Ключові слова: хронічна серцева недостатність, медикаментозна терапія, інгібітори натрійзалежного котранспортера глюкози 2-го типу, веріцигуат, омекамтив мекарбил.

NEW ERA IN THE TREATMENT OF CHRONIC HEART FAILURE

Zaikina T. S., Rynchak P. I., Tytova G. Yu., Zaliubovska O. I., Lantukhova N. D.

Abstract. Heart failure is one of the most urgent problems of medicine, because the number of patients suffering from this pathology continues to grow steadily. The arsenal of drugs for the treatment of chronic heart failure has been replenished with new samples that have demonstrated significant effectiveness in improving the course and prognosis of patients in this cohort. However, the search for other promising drugs continues.

The aim of our work is to summarize existing scientific data on the effect of sodium-glucose cotransporter-2 inhibitors, vericiguat, omecamtiv mecarbil on the clinical course and prognosis in patients with chronic heart failure, as well as the analysis of current clinical studies aimed at evaluating hemodynamic effects, tolerability and safety of experimental drugs in patients with chronic heart failure.

The positive effects of sodium-glucose cotransporter-2 inhibitors have led to their inclusion in European guidelines for treating patients with chronic heart failure, regardless of left ventricular ejection fraction.

Vericiguat is recommended for patients with NYHA class II-IV chronic heart failure and reduced left ventricular ejection fraction who have decompensated heart failure within the past 3 months despite receiving optimal chronic heart failure therapy.

Omecamtiv mecarbil has been considered a promising drug for the treatment of heart failure due to its ability to reduce the primary composite endpoint compared to placebo for many years. However, in 2023, the US Food and Drug Administration refused to approve omecamtiv mecarbil for the treatment of adult heart failure patients with reduced left ventricular ejection fraction, citing insufficient evidence of the drug's effectiveness.

Development of new drugs for patients with chronic heart failure opens up new opportunities to improve the quality of life and prognosis of patients. Ongoing clinical trials of experimental drugs give hope for breakthrough results.

Key words: chronic heart failure, drug therapy, sodium-glucose cotransporter-2 inhibitors, vericiguat, omecamtiv mecarbil.

ORCID and contributionship:
Zaikina T. S.: https://orcid.org/0000-0003-1587-2146 ADF
Rynchak P. I.: https://orcid.org/0000-0002-7413-0970 BD
Tytova G. Yu.: https://orcid.org/0000-0001-6876-083X AE
Zaliubovska O. I.: https://orcid.org/0000-0003-2165-6386 BE
Lantukhova N. D.: https://orcid.org/0000-0003-4713-7971 BE

Conflict of interest:
The authors declare that there is no conflict of interest.

Corresponding author
Zaikina Tetiana Serhiivna
Kharkiv National Medical University
Ukraine, 61022, Kharkiv, 4 Nauky avenue
Tel.: 0508127688
E-mail: ts.zaikina@knmu.edu.ua

A – Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article.

Received 04.10.2023
Accepted 01.03.2024

DOI 10.29254/2077-4214-2024-1-172-24-29
UDC 616.314.2

Ivanov R. O., Zverkhanovskyi O. A., Sarafiniuk L. A., Androshchuk O. V., Tatarina O. V.

MAIN METHODOLOGICAL ASPECTS OF DETERMINING THE CHEWING EFFICIENCY

National Pirogov Memorial Medical University (Vinnytsya, Ukraine)
lsarafinyuk@gmail.com

In modern dentistry, one of the problems that needs to be urgently addressed is the determination and evaluation of masticatory efficiency, in particular, a reliable assessment of masticatory pressure at the time of occlusion. Occlusion is a system of integrated structures that ensure the interconnection of tooth contacts, which is based on the morphological and functional state of the maxillary joint and the neuromuscular system in general. The purpose of our study is to analyse the existing data on methods for determining and evaluating chewing efficiency, in particular, bite force and chewing pressure in people of different ages and genders. We conducted a systematic review and analysis of the literature with a depth of 10 years based on PubMed, Google Scholar, ScienceDirect, Scopus,

Web of science, UpToDate databases. Solving the problem of determining and evaluating chewing efficiency is of direct practical importance for orthopedic and orthodontic treatment, and scientific and practical interest in solving this problem is observed in such fields as human anatomy and physiology, nutrition and pharmacology. Bite force and chewing pressure are studied using various measurement methods: gnathodynamometry; electromyography; muscle sedation with appropriate drugs to determine chewing efficiency; use of strain gauges to determine electrical resistance, fibre optic Bragg gratings, piezoelectric pressure transducers; occlusiography. However, according to the results of our literature analysis, we found that there is no structured approach to comparing different methods for determining indicators of chewing function, taking into account the age and gender characteristics of the subjects.

Key words: *chewing efficiency, chewing pressure, bite force, methods of determination.*

Connection of the publication with planned research works.

The work was performed within the framework of the planned research work of National Pirogov Memorial Medical University, Vinnytsya on the topic: «Somato-viscerometric features of the human body in different periods of ontogenesis», state registration number 0121U113772.

Introduction.

In modern prosthetic dentistry, one of the problems that requires urgent solution is a reliable assessment of masticatory pressure at the time of occlusion. Occlusion is a system of integrated structures that ensure the interconnection of tooth contacts, which is based on the morphological and functional state of the maxillary joint and the neuromuscular system as a whole, since it is responsible for the chewing function associated with opening and closing the mouth [1]. The solution to this problem is of undeniable practical importance for improving the functioning of implants or dentures, as well as for monitoring the condition of patients with dental injuries after treatment, and for assessing the morphological and functional state of the dentoalveolar system in people with bruxism. Scientists emphasize the importance of assessing the human bite from the standpoint of practical interest in such fields as human anatomy and physiology, dietetics and pharmacology [2]. Thus, the scientific interest in determining the chewing pressure is due to the relationship between the amount of chewing pressure and the correct bite and anatomical position of the teeth. The bite force is the force generated by the masticatory muscles at the moment of occlusion. This indicator serves as a basis for assessing the effectiveness of various dental procedures, including orthopedic and orthodontic treatment; or for determining the impact of such deformities of the masticatory system as malocclusion [3].

In most modern studies, to evaluate the effectiveness of the masticatory system, the bite force, masticatory pressure, masticatory efficiency, and bioelectrical activity of the masticatory muscles are determined using a variety of devices that differ in their operating principles and design. However, according to some researchers, most devices are not able to record all the necessary efforts and satisfy the tasks [4]. In addition, the literature we have studied lacks a systematic approach to comparing different devices for determining indicators of masticatory function, taking into account the age and gender characteristics of the subjects.

The aim of the study.

To analyse the existing literature on methods of determining and evaluating chewing efficiency, in particular: bite force and chewing pressure in people of different ages and sexes.

Main part.

In writing this paper, we used analytical and synthetic research methods, the scientific basis of which was the use of deduction and induction. The search for literature sources over the past 10 years was based on databases: PubMed, Google Scholar, ScienceDirect, Scopus, Web of Science, UpToDate. Combinations of the following keywords were used to search for information: Dental prescale, prescale film, masticatory performance, occlusal contact, mastication, pressure, which were further processed. When reading the full text of the articles, we focused on a detailed analysis of 30 sources that met the conditions of the literature search.

Our literature search has raised a number of issues that require detailed study. Firstly, modern methods of determining chewing pressure and bite force.

Bite force has been studied using various measurement methods. The first experimental study of the chewing force was performed by Borelli, it dates back to 1681, it was the world's first use of gnathodynamometry in dentistry, but in this experiment, not only the masticatory muscles but also the cervical muscles participated in holding the load. Later, Black and Thiessenbaum proposed a different structure of the gnathodynamometer, which is closer to the modern one in terms of mechanism and structure. A digital gnathodynamometer consists of a forked bite plate and a plastic housing. The use of a high-precision strain gauge and electronic circuitry makes it possible to obtain accurate pressure readings [5]. Gnathodynamometry, as a method of measuring chewing pressure, has certain disadvantages. After all, it measures only vertical chewing pressure, not horizontal pressure, which does not allow us to fully assess the effectiveness of chewing.

When using electromyography, we can determine the electrical activity of the masticatory muscles during chewing, but this method does not take into account the condition of the teeth, periodontium, the presence of structures in the oral cavity, which directly affects chewing efficiency [6].

Studies have been conducted in which muscle sedation was performed with appropriate drugs to determine their effect on bite force and how this would affect chewing efficiency [7].

Load cells use electrical resistance to detect pressure. Some publications report the use of these devices to measure the maximum bite force of a person. The range of forces ranging from 50 to 800 N inclusive was found [8].

A wide range of results on bite force is associated with several factors such as body mass index, gender,

muscle strength, age and changes associated with it, craniometric variability, periodontal condition and psycho-emotional stress, constitutional characteristics, etc. [9, 10, 11].

Recently, fiber-optic Bragg gratings have been used, which are widely used in biomechanics and biomedicine. They have a number of advantages over piezoelectric or other solid-state sensors. Optical fiber Bragg gratings are tiny in size and light in weight – a typical grating is 3mm long and has a fiber diameter of 250µm (125µm without the sheath) [9]. This fiber is non-conductive and resistant to electrical and radio frequency interference. Bragg's fiber is more resistant to temperature and pressure fluctuations, and has the flexibility and ability to adapt to complex shapes. Optical fiber polymers can be used in instruments that require sterilization. They are also resistant to corrosion [12, 13, 14].

In some cases, piezoelectric transducers have been used, using quartz or other crystalline materials as the main material in the mechanism, because due to their structure, crystals are able to create charges on their surface [15], which are proportional to the rate of change of force. However, it is known that certain piezoelectric devices provide unreliable readings [16].

Pressure transmitters consist of a cavity that is filled with gas or liquids. When a force is applied to the contents of the cavity, the pressure inside increases, and this pressure can be transferred to a pressure gauge for measurement. Depending on the type, they are divided into pneumatic (with a gas medium) or hydraulic (with a liquid medium). Such a device was developed by S. Braun. The device consists of a fiber-reinforced sterilised rubber tube connected to a pressure sensor (PX-300 1KGV) [4, 17, 18].

It is worth mentioning the T Scan system, which is an occlusal analysis system developed by Tekscan for performing occlusiograms. The system processes the data and displays the sequence of occlusal contacts along with relative force data in real-time. The main advantage of the T-scan is a thin sensor, thanks to which we can assess the bite force and the area of occlusal contacts in the intercuspal position [19]. The system has been criticized because sometimes the readings were erroneous and a narrow range of occlusal force was reported [14, 20].

Secondly, there is the problem of determining and evaluating masticatory pressure and masticatory efficiency, taking into account the factor of sexual dimorphism and age heterogeneity in dentistry [21]. Our attention was drawn to the study by H. Edmonds and H. Glowacka [22], which searched for review and experimental studies to determine the bite force in people of different ages and genders, as well as to study various means of measuring the maximum bite force. The importance of the average value of chewing pressure depending on gender, age (dentition), ethnicity, place and side of the bite, as well as the devices used to measure bite force was emphasized. It was noted that the individuality of the bite force in different types of dentition varied from 246.22 N (220.47; 274.98) to 311.72 N (255.99; 379.59) and 489.35 N (399.86; 598.87), respectively. The results of this systematic review provided valid and useful baseline reference values for maximum pressure force, which is important for clinicians and researchers.

As bite force is essentially the ability of the jaw musculature to apply maximum force to the lower teeth against the upper teeth under certain positive conditions, the determination of maximum voluntary or forced bite forces and their variance, respectively, is an important criterion for assessing a healthy or abnormal mouth. Determination of occlusion and the forces applied to the dentoalveolar system during occlusion in dentition pathology further contributes to the quantification of various clinical complications in patients [23].

The determination of masticatory pressure using various types of devices helps to diagnose pathologies such as malocclusion, caries, temporomandibular joint or muscle disorders, and early tooth loss in a timely manner [24].

According to the literature search [25], various parameters are used for clinical assessment of masticatory efficiency, including masticatory force and determination of the maximum bite force. However, chewing performance and electromyographic activity cannot be determined in quantitative and numerical parameters, unlike maximum bite force. Literature data [18] link the maximum bite force and its impact on health, including in children of different ages. However, there is uncertainty regarding the calibrated values of maximum bite force in children of different ages. This may be due to the presence of different sites and units, or multiple devices, used to assess chewing force. In addition, the absence of baseline criteria for primary, mixed and permanent dentitions necessitates a quantitative assessment of the average level of bite force [26].

Sex differences in certain age groups and differences between age groups of different sexes were analyzed, and the relationship between chewing ability and factors such as sex, age and individual oral functions was identified. The criteria used for the study were oral functions, the number of functional teeth and anthropometric measurements. The study found that the development of masticatory function had gender-specific characteristics, with male children, adolescents and adults showing higher masticatory performance than girls and women. It was determined that the chewing performance of the subjects was significantly related to the number of functional teeth, maximum occlusal force and tongue pressure [22].

In addition, age – and gender-specific features of maximum tongue pressure, maximum occlusal force, motor function of the tongue and lips, as well as the relationship between parameters in children of different ages and young adults were identified. The authors point out a clear increase in oral functions with age in male subjects and a significant decrease in maximum tongue pressure in girls and women. This gives them reason to believe that with increasing age groups, the maximum occlusal force, maximum tongue pressure, and tongue and lip motility increase in males [27].

Scientists also pay attention to the ontogenetic features of the human masticatory apparatus, characterized by an increase in such indicators as chewing efficiency and bite force during growth and development. To date, there are known force criteria for molar and incisor bites in humans, [28] but there is insufficient data on determining bite force for all types

of teeth or age-related features of bite force potential. Various bite force models can be used to predict the bite force at different points of the bite in the adult population, such as the limited leverage model [29].

However, R. Godinho et al. [30] checked the literature available to us almost no data whether the limited leverage model can accurately predict the bite force potential of children and adolescents. They compared theoretically obtained bite force data with experimental results in an ontogenetic context. It was tested whether the parameters of maximum bite force increase along the dentition during ontogeny, whether it is possible to estimate the bite force model using the limited leverage model matching patterns, and whether concomitant changes in the leverage of the adductor muscle would be associated with a decrease or increase in bite force along the dentition and throughout ontogeny [30]. Their results indicate that the maximum bite forces increase during ontogeny and changes occur along the dentition, especially in the posterior parts of the dentition. This confirms the importance of the limited lever model for predicting bite force parameters in different conditions [22].

Thus, in our opinion, standard basic parameters of bite force are needed to diagnose dentition anomalies depending on age and gender, location and side of the teeth, type of equipment and ethnicity. And this, in turn, is necessary for compiling the definition of chewing pressure in children of different ages and the use of appropriate devices.

Conclusions.

Despite the contradictory results regarding the use of different methods for determining masticatory function, most data indicate the importance of this problem for orthopedic and orthodontic treatment. The effectiveness of the chewing function is determined by the values of chewing pressure and bite force. In the literature we studied, there is no systematic approach to comparing different devices for determining the indicators of chewing function, taking into account the age and gender characteristics of the subjects. Therefore, there is an urgent need to determine the appropriate parameters of chewing efficiency for the diagnosis of dentition anomalies, depending on the location and side of the teeth, type of equipment and research methods, age, gender and ethnicity of the subjects.

Prospects for further research.

In the future, additional data are needed to determine the chewing efficiency based on the study of chewing pressure in practically healthy individuals of different sexes of a certain period of ontogeny belonging to a separate ethno-territorial region of Ukraine.

References

1. Gajapathi B, Rangarajan V, Yogesh P, Ibrahim M, Kumar R, Karthik P. Concepts of occlusion in prosthodontics: A literature review, part I. J Indian Prosthodont Soc. 2015;15(3):200. DOI: 10.4103/0972-4052.165172.
2. Bulanda S, Ilczuk-Rypuła D, Nitecka-Buchta A, Nowak Z, Baron S, Postek-Stefańska L. Sleep bruxism in children: etiology, diagnosis, and treatment – a literature review. Int J Environ Res Public Health. 2021;18(18):9544. DOI: 10.3390/ijerph18189544.
3. Hama Y, Hosoda A, Kubota C, Guo R, Soeda H, Yamaguchi K, et al. Factors related to masticatory performance in junior and senior high school students and young adults: a cross-sectional study. J Prosthodont Res. 2022;36:424-429. DOI: 10.2186/jpr.jpr_d_22_00137.
4. Gu Y, Bai Y, Xie X. Bite force transducers and measurement devices. Front Bioeng Biotechnol. 2021;9:9. DOI: 10.3389/fbioe.2021.665081.
5. Vilela M, Picinato-Pirola MN, Giglio LD, Anselmo-Lima WT, Valera FC, Trawitzki LV, et al. Força de mordida em crianças com mordida cruzada posterior. Audiol Commun Res. 2017;22:e1723. DOI: 10.1590/2317-6431-2016-1723.
6. Mehendale N, Gohel V. Review on electromyography signal acquisition, processing and its applications. SSRN Electron J. 2020;12:1361-1367 DOI: 10.2139/ssrn.3598928.
7. Abe I, Milczewski MS, Souza MA, Kalinowski HJ, Machuca OF, Marin GC, Camargo ES. The force magnitude of a human bite measured at the molar intercuspidation using fiber Bragg gratings. J Microw Optoelectron Electromagn Appl. 2017;16(2):434-444. DOI: 10.1590/2179-10742017 v16i2808.
8. Shiga H, Komino M, Uesugi H, Sano M, Yokoyama M, Nakajima K, et al. Comparison of two dental prescale systems used for the measurement of occlusal force. Odontology. 2020;108(4):676-80. DOI: 10.1007/s10266-020-00509-9.
9. Padma S, Umesh S, Asokan S, Srinivas T. Bite force measurement based on fiber Bragg grating sensor. J Biomed Opt. 2017;22(10):1. DOI: 10.1117/1.jbo.22.10.107002.
10. Araujo DS, Marquezin MC, Barbosa TD, Gavião MB, Castelo PM. Evaluation of masticatory parameters in overweight and obese children. Eur J Orthod. 2015;38(4):393-7. DOI: 10.1093/ejo/cjv092.
11. Nimura K, Shiga H, Yokoyama M. Relationships of physical constitution with occlusal force and masticatory performance in adults with natural dentition. Odontology. 2023;111:1018-1024 DOI: 10.1007/s10266-023-00803-2.
12. Katrenova Z, Alisherov S, Yergibay M, Kappasov Z, Blanc W, Tosi D, et al. Bite force mapping based on distributed fiber sensing network approach. Sensors. 2024;24(2):537. DOI: 10.3390/s24020537.
13. Khan F, Donder A, Galvan S, Baena FR, Misra S. Pose measurement of flexible medical instruments using fiber bragg gratings in multi-core fiber. IEEE Sens J. 2020;20(18):10955-10962. DOI: 10.1109/jsen.2020.2993452.
14. Loranger S, Gagné M, Lambin-Iezzi V, Kashyap R. Rayleigh scatter based order of magnitude increase in distributed temperature and strain sensing by simple UV exposure of optical fibre. Sci Rep. 2015;5(1):1-7. DOI: 10.1038/srep11177.
15. Sattayasoonthorn P, Suthakorn J, Chamnanvej S. On the feasibility of a liquid crystal polymer pressure sensor for intracranial pressure measurement. Biomed Eng Biomed Tech. 2019;64(5):543-53. DOI: 10.1515/bmt-2018-0029.
16. Song P, Si C, Zhang M, Zhao Y, He Y, Liu W, et al. A novel piezoresistive MEMS pressure sensors based on temporary bonding technology. Sensors. 2020;20(2):337. DOI: 10.3390/s20020337.
17. Peng X, Hu L, Liu W, Fu X. Model-Based analysis and regulating approach of air-coupled transducers with spurious resonance. Sensors. 2020;20(21):6184. DOI: 10.3390/s20216184.
18. Rosier PF. Good urodynamic practice: Pressure signal quality immediately after catheter insertion for cystometry with a water□filled pressure transducer system and its relevance for the ICS zero procedure. Neurourol Urodyn. 2020;40:319-325. DOI: 10.1002/nau.24561.
19. Assery MK, Albusaily HS, Pani SC, Aldossary MS. Bite force and occlusal patterns in the mixed dentition of children with down syndrome. J Prosthodont. 2020;29(6):472-8. DOI: 10.1111/jopr.13186.
20. Verma TP. Bite force recording devices - A review. J Clin Diagn Res. 2017;11(9):ZE01-ZE05. DOI: 10.7860/jcdr/2017/27379.10450.
21. de Abreu RA, Pereira MD, Furtado F, Prado GP, Mestriner W, Ferreira LM. Masticatory efficiency and bite force in individuals with normal occlusion. Arch Oral Biol. 2014;59(10):1065-1074. DOI: 10.1016/j.archoralbio.2014. 05.005.
22. Edmonds HM, Glowacka H. The ontogeny of maximum bite force in humans. J Anat. 2020;237:529-542. DOI: 10.1111/joa.13218.
23. Arakawa I, Abou□Ayash S, Genton L, Tsuga K, Leles CR, Schimmel M. Reliability and comparability of methods for assessing oral function: chewing, tongue pressure and lip force. J Oral Rehabil. 2020;47(7):862-71. DOI: 10.1111/joor.12976.

24. Todic J, Martinovic B, Pavlovic J, Tabakovic S, Staletovic M. Assessment of the impact of temporomandibular disorders on maximum bite force. Biomed Pap. 2019;163(3):274-8. DOI: 10.5507/bp.2019.001.
25. Guo R, Hama Y, Hosoda A, Kubota C, Minakuchi S. Age and sex differences in oral functions from junior high school to young adulthood: a cross-sectional study. J Oral Rehabil. 2021;48:1373-1379. DOI: 10.1111/joor.13253.
26. Chong MX, Khoo CD, Goh KH, Rahman F, Shoji Y. Effect of age on bite force. J Oral Sci. 2016;58(3):361-3. DOI: 10.2334/josnusd.15-0675.
27. Jayakumar P, FelsyPremila G, Muthu M, Kirubakaran R, Panchanadikar N, Al-Qassar S. Bite force of children and adolescents: a systematic review and meta-analysis. J Clin Pediatr Dent. 2023;47:39-53. DOI: 10.22514/jocpd. 2023.022.
28. Al-Gunaid T. Bite force - What we should know: a literature review. Int J Orthod Rehabil. 2019;10(4):168. DOI: 10.4103/ijor.ijor_33_19.
29. Huang YF, Wang CM, Shieh WY, Liao YF, Hong HH, Chang CT. The correlation between two occlusal analyzers for the measurement of bite force. BMC Oral Health. 2022;22(1):472. DOI: 10.1186/s12903-022-02484-9.
30. Godinho RM, Fitton LC, Toro-Ibacache V, Stringer CB, Lacruz RS, Bromage TG, et al. The biting performance of Homo sapiens and Homo heidelbergensis. J Hum Evol. 2018;118:56-71. DOI: 10.1016/j.jhevol.2018. 02.010.

ОСНОВНІ МЕТОДОЛОГІЧНІ АСПЕКТИ ВИЗНАЧЕННЯ ЖУВАЛЬНОЇ ЕФЕКТИВНОСТІ

Іванов Р. О., Зверхановський О. А., Сарафинюк Л. А., Андрощук О. В., Татаріна О. В.

Резюме. У даній роботі представлено огляд наукової літератури, що стосується проблеми визначення та оцінки жувальної ефективності з використанням різноманітнітних пристроїв і методів та врахуванням фактору статевого диморфізму та вікової неоднорідності в стоматології.

Метою нашої роботи є проаналізувати існуючі дані щодо методів визначення та оцінки жувальної ефективності, зокрема: сили прикусу та жувального тиску в осіб різного віку та статі. Нами було проведено систематичний огляд та аналіз літератури глибиною 10 років на основі баз PubMed, Google Scholar, ScienceDirect, Scopus, Web of science, UpToDate. Під час пошуку інформації було застосовано комбінації таких ключових слів: Dental prescale, prescale film, masticatory performance, occlusal contact, mastication, pressure, які в подальшому були опрацьовані. Вирішення проблеми визначення та оцінка жувальної ефективності має безпосереднє практичне значення для ортопедичного й ортодонтичного лікування, а науково-практичний інтерес до вирішення даної проблеми спостерігається у таких галузях, як анатомія та фізіологія людини, дієтологія та фармакологія. Сила прикусу та жувальний тиск вивчають за допомогою різних методів вимірювання: гнатодинамометрії; електроміографії; седації м'язів відповідними препаратами для визначення жувальної ефективності; використання тензодатчиків для визначення електричного опору, оптоволоконних брегговських решіток, п'єзоелектричних перетворювачів тиску; оклюзіографія. Але за результатами проведеного нами літературного аналізу була встановлена відсутність структурованого підходу до порівняння різних методів для визначення показників жувальної функції. Крім того, потрібні стандартні базові параметри жувальної ефективності для діагностики аномалій зубного ряду в залежності від віку та статі, місця та боку розташування зубів, виду апаратури та етнічних особливостей.

Ключові слова: жувальна ефективність, жувальний тиск, сила прикусу, методи визначення.

MAIN METHODOLOGICAL ASPECTS OF DETERMINING THE CHEWING EFFICIENCY

Ivanov R. O., Zverkhanovskyi O. A., Sarafiniuk L. A., Androshchuk O. V., Tatarina O. V.

Abstract. This paper presents a review of the scientific literature on the problem of determining and evaluating masticatory efficiency using various devices and methods and taking into account the factor of sexual dimorphism and age heterogeneity in dentistry.

The purpose of our work is to analyze the existing data on methods for determining and assessing chewing efficiency, in particular, bite force and chewing pressure in people of different ages and genders. We conducted a systematic review and analysis of the literature with a depth of 10 years based on PubMed, Google Scholar, ScienceDirect, Scopus, Web of Science, UpToDate databases. Combinations of the following keywords were used to search for information: Dental prescale, prescale film, masticatory performance, occlusal contact, mastication, pressure, which were further processed. The solution of the problem of determining and evaluating masticatory efficiency is of direct practical importance for orthopedic and orthodontic treatment, and scientific and practical interest in solving this problem is observed in such fields as human anatomy and physiology, nutrition and pharmacology. Bite force and chewing pressure are studied using various measurement methods: gnathodynamometry; electromyography; muscle sedation with appropriate drugs to determine chewing efficiency; use of strain gauges to determine electrical resistance, fibre optic Bragg gratings, piezoelectric pressure transducers; occlusion. However, the results of our literature analysis revealed the absence of a structured approach to comparing different methods for determining indicators of masticatory function. In addition, standard basic parameters of chewing efficiency are needed to diagnose dentition anomalies depending on age and gender, location and side of the teeth, type of equipment and ethnicity.

Key words: chewing efficiency, chewing pressure, bite force, methods of determination.

ORCID and contributionship:
Ivanov R. O.: https://orcid.org/0000-0002-2593-6505 BCD
Zverkhanovskyi O. A.: https://orcid.org/0000-0001-7972-7015 AF
Sarafyniuk L. A.: https://orcid.org/0000-0001-8253-5997 AEF
Androshchuk O. V.: https://orcid.org/0000-0002-9288-0660 ED
Tatarina O. V.: https://orcid.org/0000-0002-6921-3624 DE

Conflict of interest:
The authors declare no conflict of interest.

Corresponding author
Sarafyniuk Larysa Anatoliivna
National Pirogov Memorial Medical University
Ukraine, 21018, Vinnytsya, 56 Pyrohova str.
Tel. +380674300853
E-mail: lsarafinyuk@gmail.com

A – Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article.

Received 28.09.2023
Accepted 29.02.2024

DOI 10.29254/2077-4214-2024-1-172-29-36
UDC 796:004.38:612.13

Imas Ye. V., Luts Yu. P., Lukyantseva H. V.

FEATURES OF REACTIVE CHANGES IN CIRCULATORY SYSTEM PARAMETERS UNDER THE INFLUENCE OF CYBER SPORTS

National University of Ukraine on Physical Education and Sport (Kyiv, Ukraine)
yulialuts06@gmail.com

The issue of the impact of eSports on the parameters of the circulatory system is very relevant due to the fact that in the modern world, eSports has become not only a popular form of entertainment but also an important element of digital culture. The growing popularity of this sport has led to an increase in the time that esports players spend behind computer screens, which raises concerns among biological and medical professionals about the impact of video games on physical health parameters. In this context, it is important to investigate the physiological aspects of esports and the possible consequences of its effect on circulatory parameters, given the lack of scientific research in this area. The review is devoted to the analysis of possible impacts on central haemodynamics parameters during and after esports training.

The study aims to analyse modern scientific literature data to systematise information on the peculiarities of the impact of esports on the parameters of the circulatory system.

The rapid development of esports worldwide has led to discussions about the feasibility of medical examination of esports athletes, as is the case before competitions in traditional sports. It is worth noting that circadian rhythm and sleep disorders, unhealthy diets, and other specifics of the players' lifestyle contribute to developing diseases, including those of the circulatory system. Prolonged stay in a forced monotonous posture under conditions of hypokinesia and physical inactivity, exposure to stress factors, etc., lead to adverse changes in the functioning of the heart and blood vessels.

The sedentary lifestyle of esportsmen can lead to negative health consequences, including a high risk of cardiovascular disease. The limited research in this area determines the need for further scientific studies of the impact of esports on the parameters of central and peripheral haemodynamics.

Key words: *eSports, circulatory system, haemodynamics, heart, blood vessels, stress.*

Connection of the publication with planned research works.

The work is a fragment of the SRW “Influence of exogenous and endogenous factors on the course of adaptive reactions of the body to physical exertion of various intensities” (state registration number 012U108187).

Introduction.

Esports is the industry of competitive video games that involves not only players but also coaches, managers, and other related professionals in this hybrid sport. At different performance levels, esports is defined as a type of competitive activity in which gamers use their physical and mental abilities to compete in various games in a virtual electronic environment [1]. The primary motivation of an esportsman in his professional activity is to defeat his opponent [2, 3, 4].

Millions of people around the world play esports every day. Zimmer R.T., Haupt S., and Heidenreich H., in their studies, emphasise that esports are characterised by a high potential for stress, so in terms of physical and psycho-emotional stress, it is sometimes considered equivalent to traditional sports [5].

The problem of morphological and functional changes in the circulatory system in the conditions of high-performance sports is covered in the modern scientific literature in depth. At the same time, the issue of the influence of esports on changes in the parameters of the functioning of executive organs and mechanisms of regulation of the cardiovascular system has not yet become the subject of active scientific research. The existing lack of knowledge on this issue is caused by insufficient scientific studies, which urgently calls for new fundamental works on the study of the peculiarities of reactive and adaptive changes in the circulatory system in professional gamers.

The aim of the study.

To analyse modern data from the scientific literature to systematise information on the peculiarities of