. In patients with the 1st class of SOCMM, a well-characterized alveolar process and alveolar part were observed, that were coated with a slightly moving mucous membrane. Hard palate was covered with a uniform layer of mucous membrane that is moderately mobile in its posterior tertiary part. Anatomical folds of the mucous membrane on both jaws are located at a distance from the apex of the alveolar process. In such patients, favorable conditions for orthopedic treatment of complete absence of teeth are created in the oral cavity. In patients with 2nd class, the mucous membrane was atrophied and with a thin tensed layer covered the alveolar process or part, the hard palate. The places of folds' fastening were placed somewhat closer to the top of the alveolar process. Patients with a 3rd class the alveolar process or its part and the back third of the hard palate were covered with a loose mucous membrane. This condition of SOCMM was often detected in the case of atrophy of the alveolar process. In the examined patients of the 4th class, the alveolar process and the alveolar part

were covered with moving mucous membranes teniae that were placed along and easily displaced during insignificant loads. The teniae were found more often on the lower jaw in the complete atrophy of the alveolar part. It should be noted that the teniae could be clamped and then the use of prosthetics becomes impossible. It is therefore of interest to early detect the changes of SOCMM in order to prevent its structural disorders.

It is known that the autonomic nervous system (ANS) is sensitive to homeostasis disorders. Attention is drawn to the study of the ANS reaction to the nociceptive signaling. The sympathetic-vagal balance adequately reflects the registering the heart rate variability (HRV). In recent years, an express method has been offered based on the analysis of purely parasympathetic tone using the ANI-Monitor apparatus [5]. On the basis of the indicated data, using the mathematical calculations, the ANI index, displayed on the device screen, is calculated. The analysis process takes a few seconds and gives an objective assessment of pain sensations in real time. The advantage of this technique is in the simplified method for registering and analyzing the respiratory patterns of HRV, which prompted us to try to apply it in dentistry.

The analysis of ANI data in the examined persons reflects mainly the state of comfort in patients of the control group. Its values significantly increase (at 23-56%, $p<0.05$) in the case of trophic disorders. The data of index are important in terms of dentition correction in dynamics. Thus, at the time of dentures' fixation, the index acquired maximum values. The day after the fixation of the prosthesis, the ANI values decreased in patients of the 2nd-b subgroup at 5-8% ($p<0.05$), 2nd-c subgroup – at 11-18% ($p<0.05$), 2nd-d – at 9-13% ($p<0.05$), 3rd-b – at 18-22% ($p<0.05$) and 3rd-c – at 9-11% ($p<0.05$) relative to the original values. During the 7th day after the dentures' fixation in the examined patients of the 2nd-b subgroup, the ANI data were not significantly different from the control. In patients of the 2nd-b and 2nd-c the index decreased at 7 and 5%, respectively ($p<0.05$), 3rd-b and 3rd-c – at 10 and 5% ($p<0.05$), respectively, regarding the data during the 2nd day. This index achieved the baseline level in these groups only during the 30th day after the prosthetics, which may reflect the complete adaptation of patients (in particular, SOCMM) to dentures. The rather high values of the ANI were an indication for a better correction

of the prosthesis and its fitting to the prosthetic bed.

Conclusion. The state of the SOCMM correlates with the data of the analgesia/nociception index. Index could be used as a predictor of dental pain, which allows us to assess the likelihood of pain sensation formation in the dentitions correction. The data of the autonomous regulation balance allow us to more broadly assess the condition of the mucous membrane, including pre-clinical stages of the development of the atrophic processes in the tissues of the prosthetic bed. Using an ANI-monitor in dentistry will prevent possible negative reactions of SOCMM on the removable dentures, and may also be effective in the planning of the stages of orthopedic rehabilitation.

Prospects for further research. To evaluate and compare the data of the analgesia/nociception index with patients' self-assessment of pain, to determine the specificity and sensitivity of the index in patients with different types of higher nervous activity and the efficacy of its use in certain dental pathologies.

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