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Оценка целесообразности определения клинической рефракции студентов медицинского вуза на практических занятиях по офтальмологии

Конфликт интересов: не заявлен.

Вклад авторов: концепция и дизайн исследования, редактирование, окончательное одобрение варианта статьи для опубликования – Бобыкин Е.В.; концепция и дизайн исследования, редактирование, окончательное одобрение варианта статьи для опубликования – Коротких С.А.; редактирование, обработка данных – Крохалев В.Я.; сбор материала, обработка данных, написание текста – Варезкина Е.С.; сбор материала, обработка данных, написание текста – Третьякова Ю.Д.; редактирование, обработка данных, написание текста – Минеева А.Н.

Подана: 21.05.2025

Принята: 08.09.2025

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Резюме

Цель. Оценить целесообразность определения клинической рефракции студентов медицинского вуза в ходе практических занятий по офтальмологии.

Материалы и методы. Проведены устный опрос, определение динамической клинической рефракции с последующим сравнением результатов самооценки и обследования, а также анонимный опрос о состоянии зрения с использованием оригинальной анкеты (всего 49 студентов, включая 35 женщин, из которых прошли анкетирование 47 человек, в том числе 33 женщины, средний возраст 22,74 [22,08; 23,41] года, составивших исследуемую группу).

Результаты. Самооценка участниками исследования состояния клинической рефракции, как правило, совпадала с результатами объективного обследования. По данным авторефрактометрии миопия выявлена у 32 из 49 участников исследования (65,3%), гиперметропия – у 2 (4,1%), а астигматизм – у 11 (22,4%). Почти все (97,1%) студенты оценили возможность определить клиническую рефракцию позитивно, при этом многие (46,8%) получили новую информацию о собственном зрении.

Выводы. Определение клинической рефракции студентов-медиков в ходе практических занятий по офтальмологии повышает их информированность о состоянии здоровья.

Ключевые слова: клиническая рефракция, студент, медицинский вуз, самооценка, анонимный опрос, миопия, офтальмология

■ INTRODUCTION

It is known that the prevalence of visual impairment among medical students exceeds the average in the population [1, 2]. This is primarily due to significant, multi-hour visual loads at close range, which positively correlate with the probability of developing myopia [3, 4]. Visual impairment can have a significant negative impact on the quality of students' education, their academic performance, and their employment prospects [5].

The relevance of the problem is confirmed by the results of a number of latter domestic studies [6–8]. A recent survey of 549 senior students from several Russian medical universities confirmed the significant prevalence of ametropia (59.4%), astigmatism (25.5%), and various eye diseases (4.9%), combined with the insufficient awareness of many study participants about their vision. Thus, 21.9% of respondents reported that they do not know their clinical refraction, and some students indicated that they do not understand the meaning of the terms "clinical refraction" (2.6%) and "astigmatism" (0.7%) after completing their ophthalmology training. The authors of the study suggested to the departmental teams teaching ophthalmology to pay more attention on medical examining students during practical classes [9].

■ THE PURPOSE OF THE STUDY

Evaluate the feasibility of determining the clinical refraction of medical students during practical classes in ophthalmology.

■ MATERIALS AND METHODS

The study design, which included the stages listed below, was approved at a meeting of the Department of Ophthalmology of the Ural State Medical University (USMU) on August 31, 2023 (Protocol No. 1):

1. An oral survey by a department teacher of students from several randomly selected groups of the Faculty of Treatment and Prevention (FTP), studying at the department, about their self-assessment of the state of clinical refraction, conducted after discussing the relevant topic.
2. Objective determination of dynamic clinical refraction (autorefractometry using the Huvitz HRK-7000A device, Republic of Korea) of students during a practical lesson with a brief discussion and recommendations from the teacher (in questionable cases, clinical refraction was additionally determined using a set of trial spectacle lenses).
3. Comparison of the results obtained from self-assessment and examination.
4. After completing the course (before the educational testing), a voluntary anonymous online survey of students on self-assessment of the condition of the eyes and visual functions was conducted using a modified version of the original questionnaire developed at the Department of Ophthalmology of USMU in 2023 [10] and previously used to survey students of a number of universities from several cities in Russia [9]. The interactive questionnaire, compiled in the Google Forms application, contains 17 questions (including 13 mandatory ones), the wording of which and the answer options are presented in Table 2. Access to the survey was granted to respondents who confirmed that they were fifth-year students of the USMU Faculty of Medicine and Prevention and agreed to take part in it. To conduct this study, the questionnaire was supplemented with two questions: "How do you feel about the opportunity to check your clinical refraction during practical classes in ophthalmology?" (No. 5) and "How much the data on your clinical refraction obtained during practical classes in ophthalmology correspond to your previous awareness about it?" (No. 6).

It is known that young people, including students, are considered a "vulnerable group" of the population when conducting research. For this reason, we received permission from the Local Ethics Committee of JSC "Ekaterinburg Center of the Scientific and Technical Complex "Microsurgery of the Eye" (Protocol No. 2 dated 01/24/2024); the study used



only standard non-invasive diagnostic methods and a survey conducted on a voluntary basis. In addition, in our opinion, raising awareness (including about the state of one's own health and methods of maintaining it) is one of the areas of protecting "vulnerable groups" [11].

Inclusion criteria: randomly selected 5th-year students of the Faculty of Medicine and Prevention of the Ural State Medical University, who studied in the discipline "Ophthalmology" (specialty) in the 2023/2024 academic year and confirmed their consent to participate in the study on terms of anonymity (without restrictions on gender, age and ethnicity). Exclusion criterion: lack of student consent to participate in the study.

The study involved students from four groups – 49 people (35 women and 14 men), of which 47 students (33 women and 14 men; average age 22.74 (22.08; 23.41) years) took part in the survey, making up the study group.

We also compared the survey results with previously published responses from 5th-year students of the medical and preventive faculty of USMU [10], received in the 2022/23 academic year (comparison group – 96 people, including 74 women, average age 22.44 (22.22; 22.66) years).

The Statistica 13.3 program was used to perform statistical analysis. The following were used as descriptive statistics for the variables: median with 25% and 75% quartiles (lower and upper quartiles); mean values and 95% confidence interval limits for the mean. The nonparametric Mann – Whitney U-test was used to compare the parameters of two independent samples (since the hypothesis of normality for the variables under consideration was rejected based on the results of the Shapiro – Wilk test). Comparison of two qualitative features in two unrelated samples, expressed as percentages (comparison of relative frequencies in two groups) as applied to 2×2 tables, was performed using the chi-square test and Fisher's exact test. Statistical hypotheses were tested at a significance level of 0.05.

■ RESULTS

The objective examination data in most cases corresponded to the results of the clinical refraction state according to the self-assessment stated during the survey by the teacher (Table 1). According to the results of autorefractometry, the types of clinical refraction were distributed as follows: emmetropia in 15 of 49 students (30.6%), hypermetropia in 2 (4.1%), myopia in 32 (65.3%); astigmatism was detected in 11 cases (22.4%). It should be noted that a significant part of the study participants – 13 people (26.5%) – reported during the oral survey that they were not sure of their answer. Some of the students who considered themselves emmetropic were found to have latent hypermetropia or mild myopia.

Table 1
Dynamic clinical refraction of students (n=49)

Type of clinical refraction	Self-assessment before examination (survey)	Survey data	
	Abs. (%)	total Abs. (%)	with astigmatism Abs. (%)
Emmetropia	18 (36.7)	15 (30.6)	0
Hypermetropia	0	2 (4.1)	0
Myopia	31 (63.3)	32 (65.3)	11 (22.4)

Note: Abs. – absolute value.

The online survey was completed by 47 out of 49 (95.9%) study participants (Table 2). The answers to the question about the subjective assessment of their vision (No. 3) were distributed as follows: "excellent" – 8 (17.0%) answers, "good" – 12 (25.5%), "satisfactory" – 17 (36.2%), "poor" – 10 (21.3%). When answering the question about clinical refraction (No. 4), 34 students (72.3%) reported that they have myopia (including mild myopia – 21, moderate myopia – 9, high myopia – 4), 13 people (27.7%) chose the option "emmetropia". Also, 13 respondents (27.7%) confirmed that they have astigmatism (question No. 7), 32 (68.1%) reported that they do not have it, and another two (4.3%) chose the option "I don't know for sure".

Almost all the students who took part in the survey (46; 97.9%) positively assessed the opportunity to check their clinical refraction during practical classes (question No. 6), one person (2.1%) answered neutrally. Answering question No. 7, almost half of the study participants – 22; 46.8% – reported that they received new information for themselves: the initial awareness about clinical refraction and the examination data during the practical class fully corresponded in 24 cases (51.1%), partially coincided – in 17 cases (36.2%), did not correspond at all in 5 students (10.6%), and another person (2.1%) found it difficult to answer this question.

33 (70.2%) students, answering question No. 8, reported that they have decreased central vision, while almost all of them (31/33) have only impaired distance visual acuity. When answering question No. 11, slightly less than half of the students (23; 48.9%) noted that they use optical vision correction (most of them – 17 people, 73.9% – glasses), and another 5 (10.6%) study participants plan to start using it in the near future. Impairment of other visual functions appeared in only one (2.1%) answer to question No. 9: a student reported impairment of peripheral vision.

The answers to question No. 10 (about limitations caused by vision problems) were distributed as follows: "in studying" – 12 (25.5%), "in driving a car" – 8 (17.0%), "in spending leisure time/hobbies" – 4 (8.5%), "in playing sports" and "in work" – one each (2.1%).

Most of the study participants had their eyesight checked within the last year (36; 76.6%), less frequently the option "several years ago" was mentioned (7 respondents; 14.9%), and 4 people (8.5%) had their eyesight checked before entering the university (question No. 12). In response to question No. 13, most respondents (30; 63.8%) reported that they had visited an ophthalmologist within the last year, less frequently the answer options "before entering the university" were mentioned – 7 (14.9%), "several years ago" – 6 (12.8%), "I don't remember" (3; 6.4%) and "never" (1; 2.1%).

Concomitant pathology of the visual analyzer (suspected glaucoma, ophthalmic herpes in remission) appeared in two (4.3%) responses to question No. 14.

More than half of the survey participants (29 people, 61.7%) answered affirmatively to the question "Do you think that your eyesight has deteriorated over the past few years?" (No. 15); negative answers were received from 13 respondents (27.7%), and 5 respondents (10.6%) found it difficult to answer. Thirty respondents answered the question about the reasons for the continuing deterioration of eyesight (No. 16): "excessive visual strain" was named by 25 people (53.2% of the survey participants and 83.3% of those who answered the question); "emotional stress" and "improper organization of the workplace" were named by 2 students each (4.3%; 6.7%), and "physical overexertion" – by 1 student (2.1%; 3.3%).



The average score that survey participants gave to assess the importance of good vision was 9.51 (9.14; 9.88) (on a conditional scale with a minimum value of 1 and a maximum of 10), including "10 points" – 36 answers, "9 points" – 6, "8 points" – 3, "3 points" and "6 points" – one each.

Comparison of the survey results of students who studied in different years revealed only isolated differences that were statistically confirmed at a significance level of 0.05. Moreover, reliable differences linked only questions related to self-assessment of the state of clinical refraction and astigmatism, the definition of which was made in close attention. In particular, students who studied in the 2023/24 academic year were significantly more likely to consider themselves emmetropic (27.7% versus 10.4%, $p < 0.01$) and significantly more likely to report the absence of astigmatism (68.1% and 50.0%, respectively, $p = 0.04$) than their older colleagues. It should be noted that when answering questions No. 4 and No. 7 in the study group, the answer options indicating the students' insufficient awareness of their health and lack of understanding of the terms were much less common, which we consider a positive result of the mandatory examination of clinical refraction. Thus, to the question "Do you know your clinical refraction?" the answer option "I don't know" was chosen by 16.7% and 0.0% in the comparison group and in the study group, respectively ($p < 0.01$), and the option "I don't know what 'clinical refraction' is" was chosen by 4.2% and 0.0% ($p = 0.15$). The proportion of answers to the question "Do you have astigmatism?" was as follows in the study group and the comparison group: "I don't know for sure" – 12.5% and 4.3% ($p = 0.12$); "I don't know what 'astigmatism' is" – 2.1% and 0.0% ($p = 0.32$), respectively.

Another positive aspect was the higher involvement of the study participants (95.9% of the students surveyed took part in the survey, while a year earlier we managed to attract only 26.0% of the students in the course to participate), which may indicate greater interest from the audience.

■ DISCUSSION

To the ancient the Chinese thinker Confucius is credited with the famous quote "Tell me – and I will forget, show me – and I will remember, let me do – and I will understand". It is consonant with the well-known concept of the National Training Laboratories Institute in the USA, which evaluates the influence of teaching methods on the quality of perception of material and is known as the "Learning Pyramid", according to which the degree of assimilation of information by listeners increases from 5% in a classic lecture (a teacher's monologue, not accompanied by slides or any other illustrations) to 50% and 75%, respectively, in such types of "active learning" accompanied by the involvement of participants in the educational process in active cognitive activities, such as group discussion and practical implementation of specific work [12, 13].

The most important problem is the low motivation of students to study [14, 15], one of the ways to solve which is to stimulate the individual's personal interest in studying the discipline/specialty [16, 17]. It is known that active teaching methods increase students' interest and the quality of material assimilation, the effectiveness and productivity of learning, and develop their creative abilities [18], and the use of interactive pedagogical methods helps to increase students' interest in the lesson, stimulates discussion and subject-matter communication between students while completing the assignment [19]. It is believed that "participation of students in self-examination and mutual examination

Table 2
Comparison of anonymous student survey results in the 2023/24 (n=47) and 2022/23 (n=96) academic year

Question, answer options		Group		p-value
		Subject (5th year of FTP, 2023/24 academic year, n=47)	Comparisons (5th year of FTP, 2022/23 academic year, n=96)	
1. How old are you in full (indicate the number in Arabic numerals)? (mean and confidence intervals; median and quartiles, years)		22.74 (22.08; 23.41) 22 [22; 23]	22.44 (22.22; 22.66) 22 [22; 23]	0.74
2. Please indicate your gender	Female	33/47 (70.2%)	74/96 (77.1%)	0.37
	Male	14/47 (29.8%)	22/96 (22.9%)	0.37
3. How do you rate your vision?	How excellent	8/47 (17.0%)	14/96 (14.6%)	0.71
	How good	12/47 (25.5%)	15/96 (15.6%)	0.16
	As satisfactory	17/47 (36.2%)	36/96 (37.5%)	0.88
	How bad	10/47 (21.3%)	27/96 (28.1%)	0.38
	How very bad	0/47 (0.0%)	4/96 (4.2%)	0.15
4. Do you know your clinical refraction (if you have had surgical or laser correction, please indicate the type of refraction before it; if you have anisometropia (different refraction of the eyes), please indicate the refraction of the better seeing eye)?	Yes, I have emmetropia	13/47 (27.7%)	10/96 (10.4%)	<0.01
	Yes, I have hyperopia	0/47 (0.0%)	5/96 (5.2%)	0.11
	Yes, I have mild myopia	21/47 (44.7%)	28/96 (29.2%)	0.07
	Yes, I have moderate myopia	9/47 (19.1%)	29/96 (30.2%)	0.16
	Yes, I have high myopia	4/47 (8.5%)	4/96 (4.2%)	0.29
	Don't know	0/47 (0.0%)	16/96 (16.7%)	<0.01
	I don't know what "clinical refraction" is	0/47 (0.0%)	4/96 (4.2%)	0.15
5. How do you feel about the opportunity to check your clinical refraction during practical classes in ophthalmology?	Positively	46/47 (97.9%)	–	–
	Neutral	1/47 (2.1%)	–	–
	Negative	0/47 (0.0%)	–	–
	I find it difficult to answer	0/47 (0.0%)	–	–
6. How much the data on your clinical refraction obtained during practical classes in ophthalmology correspond to your previous awareness about it?	Completely correspond (didn't learn anything new)	24/47 (51.1%)	–	–
	Partially compliant (refraction has changed slightly since the previous check)	17/47 (36.2%)	–	–
	They don't match at all (I didn't know my refraction before or it has changed dramatically)	5/47 (10.6%)	–	–
	I find it difficult to answer	1/47 (2.1%)	–	–
7 (5)#. Do you have astigmatism?	Yes	13/47 (27.7%)	34/96 (35.4%)	0.36
	No	32/47 (68.1%)	48/96 (50.0%)	0.04
	I don't know exactly	2/47 (4.3%)	12/96 (12.5%)	0.12
	I don't know what "astigmatism" is	0/47 (0.0%)	2/96 (2.1%)	0.32



8 (6). If your visual acuity is reduced, please indicate at what distance to the greatest extent (if your vision is not reduced, skip this question)	Only into the distance	31/33 (93.9%*/66.0%**)	62/74 (83.8%*/64.6%**)	0.87
	Only nearby	2/33 (6.1%*/4.3%**)	6/74 (8.1%*/6.3%**)	0.63
	Far and near	0/33 (0.0%)	6/74 (8.1%*/6.3%**)	0.08
9 (7). Are you concerned about limitations associated with other (excluding central vision) functions of the visual analyzer?	No	46/47 (97.9%)	91/96 (94.8%)	0.38
	Yes, peripheral disorders Vision	1/47 (2.1%)	3/96 (3.1%)	0.73
	Yes, color vision pathology	0/47 (0.0%)	1/96 (1.0%)	0.49
	Yes, lack of binocular vision	0/47 (0.0%)	1/96 (1.0%)	0.49
10 (8). If you have problems with your vision, what is the main limitation (if you don't have such problems, you don't need to answer the question)?	In training	12/26 (46.2%*/25.5%**)	25/64 (39.1%*/26.0%**)	0.95
	In progress	1/26 (3.8%*/2.1%**)	6/64 (9.4%*/6.3%**)	0.28
	In leisure/hobbies	4/26 (15.4%*/8.5%**)	13/64 (20.3%*/13.5%**)	0.39
	In sports activities	1/26 (3.8%*/2.1%**)	7/64 (10.9%*/7.3%**)	0.20
	In driving a car	8/26 (30.8%*/17.0%**)	13/64 (20.3%*/13.5%**)	0.58
11 (9). Do you use any optical vision correction?	No, because I don't feel the need for it	19/47 (40.4%)	26/96 (27.1%)	0.11
	No, but I'm going to start using it soon	5/47 (10.6%)	4/96 (4.2%)	0.14
	Yes, I wear glasses	17/47 (36.2%)	42/96 (43.8%)	0.39
	Yes, I use contact lenses	5/47 (10.6%)	19/96 (19.8%)	0.17
	I had vision correction surgery	1/47 (2.1%)	5/96 (5.2%)	0.38
12 (10). How long ago did you last have your eyesight checked (before the practical ophthalmology classes##)?	Over the past year	36/47 (76.6%)	74/96 (77.1%)	0.95
	A few years ago	7/47 (14.9%)	13/96 (13.5%)	0.82
	Before entering university	4/47 (8.5%)	7/96 (7.3%)	0.80
	I don't remember	0/47 (0.0%)	2/96 (2.1%)	0.32
	Never	0/47 (0.0%)	0/96 (0.0%)	–
13 (11). How long ago was your last appointment with an ophthalmologist (before the practical classes in ophthalmology##)?	Over the past year	30/47 (63.8%)	63/96 (65.6%)	0.83
	A few years ago	6/47 (12.8%)	16/96 (16.7%)	0.54
	Before entering university	7/47 (14.9%)	13/96 (13.5%)	0.82
	I don't remember	3/47 (6.4%)	2/96 (2.1%)	0.19
	Never	1/47 (2.1%)	2/96 (2.1%)	1.00
14 (12). If you have any eye diseases (excluding refractive errors), please indicate them (otherwise skip this question)		2/47 (4.3%)	6/96 (6.3%)	0.63
15 (13). Do you think that your eyesight has worsened over the past few years?	Yes	29/47 (61.7%)	63/96 (65.6%)	0.65
	No	13/47 (27.7%)	27/96 (28.1%)	0.96
	I find it difficult to answer	5/47 (10.6%)	6/96 (6.3%)	0.37

16 (14). If you think that your vision has become worse recently, what is this primarily related to (if your vision has not worsened, then skip this question)?	Excessive visual stress	25/30 (83.3%*/53.2%**)	61/66 (92.4%*/63.5%**)	0.24
	Incorrect organization of the workplace	2/30 (6.7%*/4.3%**)	2/66 (3.0%*/2.1%**)	0.46
	Physical overexertion	1/30 (3.3%*/2.1%**)	1/66 (1.5%*/1.0%**)	0.59
	Emotional stress	2/30 (6.7%*/4.3%**)	1/66 (1.5%*/1.0%**)	0.20
	Bad ecology	0/47 (0.0%)	0/66 (0.0%)	–
	Malnutrition	0/47 (0.0%)	0/66 (0.0%)	–
	Associated general disease	0/47 (0.0%)	1/66 (1.5%*/1.0%**)	0.49
17 (15). Please rate on a scale from 1 to 10 (where 1 is the minimum score and 10 is the maximum) how important good vision is for you (mean value and confidence intervals; median and quartiles, points)		9.51 (9.14; 9.88) 10.0 [10.0; 10.0]	9.39 (9.19; 9.59) 10.0 [9.0; 10.0]	0.27

Notes: * % of the number of participants who answered this (optional) question; ** % of the total number of survey participants; #, ## questions and clarifications were used in the survey of students in the 2023–2024 academic year.

programs during practical training in various disciplines related to the measurement of objective psychophysical health indicators and their comparison with the student's self-assessment of these indicators has a normalizing and formative effect on reflexive, emotional, creative processes, and increases students' cognitive interests" [20].

In our work, the students' self-assessment of clinical refraction according to the survey data (Table 2) did not fully correspond to the results of the autorefractometry (Table 1), which may partly be due to the unequal number of participants (47 and 49, respectively). At the same time, in the survey, almost half of the respondents reported that they received new information about their vision condition (question No. 6).

A positive aspect, which demonstrated an improvement in the quality of learning the discipline, was the absence among the survey participants of students who did not understand the meaning of the terms "clinical refraction" and "astigmatism", and who did not know their refraction (at the same time, two students, despite the survey, did not have a clear understanding of the situation regarding the presence/absence of astigmatism).

The overwhelming majority of study participants positively assessed the possibility of determining clinical refraction in a practical lesson on ophthalmology (97.9%, question No. 5); at the same time, many of them – 46.8% (question No. 6) – received new information about their own health. This fact, along with the high level of involvement of students and the improvement in the quality of their assimilation of the material, allows us to positively assess the experience of using the proposed method and recommend it for wide application in the pedagogical process.

In addition, our work confirmed the main patterns identified in previously conducted surveys of senior medical students [9, 10]: a significant prevalence of visual impairments, increasing over the years of study, the need of most students for optical vision correction, as well as the fact that most of them highly value the importance of good vision and are inclined to monitor their health.

The main limitation of the study was the relatively small sample size and its non-continuous nature.



■ CONCLUSION

Determining the clinical refraction of students in practical classes in ophthalmology increases their awareness of their health status, and can also indirectly contribute to increase the motivation of students to study the discipline by developing personal interest, which improves the quality of assimilation of the material, the effectiveness and productivity of training.

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