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Integrative condition assessment in dentists as a basis for the prevention of emergency situations in outpatient dentistry

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ABSTRACT

BACKGROUND: Dentists' work is associated with significant emotional stress, specific physical exertion, including prolonged static positions, and exposure to noise and vibration. These occupational factors are linked to hypertension.

AIM: To assess the functional status of a dentist under outpatient visit conditions.

MATERIALS AND METHODS: The study included dentists of varying ages. A functional and psychoemotional status assessment protocol was developed, which was used by study subjects to enter self-measured blood pressure (BP) and heart rate (HR) before and after work (8:00 AM, 2:00 PM, and 8:00 PM). To ensure objective assessment, the study included a control group of dentists of varying ages, where functional parameters were measured and monitored by healthcare professionals.

RESULTS: BP and HR measurements before and after work were received in both groups. In young dentists, the measurements before work were as follows: systolic BP (SBP) 117.6 mm Hg [115; 121], diastolic BP (DBP) 74.3 mm Hg [71; 78], and HR 75.4 bpm [70; 81]. In middle-aged dentists, the measurements before work were as follows: SBP 120.5 mm Hg [117; 123], DBP 78.2 mm Hg [74; 83], and HR 75.2 bpm [73; 78]. In older dentists, the measurements before work were as follows: SBP 130.6 mm Hg [128; 132], DBP 80.8 mm Hg [77; 84], and HR 79.2 bpm [77; 85].

After work, there was an expected increase in all parameters in all age groups. In young dentists of the control group, the measurements before and after work were as follows: SBP 119.6 mm Hg [117; 122] and 130.2 mm Hg [128; 133], respectively; DBP 82.4 mm Hg [78; 84] and 85.4 mm Hg [72; 87], respectively; and HR 77.2 bpm [75; 79] and 83.3 bpm [80; 83], respectively. In middle-aged dentists of the control group, the measurements before and after work were as follows: SBP 125.3 mm Hg [123; 127] and 137.4 mm Hg [134; 139], respectively; DBP 85.4 mm Hg [82; 87] and 86.2 mm Hg [84; 88], respectively; and HR 75.4 bpm [73; 79] and 83.2 bpm [80; 85], respectively. In older dentists of the control group, the measurements before and after work were as follows: SBP 140.2 mm Hg [138; 141] and 149.5 mm Hg [147; 151], respectively; DBP 88.3 mm Hg [86; 90] and 92.3 mm Hg [89; 94], respectively; and HR 80.3 bpm [78; 83] and 81.2 bpm [79; 83], respectively.

CONCLUSION: There were significant changes in functional parameters (BP and HR) during the day in dentists of varying ages, depending on the time of day and age, which may indicate potential cardiovascular risks. The control group showed a significant increase in the assessed functional parameters in the same age groups. These findings necessitate additional informing of dentists on occupational risks in order to encourage preventive measures, which may have a significant impact on quality of life and life expectancy in the future.

Keywords: dentist; occupational pathology; hypertension.

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Интегративная оценка состояния врачей-стоматологов как основа профилактики неотложных ситуаций в амбулаторной стоматологии

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АННОТАЦИЯ

Обоснование. Во время работы врачу-стоматологу приходится сталкиваться с высоким уровнем эмоционального напряжения; специфической физической нагрузкой, включающей длительное пребывание в статическом положении; посторонними шумами и вибрацией. Эти факторы профессиональной деятельности связаны с артериальной гипертензией.

Цель исследования — оценка функционального состояния врача-стоматолога в условиях амбулаторного приёма.

Материалы и методы. В исследовании принимали участие врачи-стоматологи различных возрастных групп. Разработан протокол исследования функционального и психоэмоционального состояния, в который каждый участник вносил данные самостоятельного измерения артериального давления (АД) и частоты сердечных сокращений (ЧСС) до и после работы (8:00, 14:00, 20:00). Для объективизации полученных данных в исследование включена контрольная группа врачей-стоматологов разных возрастов, у которых измерение и контроль функциональных показателей проводились медицинским персоналом.

Результаты. Продемонстрировано изменение АД и ЧСС у обследуемых обеих групп до и после работы. До работы у врачей молодого возраста систолическое АД (САД) 117,6 [115; 121] мм рт. ст., диастолическое АД (ДАД) 74,3 [71; 78] мм рт. ст., ЧСС 75,4 [70; 81] в минуту. У врачей среднего возраста САД 120,5 [117; 123] мм рт. ст., ДАД 78,2 [74; 83] мм рт. ст., ЧСС 75,2 [73; 78] в минуту. У пожилых врачей САД 130,6 [128; 132] мм рт. ст., ДАД 80,8 [77; 84] мм рт. ст., ЧСС 79,2 [77; 85] в минуту.

После завершения работы наблюдается закономерное увеличение значений всех показателей у врачей всех возрастных категорий. В контрольной группе у врачей молодого возраста до начала работ: САД 119,6 [117; 122] мм рт. ст., ДАД 82,4 [78; 84] мм рт. ст., ЧСС 77,2 [75; 79] в минуту; после работы САД 130,2 [128; 133] мм рт. ст., ДАД 85,4 [72; 87] мм рт. ст., ЧСС 83,3 [80; 83] в минуту. У врачей-стоматологов среднего возраста до начала работы САД 125,3 [123; 127] мм рт. ст., ДАД 85,4 [82; 87] мм рт. ст., ЧСС 75,4 [73; 79] в минуту; после работы САД 137,4 [134; 139] мм рт. ст., ДАД 86,2 [84; 88] мм рт. ст., ЧСС 83,2 [80; 85] в минуту. У врачей пожилого возраста до начала работы САД 140,2 [138; 141] мм рт. ст., ДАД 88,3 [86; 90] мм рт. ст., ЧСС 80,3 [78; 83] в минуту; после работы САД 149,5 [147; 151] мм рт. ст., ДАД 92,3 [89; 94] мм рт. ст., ЧСС 81,2 [79; 83] в минуту.

Заключение. Изучение функциональных показателей (АД и ЧСС) у врачей-стоматологов различных возрастных групп в течение дня показало статистически значимые изменения в зависимости от времени суток и возраста, что может указывать на потенциальные риски для сердечно-сосудистой системы. Полученные результаты в контрольной группе продемонстрировали статистически значимое повышение изучаемых функциональных показателей у врачей в тех же возрастных группах. Показана необходимость дополнительного информирования врачей-стоматологов о профессиональных рисках с целью выработки мотивации на проведение профилактических мероприятий, что в дальнейшем может значительно повлиять на качество и продолжительность их жизни.

Ключевые слова: врач-стоматолог; профессиональная патология; артериальная гипертензия.

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ЭКО•ВЕКТОР

BACKGROUND

Physicians play a key role in healthcare. The quality of medical care, and hence the patient's life expectancy and quality of life, depends on their expertise, skills, and physical and emotional well-being. Studies conducted under the auspices of the World Health Organization (WHO) indicate a global trend toward increased life expectancy over the past 35 years. Cardiovascular diseases continue to be the leading cause of mortality worldwide [1], whereas the average life expectancy has increased from 61.7 to 71.8 years [2]. According to data from Rosstat, the population of the Russian Federation is experiencing demographic aging [3]. This trend is particularly prominent in Moscow, where individuals older than working age comprise 25.6% of the population, including 32.7% of women[1]. The rise in average age has led to a growing prevalence of chronic noncommunicable diseases and an increase in metabolic risk factors such as overweight, hypertension, hyperglycemia, arterial plaque formation, and hyperlipidemia.

Multiple factors, including age and metabolic risks, significantly impair cardiovascular health and are further exacerbated by adverse occupational conditions. Studies by Izmerov and Skvirskaya highlight the impact of professional activity on cardiovascular risk [4]. Occupational hazards contributing to cardiovascular risk are also addressed in a study by Babanov and Baraev, who emphasize the importance of accounting for harmful working conditions. These include chronic occupational stress, noise, localized vibration, radiation exposure, prolonged static posture, and excessive physical strain on an untrained heart [5]. Approximately 15% of healthcare professionals reportedly experience tachycardia [6]. Boerma et al. found that even low doses of ionizing radiation may affect cardiovascular function, challenging established safety thresholds for cardiac performance [7].

Dentists are often forced to maintain awkward static postures during procedures despite adherence to ergonomic principles, which contributes to emotional stress. Daily work requires sustained physical effort, particularly for the dominant arm. Additional stressors include visual strain, high noise levels, fine particulate matter, vibration, and ultrasonic exposure. Some practitioners are also regularly exposed to X-ray radiation [8].

Harsh working conditions and time-limited appointments increase fatigue. This has been identified as a key indicator of chronic fatigue syndrome. Barbadoro et al. demonstrated a direct association between overweight and obesity, which are classified by WHO as risk factors for metabolic disorders, and the duration of work shifts [9]. Exceeding recommended workload limits accelerates the onset of cardiovascular disorders and increases the risk of neurological and musculoskeletal disorders [10]. Aging also impairs cardiovascular adaptability, reducing the body's capacity for sustained physical activity [11].

Chronic emotional strain directly reduces concentration, increasing the risk of medical errors, which in turn compromise care quality and increase the incidence of iatrogenic complications [12]. Mental performance of healthcare professionals varies by specialty: only 1.6% of general dentists, 3.2% of oral surgeons, and 26.6% of prosthodontists maintain high cognitive function, which is an essential indicator of central nervous system integrity [13].

Working conditions and workload in dentistry contribute to occupational diseases. However, the relationship between dental practice and practitioners' health is not receiving sufficient attention in the scientific community. A thorough understanding of this link is essential for effective prevention of occupational diseases [14].

Existing publications provide fragmented data on the prevalence of systemic diseases in healthcare professionals. Therefore, we aimed to assess cardiovascular function in dentists. Contemporary research emphasizes the importance of identifying risk factors for cardiovascular diseases in this professional group. The first stage of our study involved a screening assessment of cardiovascular function in dentists, including measurement of average blood pressure (BP) and heart rate (HR) before and after outpatient visits.

AIM: To assess the functional status of a dentist under outpatient visit conditions.

METHODS

The study included male and female dentists employed at state-funded dental clinics in the Moscow region. Participants were divided into three age groups according to the WHO classification: young (under 44 years; *n*=328), middle-aged (45–59 years; *n*=70), and older (60–74 years; *n*=12). All participants provided written informed consent to the use of their data for research purposes.

Inclusion criteria: practicing dentists within the defined age groups.

Exclusion criteria: refusal to participate; pregnancy; dentists outside the target age range; severe decompensated medical condition.

An observational, multicenter, prospective study protocol was developed to assess the functional and psycho-emotional status of dentists, as well as to evaluate the effectiveness and appropriateness of diagnostic approaches according to international and Russian standards of medical care.

The study group included dentists of all specialties and both sexes (*n*=410), with 328 young, 70 middle-aged, and 12 older participants.

[1] Federal Service for State Statistics of the Russian Federation (Rosstat). Russian Statistical Yearbook 2024. Available at: https://rosstat.gov.ru/folder/12781

Blood pressure (BP) and heart rate (HR) were recorded before and after work (morning and afternoon shifts) at predetermined intervals: 8:00 AM, 2:00 PM, and 8:00 PM.

In the study group, dentists self-measured and recorded their hemodynamic parameters (BP and HR) using modern automated and oscillometric devices approved for medical use.

To ensure objectivity, a control group of 45 dentists was selected from the study group using a blind method. BP measurements in this group were conducted under medical supervision. The control group included 20 young, 15 middle-aged, and 10 older dentists. BP measurements were taken at the same time points as in the study group.

To facilitate data recording, a training manual titled Assessment of Functional and Psycho-emotional Status in Dentists was developed, detailing key diagnostic steps for evaluating dentists' functional and emotional status [15].

Statistical analysis. Data were analyzed using SPSS Statistics version 24 (IBM, USA). The Student's t-test for independent samples was used to compare numerical data after testing for normality. The Wilcoxon signed-rank test, which is used for ordinal and numerical data, was applied to assess differences in repeated measurements within the same group at different time points. Data are presented as median and interquartile range: Me [Q1; Q3].

RESULTS

The assessment of cardiovascular parameters in dentists of different age groups throughout the workday revealed notable trends in BP and HR fluctuations. Data analysis identified distinct patterns. Measurements taken before the morning and afternoon shifts, at 8:00 AM and 2:00 PM, respectively, showed the following results for young dentists: systolic BP (SBP) 117.6 mm Hg [115, 121], diastolic BP (DBP) 74.3 mm Hg [71, 78], and HR 75.4 bpm [70, 81]. In middle-aged dentists, these parameters were slightly higher: SBP 120.5 mm Hg [117, 123], DBP 78.2 mm Hg [74, 83], and HR 75.2 bpm [73, 78]. In older dentists, the pre-shift measurements were as follows: SBP 130.6 mm Hg [128, 132], DBP 80.8 mm Hg [77, 84], and HR 79.2 bpm [77, 85].

A consistent post-work increase in all measured parameters was observed across all age groups.

In young dentists, post-shift values were as follows: SBP 130.4 mm Hg [125, 131], DBP 83.3 mm Hg [78, 85], and HR 78.2 bpm [75, 83]. In middle-aged participants, post-shift values were as follows: SBP 133.6 mm Hg [127, 136], DBP 84.7 mm Hg [80, 88], and HR 77.9 bpm [74, 85], differing slightly from those in younger dentists. Older dentists showed the highest post-shift values among all groups: SBP 140.3 mm Hg [137, 143], DBP 89.7 mm Hg [86, 93], and HR 81.9 bpm [79, 83] (Table 1, Figs. 1 and 2).

In the control group, functional parameters measured by healthcare professionals were as follows: in young dentists, pre-shift SBP was 119.6 mm Hg [117, 122], DBP was 82.4 mm Hg [78, 84], and HR was 77.2 bpm [75, 79]; post-shift SBP was 130.2 mm Hg [128, 133], DBP was 85.4 mm Hg [72, 87], and HR was 83.3 bpm [80, 83]. In middle-aged dentists, pre-shift SBP was 125.3 mm Hg [123, 127], DBP was 85.4 mm Hg [82, 87], and HR was 75.4 bpm [73, 79]; post-shift SBP was 137.4 mm Hg [134, 139], DBP was 86.2 mm Hg [84, 88], and HR was 83.2 bpm [80, 85]. In older dentists, pre-shift SBP was 140.2 mm Hg [138, 141], DBP was 88.3 mm Hg [86, 90], and HR was 80.3 bpm [78, 83]; post-shift SBP was 149.5 mm Hg [147, 151], DBP was 92.3 mm Hg [89, 94], and HR was 81.2 bpm [79, 83] (Table 2, Figs. 3 and 4).

DISCUSSION

Screening of cardiovascular function (BP and HR) in dentists of different age groups providing outpatient care in dental clinics in the Moscow region revealed significant fluctuations in these parameters depending on the time of day (start vs. end of work shift) and participant age, regardless of sex. Measurements taken in the control group, where BP and HR were recorded under medical supervision, demonstrated a significant increase in all parameters compared to those self-reported by participants in the study group. This variation in vascular tone, regardless of the method of measurement, indicates a potential predisposition to hypertension.

CONCLUSION

These findings highlight the need to inform dentists about occupational health risks and to encourage the development of skills for routine self-monitoring of blood pressure and heart rate. Establishing long-term habits of self-assessment and self-screening may help improve both life expectancy and quality of life in this professional group.

ADDITIONAL INFORMATION

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Table 1. Changes in hemodynamic parameters in dentists before and after work, M ± m

Age group (*n*=410)	Hemodynamic parameters before work, *p* <0,05			Hemodynamic parameters after work, *p* <0,05		
	SBP	DBP	HR	SBP	DBP	HR
Young	117.6±0.2	74.3±0.3	75.4±0.2	130.4±0.6	83.3±0.4	78.2±0.3
Middle-aged	120.5±0.4	78.2±0.3	75.2±0.2	133.6±0.6	84.7±0.3	77.9±0.3
Older	130.6±0.4	80.8±0.3	79.2±0.5	140.3±0.2	89.7±0.2	81.9±0.3

Note. SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate.

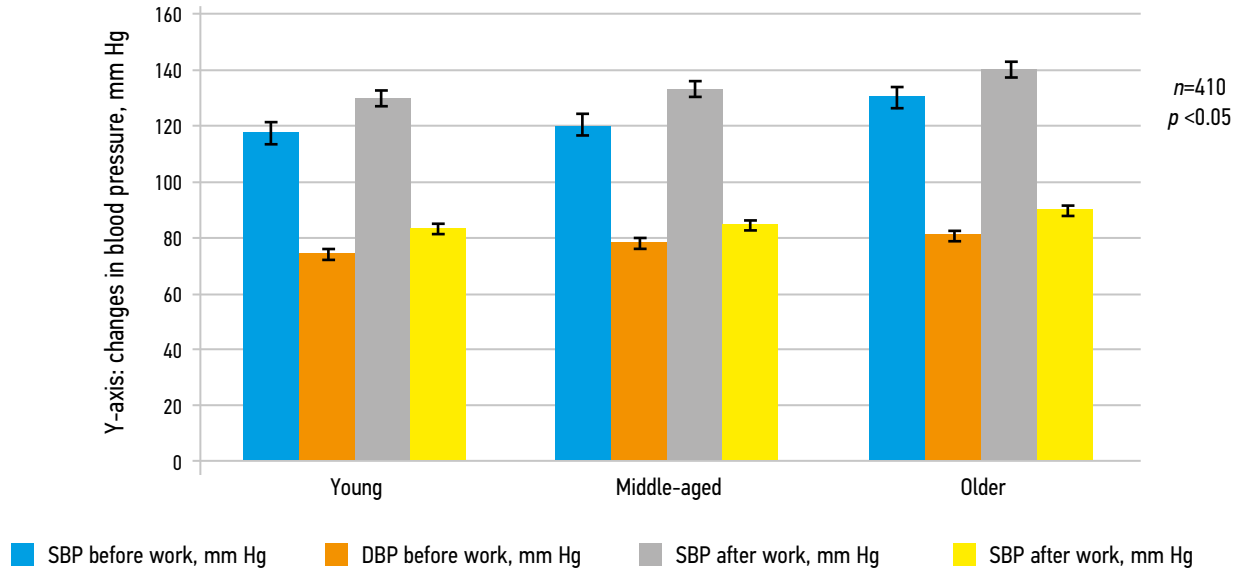

Fig. 1. Changes in hemodynamic parameters in dentists from the study group. SBP, systolic blood pressure, mm Hg; DBP, diastolic blood pressure, mm Hg.

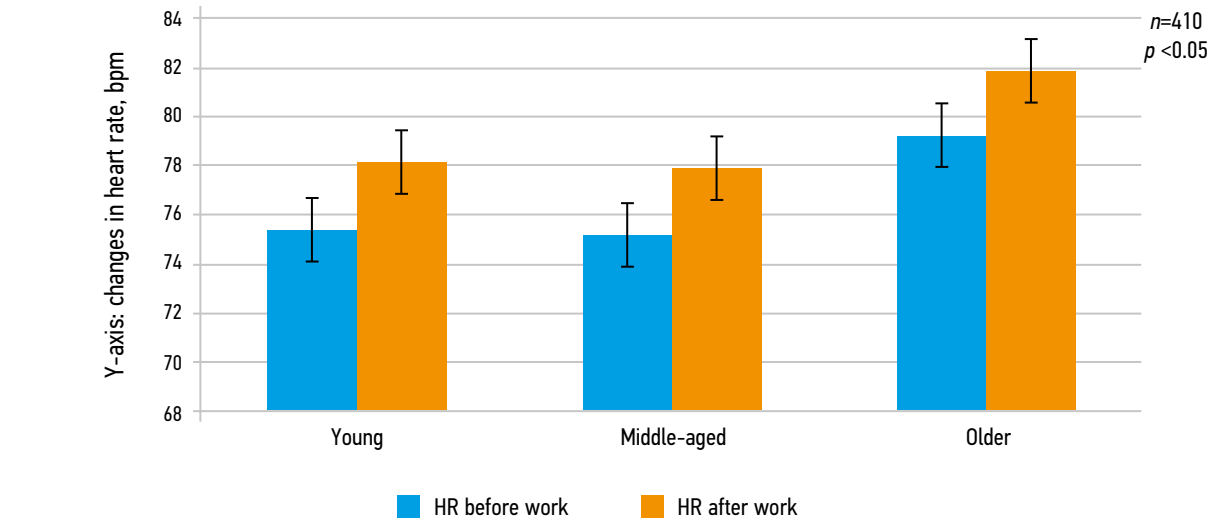

Fig. 2. Changes in hemodynamic parameters in dentists from the study group. HR, heart rate.

Table 2. Changes in hemodynamic parameters in dentists before and after work, M ± m

Age group (*n*=45)	Hemodynamic parameters before work, *p* <0,05			Hemodynamic parameters after work, *p* <0,05		
	SBP	DBP	HR	SBP	DBP	HR
Young	119.6±0.4	82.4±0.2	77.2±0.4	130.2±0.2	85.4±0.2	83.3±0.4
Middle-aged	125.3±0.3	85.4±0.2	75.4±0.3	137.4±0.3	86.2±0.4	83.2±0.2
Older	140.2±0.3	88.3±0.2	80.3±0.4	149.3±0.3	92.3±0.3	81.2±0.2

Note. SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate.

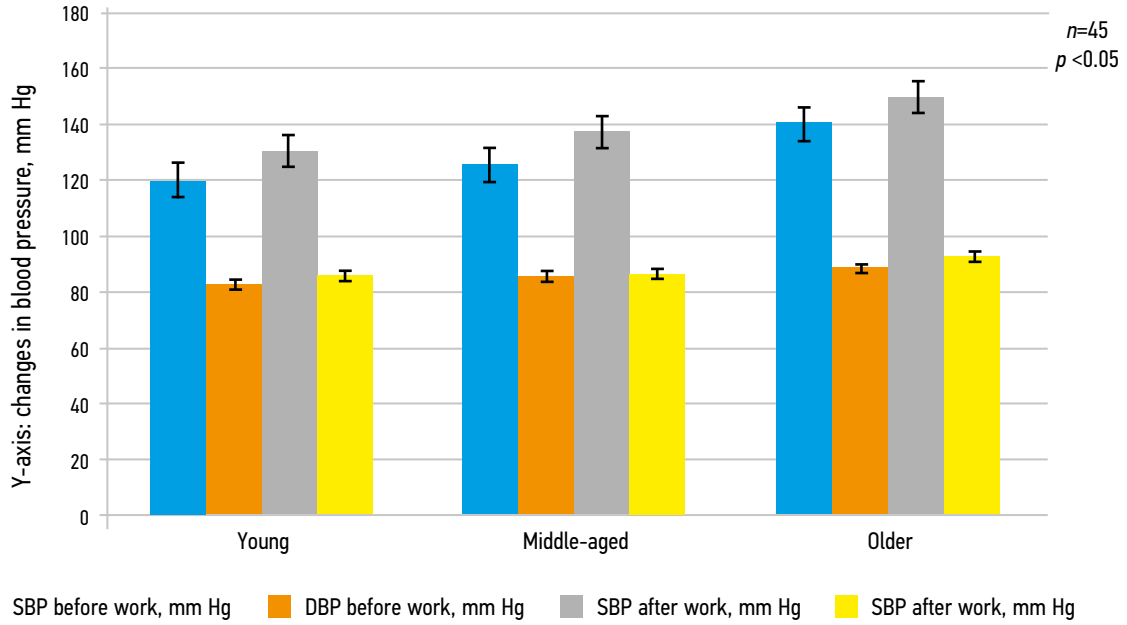

Fig. 3. Changes in hemodynamic parameters in dentists from the control group. SBP, systolic blood pressure, mm Hg; DBP, diastolic blood pressure, mm Hg.

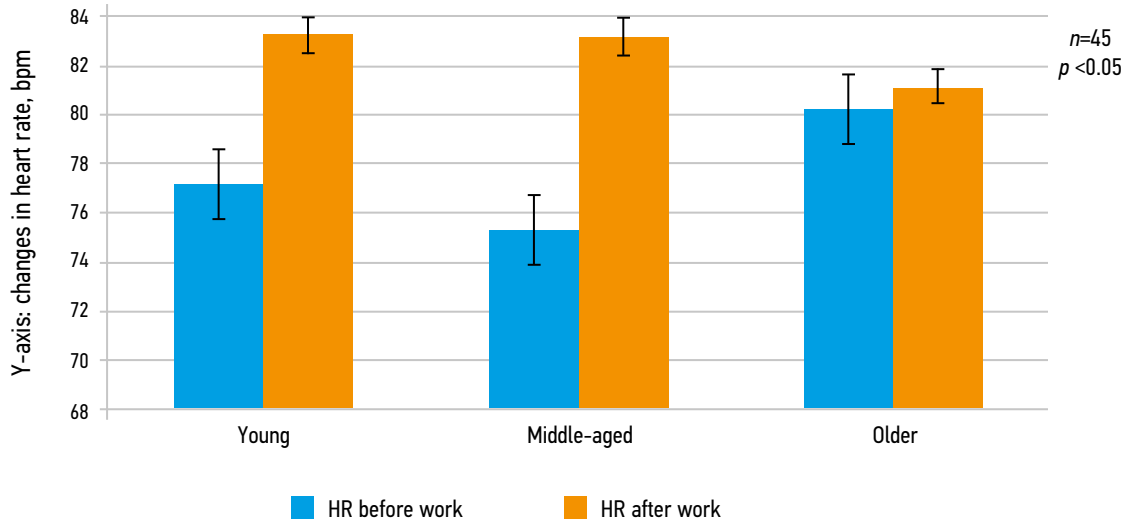

Fig. 4. Changes in hemodynamic parameters in dentists from the control group. HR, heart rate.

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