

Research Letter

The reaction of cardiovascular system and orbital vessels after THz irradiation of molecular spectrum of emission and absorption of 129.0 GHz atmospheric oxygen in healthy volunteers and in patients with involutinal macular degeneration

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Abstract: The study aims the influence of THz radiation on 129.0 GHz of atmospheric oxygen on blood pressure (BP) and pulse, hemodynamic parameters of orbital arteries during the irradiation of biological active points of application in healthy volunteers and in patients with involutinal macular degeneration (IMD). It had been noticed a decrease of systolic and diastolic components of arterial pressure and pulse; a normalization of systolic velocity of bloodstream (SVB) and of resistance index (RI) in orbital arteries in patients with IMD. The result of the research is: 1) the method of THz influence of on molecular spectrum of emission and absorption of 129.0 GHz atmospheric oxygen is safe and does not cause any negative side effects on common state in healthy volunteers and in patients with IMD; 2) single of THz influence of molecular spectrum of emission and absorption of 129.0 GHz atmospheric oxygen caused a statistical important improvement in vascular system of eyeball.

Keywords: THz waves, atmospheric oxygen, orbital vessels, macular degeneration

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Introduction

Pathology of retina macular zone is one of the topical medico-social problems of modern ophthalmology; it is the leading reason of the loss of a central vision [1].

The incidence of involutinal macular degeneration in Russia is 15 on 1000 of population [2, 3]. Dystrophic changes in central zone of retina take place in 40% – 76.5% and occupy the third place in reasons of significant decrease of vision in people after 50 years [4].

Involutinal macular degeneration (IMD) characterized of non-reversible progressive hitting of central photoactive zone of retina and is one of nosologic forms which very often lead to the loss of vision in population of developed world countries [5]. One of factors of chorioretinal changes on eyeground is disturbance of microcirculation in choroid (in its choroid capillaceous layer) and in the retina because of vessel obliteration, development of microaneurysms, stasis and thrombogenicity in choroid capillaries causing local ischemia [6-8]. Appeared increased vessel permeability of choroid capillaceous layer leading to exudation, edema and hypoxia of retinal tissue.

Today there are conservative, laser, surgical and physiotherapeutic methods of IMD treatment. Physical factors of treatment increase every year. It is connected with the growing effectiveness of physical therapy methods. Further items of new

noninvasive therapy of dystrophic processes of retina are still topical.

Recently the processes of basic science, medical technology and clinical medicine have been determined by achievements in electromagnetic biology, in extremely-high frequencies (EHF) radiations [9, 10].

Oxygen deficit in tissues leads to disturbance of oxidative processes causing hypoxia and ischemia. So, it is very important to study THz electromagnetic waves of molecular spectrum of emission and absorption of 129.0 GHz atmospheric oxygen [11]. Recently THz waves of molecular spectrum of emission and absorption of 129.0 GHz atmospheric oxygen are very interesting to research [12-16]. In experiments on animals there had been discovered normalization of clotting and fibrinolytic blood activity, blood rheology after electromagnetic radiation and absorption on 129.0 GHz atmospheric oxygen [13-16].

To study the influence of THz waves of molecular spectrum of emission and absorption of 129.0 GHz atmospheric oxygen on common state and hemodynamic parameters of orbital arteries during the irradiation of biological points of application (points of acupuncture) in healthy volunteers and in persons with IMD.

Material and Methods

There had been examined 18 apparently healthy persons (36 eyes) – the 1st group and 20 patients (34 eyes) with IMD – the 2nd group. The 1st group consisted of persons aged 25–45 years, the 2nd group – from 50–75 years.

Ophthalmic examination included: visometry with correction and without it, perimetry, pneumotometry, biomicroscopy, direct ophthalmoscopy. Also arterial pressure and pulse had been examined. Modern additional noninvasive methods included color doppler mapping of central retinal artery (CRA), ophthalmic artery (OphA), rear short ciliary medial and lateral arteries (RSmCA, RSlatCA) on the apparatus Voluson 730 ProGE with the help of sensor SP 6-12. Determined systolic bloodstream velocity, diastolic bloodstream velocity and resistance index in the vessels. The examination of orbital vessels was organized from a supine position.

All of the persons had got THz irradiation of the skin in two biological active points (BAP) – VB1, TR23 on 129.0 GHz of atmospheric oxygen on the uninterrupted regime. The point VB1 is situated on 0.5 sun from the lateral angle of an eye, in the depression, and TR23 – on the lateral end of the eyebrow. These are the points of the traditional EHF-therapy [17].

The session was held with the help of medical apparatus of THz-therapy created by Saratov Central Scientific Institute of Measuring Equipment (Saratov, Russia). The procedure was held in the patients sitting in an armchair in a comfortable relax posture.

Each point was irradiated separately, during 5 minutes on each BAP (total 10 minutes). After the irradiation arterial pressure, pulse and bloodstream of orbital arteries were examined once again.

Results

Persons of the 1st group had emmetropia. They had no pathologies of the eyeground. Visual acuity was 0.9-1.0.

Patients of the 2nd group had a central involutinal maculadystrophy in one or both eyes. They had different forms of IMD: "dry" – 13 patients (24 eyes), "wet" – 7 patients (10 eyes). At an average incorrective visual acuity was 0.21±0.03.

In persons of the 1st group arterial pressure and pulse were within physiological norm: systolic blood pressure (BP) – 112.88±8.15 millimeter of mercury, diastolic BP – 73.98±3.06 millimeter of mercury; pulse – 74.63±2.05 beats per minute. In the 2nd group were patients with arterial hypertonia, so their parameters of arterial pressure and pulse were increased: systolic BP – 151.80±9.47 millimeter of mercury, diastolic BP – 82.06±2.02 millimeter of mercury; pulse – 77.8±2.1 beats per minute (Table 1).

Medium bloodstream parameters of orbital arteries are in Table 2.

In Table 2 we can see that bloodstream parameters of orbital arteries in the 1st group are within physiological norm. But in the patients the 2nd group, there are decreased indices of SVB in all examined vessels comparing with the 1st group. There are increased indices of RI comparing with norms in all vessels in patients of the 2nd group. These abnormalities show hemodynamic disturbances in the rear segment of eyeball in patients with IMD.

During and after the irradiation of the given points of application with the help of THz electromagnetic waves on 129.0 GHz of atmospheric oxygen there had not been any complaints on bad common state or discomfort near application place.

Table 1. Indices of BP and pulse in the 1st and 2nd groups (M±m)

Parameters	1 st group (n=18 patients)	2 nd group (n=20 patients)
SBP, mmHg	112.88±8.15	151.8±9.47**
DBP, mmHg	73.98±3.06	82.06±2.02*
Pulse, beats/min	74.63±2.05	77.8±2.1

SBP, systolic BP; DBP, diastolic BP.

* is p<0.05; ** is p<0.01 (comparing with the 1st group).

Table 2. Bloodstream parameters of orbital arteries in healthy persons and in patients with IMD (M±m)

Parameters	1 st group (n=36 eyes)	2 nd group (n=34 eyes)
SVB CRA, cm/s	16.17±0.7	13.02±1.04*
DVB CRA, cm/s	3.53±0.23	3.86±0.96
RI CRA	0.71±0.04	0.81±0.03*
SVBmed RSCA, cm/s	14.47±1.05	10.86±1.06*
DVBmed RSCA, cm/s	5.05±0.42	3.77±0.31*
RI med RSCA	0.60±0.06	0.75±0.03*
SVB lat RSCA, cm/s	14.85±0.9	10.53±0.87*
DVB lat RSCA, cm/s	5.01±0.36	3.42±0.64*
RI lat RSCA	0.63±0.05	0.74±0.02*
SVB OphA, cm/s	31.45±1.01	27.56±1.15*
DVB OphA, cm/s	8.31±0.65	11.07±1.06*
RI OphA	0.77±0.02	0.87±0.04*

* is p<0.05 (comparing with the 1st group).

Table 3. Indices of arterial pressure and pulse in the 1st and the 2nd groups before and after THz exposure on the BAPs (M±m)

Parameters	SBP, mmHg	DBP, mmHg	Pulse, beats/min
1 st group			
- before	112.88±8.15	73.98±3.06	74.63±2.05
- after	90.05±4.05*	65.16±4.04	68.52 ± 1.9*
2 nd group			
- before	151.8±9.47	82.06±2.02	77.8±2.1
- after	106.25±9.04*	72.5±3.46*	71.65 ± 2.0*

* is p<0.05 (comparing with the initial value).

In the 1st and the 2nd groups there was a reliable decrease of systolic and diastolic components of arterial pressure and pulse frequency. Indices of arterial pressure and pulse in the 1st and the 2nd groups before and after THz influence are in Table 3.

Conclusion

1) The observation shows safety of the THz-waves influence on 129.0 GHz of atmospheric oxygen because it didn't cause any negative side effects on common state in healthy volunteers and in the patients with IMD.

2) Short single THz influence on 129.0 GHz of atmospheric oxygen caused a statistically valid improvement in eyeball vascular system. So, the research will be continued. This method can be used for treatment of patients with different vascular eye pathologies.

3) There are first clinical results of THz influence on 129.0 GHz of atmospheric oxygen on eye hemodynamic in healthy people and in patients with macular degeneration.

Conflict of interest: none declared.

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