

Color light therapy in the treatment of chronic tonsillitis
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SUMMARY

An overview of the clinical results of the use of color light therapy in the treatment of chronic tonsillitis with low-intensity optical radiation from LED sources is presented. The results of the impact both on certain areas of the skin and directly on the palatine tonsils, including endolacunar irradiation using special LED probes, are analyzed. The article considers the use of color therapy in the treatment of foci of pharyngeal infection in patients with chronic tonsillitis, as well as the comparative results of treatment of chronic tonsillitis with laser and LED color therapy.

Key words: phototherapy, color light therapy, ENT diseases, tonsillitis, chronic tonsillitis, tonsillo-pharyngeal infection, optical radiation, LEDs, skin zones.

RESUME

The article reviews clinical results of color light therapy in treatment of chronic tonsillitis by low intensity optical emission from light emitting diodes. Results of influence on skin zones, palatine tonsils including endolacunar exposure via special LED sondes are analyzed. The use of color therapy in the treatment of foci of pharyngeal infection in patients with chronic tonsillitis as well as comparative results of therapy with laser and LED color therapy are considered.

Keywords: phototherapy, color light therapy, ENT diseases, tonsillitis, chronic tonsillitis, tonsillpharyngeal infection, optical emission, light emitting diodes, zones of skin.

INTRODUCTION

Chronic tonsillitis has been and remains an urgent problem of modern otorhinolaryngology and firmly occupies one of the first places among all ENT diseases. Despite the achievements of modern medicine, the proportion of chronic tonsillitis in the overall structure of diseases does not decrease, which is due to the widespread prevalence of this pathology both among the adult population (from 5-6 to 37%) and among children (from 15 to 63%) [1]. Chronic tonsillitis was one of the unsolved problems of the 20th century and continues to remain so in the 21st century, being one of the most difficult sections not only in otorhinolaryngology, but also in many other clinical disciplines.

Currently, chronic tonsillitis is considered as an infectious-allergic disease with local manifestations in the form of a persistent inflammatory focus in the tonsils [2, 3]. In the development of chronic tonsillitis and its complications, a significant role is played by the microbial pathogenic microflora localized in the palatine tonsils, as well as the foci of tonsillopharyngeal infection present on the mucous membrane of the pharynx and throat, which are caused by microbial non-pathogenic or opportunistic microflora [4, 5]. The most frequently detected opportunistic and pathogenic microorganisms of the oropharynx include: *Streptococcus pyogenes*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Haemophilus influenza*, *Candida* fungi and gram-negative enterobacteriaceae. The most important problem with conservative treatment of chronic tonsillitis is the elimination of the pathogenic microflora localized in the palatine tonsils, which is considered as the most important etiopathogenetic factor in the development of chronic tonsillitis and its complications. In the pathogenesis of chronic tonsillitis, the main role is played by allergies, focal infection and deficient conditions of local and systemic immunity, which, in conditions of antibiotic resistance and the associated low efficiency of antibiotic therapy and other methods of treatment, causes a chronic course of the disease. Particular urgency in the use of new methods of treatment of this pathology is due to the occurrence of serious complications and chronic diseases in chronic tonsillitis from the cardiovascular, nervous, endocrine systems, as well as kidneys, joints and other organs and systems of the body [2, 6].

At present, in clinical practice, various methods of using low-intensity optical radiation, predominantly of the visible part of the spectrum, are widely used - color light therapy [7]. In otorhinolaryngology, color therapy is used to treat a number of inflammatory diseases, in particular chronic tonsillitis, which is explained by anti-inflammatory and

immunostimulating effect of visible light, which determines the therapeutic effect [8]. The immunomodulatory effect of optical radiation is evidenced by the results of a positive effect on the humoral immunity of volunteers-tested single exposure to visible light and IR radiation in the wavelength range of 400–3400 nm on the lumbar region [9, 10]. In addition, the bactericidal effect of visible blue (400–500 nm) and red (500–800 nm) colors plays an important role in the elimination of pathogenic microflora, the mechanism of action of which is associated with the production of reactive oxygen species in cells [11].

Publication search algorithm and used electronic databases

When preparing the review, we searched for publications in the domestic and foreign press of the results of clinical trials devoted to the use of color light therapy in the treatment of chronic tonsillitis, in electronic databases available through Internet resources: eLibrary.ru, PubMed.com, Scopus, Medline. The search for publications was carried out for the period from 1991 to December 2019 using the keywords: color light therapy, ENT diseases, tonsillitis, chronic tonsillitis, optical incoherent radiation of the visible range, LEDs, zones and points of the skin.

Selection criteria for articles

For the analysis, articles were selected that met the following criteria: original articles published in peer-reviewed scientific journals that studied the results of using color light therapy versus control, studies that use visible optical radiation with one or more wavelengths, including in combination with conventional methods of treating chronic tonsillitis. When articles similar in content were found by the same authors, summary results were taken into account during data processing.

Results of generalized analysis of publications

The generalized results of the effectiveness of the use of color light therapy in the treatment of chronic tonsillitis are presented in table. 1, foci of tonsillo-pharyngeal infection - in table. 2.

Table 1

Clinical Results of Color Light Therapy in the treatment of chronic tonsillitis

No.	Disease vanie	Author (s)	Impact parameters	results	Lite- ratura
1.	Chrono- Česky tonsillitis	Kiryanova V.V., V.I. Linkov, Hammad I.A., Grebenshchikova L.A. ; Hammad I.A.	Irradiation of the area of projections of the palatine tonsils and regional lymphatic nodes on both sides in red (3 min.) and blue (4 min.) color, local exposure to red and blue directly on the palatine tonsils for 1 min. on each side, 7-10 sessions.	After 4 procedures, the disappearance of complaints, by the fourth day contraction of the palatine tonsils, reducing the thickening of the edges of the anterior arches and the discharge of plugs, normalizing the level of circulating immune complexes, phagocytosis in neutrophils and the content of IgM and IgA (tendency).	[12, 13]
2.	Chrono- Česky tonsillitis	Veselovsky A.B., Kiryanova V.V., Mitro- fans A.S., Fefilov G.D.	Red (670 nm) and blue (480 nm) color, local irradiation of the palatine tonsils for 1 min on each side, irradiation of the skin in the area of the projection of the palatine tonsils and regional lymph nodes on each side with red (5 min) and blue (6 min) color, 8-10 procedures.	Positive dynamics symptoms of chronic tonsillitis in 70% of patients after local and zonal irradiation in red and alternating with blue, preservation therapeutic effect in patients after 6; 12 and 18 months after the end of treatment.	[fourteen]
3.	Chrono- Česky nonspecific	Blotsky A.A., Antipenko V.V., Tseplyaev M.Yu.,	Endopharyngeal LED therapy in red (630 nm), green	Reducing the severity of local signs of chronic	[15-18]

	nonspecific physical tonsillitis	Tseplyaev M.Yu., E.V. Shcherbakova	red (630 nm), green (530 nm) color, intra-lacunar irradiation with helium-neon laser, course of treatment 7 days.	tonsillitis according to the results on days 6-7 in 91.1% of patients, level normalization serum IgM and IgA (trend).	
4.	Chrono-Česky tonsillitis	Blotsky A.A., V.V. Antipenko	Endolacunar irradiation with red (630-640 nm), blue (450 nm), green (530 nm) and IR radiation (850 nm).	A year after treatment, 44 patients (69%) obtained a stable clinical result in the form of the absence of relapses of tonsillitis and paratonsillar abscesses.	[19]

table 2

**Clinical Results of Color Light Therapy
in the treatment of tonsillo-pharyngeal infection in patients with tonsillar pathology**

No.	Disease	Author (s)	Options impact	results	Literatura
1.	Staphylococcal infection oropharynx	Khudonogova Z.P., Sholar M.V., Elkina T.N., Zakharova L.N., Pustovetova M.G., Evstropov A.N., Grachev V.I., Marinkin I.O.	Blue color (440–495 nm), 30 minutes a day, 14 days.	Improvement in the condition of the tonsils in 12 patients, less pronounced in 5, a decrease in the presence of pathogenic staphylococcus in the oropharynx in 11 out of 17 patients.	[twenty]
2.	Chronic foci mouth infections pharynx	Andamova O.V., Kiselev A.B., Chaukina V.A., Avtushko A.S., Vertakova O.V.	Red color (650 nm) and IR radiation (920 nm) contact on submandibular area from both sides for 5 minutes in combination with distant irradiation through the rotocavity in within 1 min.	30 days after the rehabilitation of chronic foci of pharyngeal infection in patients of the main group, there was an improvement in subjective sensations, a decrease in desquamation of epithelial cells and migration of leukocytes from the palatine tonsils and pharyngeal mucosa, changes in the species composition of microflora and the degree of contamination in positive side.	[21]

**Effectiveness of using color light therapy
in the treatment of chronic tonsillitis**

Evaluation of the effectiveness of the use of light color therapy in the complex treatment of chronic tonsillitis was carried out against the background of sanitation (washing the lacunae of the palatine tonsils with antiseptic agents) of the chronic inflammatory process in the tonsils [12, 13]. The study was conducted on 33 patients with chronic compensated tonsillitis aged 5 to 38 years, who, depending on the method of treatment used, were divided into two groups. In the first group (21 people), patients underwent a course of light therapy using the "SPECTR-I" apparatus by applying a red LED matrix for 3 minutes. or 4 min. blue on the skin in the area of projections of the palatine tonsils and regional lymph nodes on both sides. Additionally, as a local effect on the palatine tonsils for 1 min. a red and blue LED emitter was used on each side. On average, the number of procedures ranged from 7 to 10. Patients of the second group (12 people) were treated in the traditional way by 8–10 rinsing of the tonsils lacunae with various anti-septic agents.

As a result of the treatment, the patients of the first group showed a significant recovery of the functional activity of the tonsils in comparison with the initial ones, while in the second group there was only a tendency towards the normalization of these parameters. So, in patients of the first group, after 4 procedures, complaints disappeared, and by the fourth day of treatment, there was a decrease in the palatine tonsils, a decrease in the roller-like thickening of the edges of the anterior arches and the discharge of caseous-purulent plugs. While in patients of the second group, this required from 6 to 7 lavages of the tonsils

antiseptic solutions, and the tendency to restore the functions of the tonsils was observed on the 6-7th day of treatment. Evaluation of the general immune status showed that in patients of the first group, after the course of color therapy, the level of circulating immune complexes in the blood, phagocytosis in neutrophils, and the content of IgM and IgA (tendency) were reliably normalized in comparison with the baseline. Among the patients of the second group, all these indicators remained practically unchanged in comparison with the initial ones. Thus, the course of color light therapy in the treatment of chronic tonsillitis proved to be effective, which was confirmed by both positive clinical dynamics and the data of assessing the immunological status.

Studies on the effectiveness of the use of LED radiation from the Spectrum LC-02 apparatus of red (wavelength 670 nm) and blue (wavelength 480 nm) in complex treatment of patients with chronic tonsillitis were carried out by comparing clinical and specific indicators for this disease [14]. Color light therapy was carried out in two ways: a) a local effect on the palatine tonsils on each side with red and blue LED emitters for 1 minute each and b) irradiation of skin zones in the projection area of the palatine tonsils and regional lymph nodes on each side with red LED matrices (for 5 min.) and blue (within 6 min.) color. The course of treatment averaged 8 to 10 procedures. All patients, depending on the method used, were divided into 4 groups. Moreover, patients in all groups underwent standard treatment - washing from 8 to 10 times the lacunae of the palatine tonsils with various antiseptic agents. In the 1st group, color therapy was not carried out, only the washing of the tonsils, in the 2nd group, after washing the lacunae, local and zonal irradiation in red was performed, in the 3rd group, after washing the lacunae, local and zonal irradiation was performed in blue. In the 4th group, in contrast to the others, after washing the lacunae, local and zonal irradiation of the tonsils with red and blue colors alternated every other day. The research results showed an improvement in well-being, a decrease in complaints and a positive dynamics of symptoms of chronic tonsillitis in 70% of patients in the 2nd and 4th groups and in 50% in the 1st and 3rd groups. Discovered the analgesic effect of blue light, since in patients of the 3rd and 4th groups, after 2-4 irradiation procedures, complaints of pain and sore throat disappeared faster. The study of long-term results of treatment revealed the preservation of the therapeutic effect in patients after 6; 12 and 18 months, and the most stable result was in 80% of patients in the 2nd and 4th groups, while in the 3rd group the effect was preserved in 50%, and in the 1st group - only in 28% of patients. Thus, the results obtained indicate a pronounced therapeutic efficacy of local and zonal irradiation with red LED radiation after washing the lacunae, as well as alternating exposure to red and blue colors every other day. Combined treatment can be recommended for use in the complex treatment of chronic tonsillitis. The study of long-term results of treatment revealed the preservation of the therapeutic effect in patients after 6; 12 and 18 months, and the most stable result was in 80% of patients in the 2nd and 4th groups, while in the 3rd group the effect was preserved in 50%, and in the 1st group - only in 28% of patients. Thus, the results obtained indicate a pronounced therapeutic efficacy of local and zonal irradiation with red LED radiation after washing the lacunae, as well as alternating exposure to red and blue colors every other day. Combined treatment can be recommended for use in the complex treatment of chronic tonsillitis. The study of long-term results of treatment revealed the preservation of the therapeutic effect in patients after 6; 12 and 18 months, and the most stable result was in 80% of patients in the 2nd and 4th groups, while in the 3rd group the effect was preserved in 50%, and in the 1st group - only in 28% of patients. Thus, the results obtained indicate a pronounced therapeutic efficacy of local and zonal irradiation with red LED radiation after washing the lacunae, as well as alternating exposure to red and blue colors every other day. Combined treatment can be recommended for use in the complex treatment of chronic tonsillitis. and in the 1st group - only in 28% of patients. Thus, the results obtained indicate a pronounced therapeutic efficacy of local and zonal irradiation with red LED radiation after washing the lacunae, as well as alternating exposure to red and blue colors every other day. Combined treatment can be recommended for use in the complex treatment of chronic tonsillitis. and in the 1st group - only in 28% of patients. Thus, the results obtained indicate a pronounced therapeutic efficacy of local and zonal irradiation with red LED radiation after washing the lacunae, as well as alternating exposure to red and blue colors every other day. Combined treatment can be recommended for use in the complex treatment of chronic tonsillitis.

A comparative assessment of the effectiveness of the use of color therapy of laser and LED radiation in the treatment of patients with nonspecific chronic tonsillitis was carried out on 60 patients (men and women, age from 18 to 54 years) with an average duration of the disease from 1 to 10 years, which were divided into four groups of 15 people in each [15-18]. Patients of all four groups, regardless of the type of color therapy, received the same traditional therapy used in the treatment of chronic tonsillitis - sanitation of the lacunae of the palatine tonsils with antiseptic solutions. In the 1st and 2nd groups, a course of LED therapy was carried out according to the endopharyngeal technique for 7 days: in the 1st group in red (wavelength 630 nm), in the 2nd - in green (wavelength 530 nm). In the 3rd group, intralacunar irradiation of the tonsils with light from a helium-neon laser was carried out for 7 days. In group 4, patients received only traditional therapy for 14 days. Evaluation of the effectiveness of the therapy was carried out before and after treatment by determining the dynamics of the pharyngoscopic picture and immunity in all groups of patients and compared with the indicators of the control group of conventionally healthy people (20 people). In the 1st, 2nd and 3rd groups, a decrease in the severity of local signs of chronic tonsillitis according to the results of the pharyngoscopic picture was revealed on the 6-7th day of treatment in 91.1% of patients. In the 4th group, similar changes were recorded in 53.3% of patients not earlier than 12-14 days. The content of immunoglobulins IgA, IgM, IgG in the blood serum was determined before and on the 7-10th day after the treatment. Serum IgG in patients of all groups did not undergo significant changes and was within the normal range. A different dynamics was observed in relation to the level of IgM, which before treatment was 13% higher than normal values, but after the therapy it returned to normal values in all four groups. At the same time, serum IgA in patients before treatment was sharply reduced, however, despite a slight increase in the level after treatment, its concentration in the first two groups and in the fourth did not reach normal values. Within six months after the treatment in patients of the 1st and 2nd groups, one case of acute tonsillitis and paratonsillitis was recorded, in the 4th - three cases, in the 3rd there was no recurrence of tonsillitis and acute paratonsillitis.

The group of patients who received LED color therapy in four wavelength ranges included 64

a patient (32 men and 32 women) with chronic tonsillitis (including 14 patients with decompensated form) who underwent endolacunar irradiation of the tonsil mucosa [19]. The treatment was carried out in four groups of 16 patients each using red (wavelength 630-640 nm), blue (wavelength 450 nm), green (wavelength 530 nm) and infrared radiation (wavelength 850 nm) using flexible light guides for endoscopic procedures. The course of treatment consisted of 7 sessions, while the number of irradiated lacunae was 8–10 on each side with an exposure duration of 5 min. on each amygdala. The use of LED color therapy made it possible to achieve a reduction in local signs of a chronic inflammatory process in patients with chronic tonsillitis.

Color light therapy in the treatment of foci of tonsillo-pharyngeal infection in patients with chronic tonsillitis

The results of using blue color (wavelength 440–495 nm) from the "AVERS-LIGHT" device in the treatment of chronic tonsillitis in 17 patients were obtained after a course of daily procedures for 30 minutes. within 14 days [20]. Chronic tonsillitis before the course of color therapy in patients manifested itself in the form of hyperemia, roller-like thickening of the edges of the palatine arches, changes in the palatine tonsils, caseous-purulent plugs in the lacunae. Bacteriological examination showed the presence of pathogenic microflora in the oropharynx of patients *Staphylococcus aureus*, which could be the causative agent of inflammatory processes. By According to the clinical examination, after a course of treatment, 12 patients showed a significant improvement in the condition of the tonsils, and in 5 the improvement was assessed as less pronounced, but at the same time, in 11 out of 17 examined patients, the presence of pathogenic *Staphylococcus aureus*. Thus, the obtained information create prerequisites for the use of blue color therapy in the treatment of chronic tonsillopharyngeal infection.

A comparative study of the use of color therapy in the treatment of chronic foci of oropharyngeal infection (chronic pharyngitis and chronic tonsillitis) included 50 patients aged 34 to 52 years, who were divided into two equal groups - the main group and the control one [21]. In the main group of patients, in addition to antifungal (intraacunar administration of clotrimazole) and biotic therapy (intake of a liquid concentrate of bifidobacteria), color light therapy was carried out using the Duna-T apparatus. The exposure was carried out with red color (wavelength 650 nm) and infrared radiation (wavelength 920 nm) contacting the submandibular region on both sides for 5 minutes. in combination with distant irradiation through the oral cavity for 1 min. In the control group, instead of the active probiotic, tablets containing a lyophilized mixture of dry bacteria were used. The results of treatment were assessed on the 15th and 30th days by the subjective feelings of the patients and by the bacteriological picture of the microflora of the oropharynx. The total assessment of subjective symptoms showed that after the completion of the course of therapy, all patients of the main group showed an improvement in subjective sensations, while in the control group on day 30 there were no significant differences in indicators before and after treatment. In the main group, after treatment, there was a significant reduction in the desquamation of epithelial cells and the migration of leukocytes from the palatine tonsils and pharyngeal mucosa, while in the control group, no significant changes were found. During the treatment of chronic foci of pharyngeal infection, changes in the species composition of the microflora, as well as the degree of contamination in the positive direction, took place.

CONCLUSION

The publications reviewed in the review indicate that the use of red and blue color light therapy in combination with classical methods of conservative treatment of chronic tonsillitis helps to reduce exacerbations of chronic tonsillitis in the form of tonsillitis, as well as the risk of complications such as paratonsillar and peripharyngeal abscesses. Systemic etiotropic color therapy when exposed to skin zones in combination with local local irradiation of the palatine tonsils has a number of advantages, including providing a multicomponent approach to therapy and a rapid onset of the therapeutic effect. Taking into account the positive results according to the data of general clinical and special research methods,

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