

Photodynamic therapy and its impact on microbial load in periodontal pockets in aggressive periodontitis

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Abstract. Introduction. Aggressive periodontitis is a rapidly progressive inflammatory and destructive disease of the periodontal tissues characterized by extensive alveolar bone resorption, a high microbial burden within periodontal pockets, and a rapidly evolving clinical course. Photodynamic therapy has emerged as a promising adjunctive approach owing to its potent local antimicrobial activity and its ability to reduce inflammatory responses. **Aim.** To evaluate changes in the microbial burden of periodontal pockets and assess the effectiveness of comprehensive treatment incorporating photodynamic therapy in patients with aggressive periodontitis. **Materials and Methods.** A prospective, randomized study was conducted involving 180 patients aged 17–35 years diagnosed with aggressive periodontitis. All participants received comprehensive treatment, including local and systemic antimicrobial therapy, professional mechanical plaque removal, dental calculus removal, root surface debridement using the Vector system, and adjunctive photodynamic therapy. Photodynamic treatment was performed using a chlorin e6-based photosensitizer followed by activation with a light-emitting diode laser operating at a wavelength of 625–635 nanometers. Microbiological evaluation was performed before treatment and at one and three months after therapy using light microscopy with Pappenheim panoptic staining. The sample size was calculated using G*Power version 3.1 with a statistical power of 80%. **Results and Discussion.** marked reduction in the microbial burden of periodontal pockets was observed as early as one month after treatment, with sustained improvement throughout the three-month follow-up period. The most pronounced therapeutic effect was demonstrated in patients aged 17–25 years with juvenile aggressive periodontitis, who exhibited a consistent reduction in microbial contamination at all follow-up assessments. Patients aged 26–35 years with rapidly progressive aggressive periodontitis also showed a decrease in microbial burden; however, the magnitude of improvement was less pronounced. These findings indicate that adjunctive photodynamic therapy significantly enhances the antimicrobial efficacy of comprehensive treatment for aggressive periodontitis. **Conclusions.** Photodynamic therapy significantly reduces the microbial burden of periodontal pockets for up to three months and demonstrates the greatest therapeutic benefit in younger patients with juvenile aggressive periodontitis.

Keywords: aggressive periodontitis, photodynamic therapy, microbial burden, periodontal pocket, chlorin, comprehensive treatment

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Фотодинамическая терапия и её влияние на микробную нагрузку пародонтальных карманов при агрессивном пародонтите

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Реферат. Введение. Агрессивный пародонтит является быстро прогрессирующим воспалительно-деструктивным заболеванием тканей пародонта, сопровождающимся выраженной резорбцией альвеолярной кости, высокой микробной контаминацией пародонтальных карманов и стремительным клиническим течением. Значительная микробная нагрузка играет ключевую роль в прогрессировании патологического процесса, что обуславливает необходимость совершенствования комплексных методов лечения. Одним из наиболее перспективных направлений является фотодинамическая терапия, обладающая выраженным локальным антимикробным действием и способствующая снижению воспалительной активности. **Цель исследования.** Оценить динамику микробной нагрузки пародонтальных карманов и эффективность комплексного лечения пациентов с агрессивными формами пародонтита с применением фотодинамической терапии. **Материалы и методы.** Проведено проспективное рандомизированное исследование с участием 180 пациентов в возрасте от 17 до 35 лет с агрессивным пародонтитом. Всем пациентам выполнено комплексное лечение, включавшее местную и системную антибактериальную терапию, профессиональную гигиену полости рта с удалением зубных отложений и биоплёнки, обработку поверхности корней зубов с использованием системы «Vector» и фотодинамическую терапию. Для фотодинамического воздействия применяли фотосенсибилизатор на основе хлорина е6 с последующей активацией светодиодным лазером с длиной волны 625–635 нанометров. Микробиологическое исследование проводили до лечения, через один и три месяца после терапии методом световой микроскопии с паноптической окраской по Паппенгейму. Расчёт объёма выборки выполнен в программе «G*Power» версии 3.1 при статистической мощности исследования 80 процентов. **Результаты и их обсуждение.** Анализ результатов лечения показал выраженное снижение микробной нагрузки пародонтальных карманов уже через один месяц после начала терапии с сохранением положительной динамики через три месяца наблюдения. Наиболее выраженный эффект зарегистрирован у пациентов 17–25 лет с ювенильной формой агрессивного пародонтита, у которых уменьшение микробной контаминации отмечалось на всех контрольных этапах исследования. У пациентов 26–

35 лет с быстро прогрессирующей формой заболевания также выявлено снижение микробной нагрузки, однако степень положительной динамики была менее выраженной. Полученные результаты свидетельствуют о высокой эффективности включения фотодинамической терапии в комплексное лечение агрессивного пародонтита.

Выводы. Применение фотодинамической терапии в составе комплексного лечения пациентов с агрессивным пародонтитом обеспечивает стойкое снижение микробной нагрузки пародонтальных карманов на протяжении **трёх месяцев** наблюдения. Наиболее выраженный терапевтический эффект достигнут у пациентов молодого возраста с ювенильной формой заболевания, что подтверждает целесообразность включения фотодинамической терапии в современные схемы комплексного лечения агрессивного пародонтита.

Ключевые слова: агрессивный пародонтит, фотодинамическая терапия, микробная нагрузка, пародонтальный карман, хлорин, комплексное лечение.

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Introduction. Aggressive periodontitis is a rapidly progressive inflammatory disease of the periodontal tissues characterized by extensive destruction of the periodontal ligament and alveolar bone, leading to early tooth loss in otherwise systemically healthy individuals. Disease progression is driven by a complex interaction between a dysbiotic subgingival microbiota and an exaggerated host immune response, resulting in accelerated connective tissue degradation and osteoclastic bone resorption [1]. Owing to its rapid clinical course and high risk of irreversible periodontal destruction, aggressive periodontitis remains a major therapeutic challenge in contemporary periodontology [2]. Aggressive periodontitis is characterized by a profound imbalance between the host immune response and inflammatory effector mechanisms, resulting in rapid destruction of periodontal tissues and alveolar bone [3]. This dysregulated inflammatory response frequently contributes to accelerated disease progression and remains one of the principal causes of treatment failure [4]. Conventional treatment strategies are technically demanding, require multidisciplinary management, and often fail to achieve long-term disease control [5]. Furthermore, surgical intervention alone does not consistently provide stable clinical remission because persistent microbial colonization and immune dysregulation continue to promote disease progression. The elimination of pathogenic microorganisms from periodontal pockets represents one of the fundamental objectives of etiopathogenetic therapy [6]. Reducing the microbial burden decreases the inflammatory stimulus within periodontal tissues, thereby promoting stabilization of the periodontal environment and preservation of alveolar bone. Although systemic and locally delivered antimicrobial agents remain integral components of periodontal therapy, their long-term use is associated with increasing bacterial resistance and an elevated risk of disease recurrence and tooth loss [7].

These limitations have stimulated interest in adjunctive treatment modalities. Photodynamic therapy has emerged as a promising non-invasive approach based on the activation of a photosensitizer by light of a specific wavelength, resulting in the generation of reactive oxygen species with potent antimicrobial activity [8]. This mechanism enables selective destruction of periodontal pathogens while minimizing damage to surrounding healthy tissues [9]. Despite growing clinical interest, the effectiveness of photodynamic

therapy remains controversial. Some investigators have reported a significant reduction in microbial burden without substantial improvement in clinical periodontal indices, whereas others have demonstrated no significant advantage over conventional laser therapy [10]. Conversely, several studies have shown that photodynamic therapy provides significant clinical benefits, particularly in young patients with aggressive forms of periodontitis. Therefore, further investigation of photodynamic therapy as an adjunct to comprehensive periodontal treatment remains clinically relevant.

Aim.

The aim of the study was to evaluate the effect of adjunctive photodynamic therapy on the microbial burden of periodontal pockets in patients with aggressive periodontitis receiving comprehensive periodontal treatment.

Materials and Methods.

This prospective, randomized clinical study was conducted at Samarkand State Medical University between 2022 and 2025. Clinical study included 180 patients diagnosed with Type A aggressive periodontitis. The sample size was calculated using G*Power version 3.1 for macOS with a statistical power of 80%. The participants were stratified into two age-based study groups. Group 1 included 90 patients aged 17–25 years, whereas Group 2 comprised 90 patients aged 26–35 years. All participants received comprehensive periodontal therapy supplemented with photodynamic therapy. Group 1 consisted of 55 men (61,1%) and 35 women (38,9%), with a mean age of 18.4 ± 5.23 years. Group 2 included 53 men (58,9%) and 37 women (41,1%), with a mean age of 27.3 ± 3.18 years. The diagnosis was established according to the International Classification of Diseases, Tenth Revision, code K05.3, corresponding to chronic periodontitis with a rapidly progressive course. To establish reference values, a control group comprising 83 periodontally healthy individuals aged 18–28 years was enrolled. All participants in the control group had a fully sanitized oral cavity and no clinical or radiographic evidence of periodontal disease. The mean age was 18.1 ± 4.25 years. The control group consisted of 43 men (51,8%) and 40 women (48,2%), with a sex distribution comparable to that of the study groups.

The inclusion criteria were severe aggressive periodontitis, radiographic evidence of alveolar bone loss exceeding one-half of the root length, age between 17 and 35 years, and no previous comprehensive

periodontal treatment. Patients were excluded if they were pregnant or breastfeeding, had systemic diseases affecting periodontal status, or had received systemic antibiotics, anti-inflammatory drugs, or immunosuppressive therapy within six months before enrollment. Baseline periodontal assessment included clinical and radiographic examinations. All patients demonstrated pronounced inflammatory changes characterized by gingival hyperemia, edema, impaired tissue hydration, and periodontal pocket formation. Gingival enlargement was observed during the active phase of the disease, whereas erosive and ulcerative lesions were absent. Fibrotic gingival thickening was frequently present along the gingival margin. Clinical examination also revealed overhanging restoration margins in approximately 20–30% of patients, subgingivally positioned crowns in 15–20%, wedge-shaped cervical defects and dental caries in 25–35%, and the previous extraction of one or two teeth in most patients. Participants exhibited a neutral occlusal relationship. The Simplified Oral Hygiene Index ranged from 2.0 to 3.0, indicating poor oral hygiene. The modified Mühlemann Bleeding Index ranged from 2.0 to 2.5, corresponding to moderate or severe bleeding on probing. Periodontal pocket depth ranged from 5 to 7 mm, whereas clinical attachment loss exceeded 6 mm. Gingival recession of 2–3 mm was observed in 50–60% of patients, predominantly in the anterior region. Grade I or II tooth mobility according to the Miller classification was detected in 60–70% of participants, while Grade I or II furcation involvement was present in 20–30%, primarily affecting multirooted teeth. Bruxism and dysphagia were identified in 15 patients in Group I and in 23% of patients in Group II. Panoramic radiography was performed using the Planmeca Pro-Max imaging system. Inflammatory alveolar bone loss extending to approximately one-half of the root length was observed in 90–95% of patients. All participants underwent comprehensive nonsurgical periodontal therapy. The treatment protocol included professional mechanical plaque removal, oral hygiene instruction and reinforcement, selective occlusal adjustment, correction of defective restorations and prosthetic constructions, local antimicrobial therapy with metronidazole gel applied twice daily for ten days, systemic antimicrobial therapy consisting of amoxicillin (500 mg) combined with metronidazole (250–500 mg) three times daily for seven days, and mechanical debridement of periodontal pockets using the Vector ultrasonic system. Adjunctive photodynamic therapy was performed using the Foto-San system operating at a wavelength of 625–635 nm and an output power of 2.5 W. A 1% chlorin e6-based photosensitizer (Geleofor, Russia) was introduced into periodontal pockets and allowed to remain for five minutes. Excess gel was removed with water before irradiation. Laser activation was performed in continuous mode using a periodontal optical tip with an energy density of 6 J/cm². The procedure was repeated every two days, for a total of four treatment sessions. Microbiological analysis was performed before treatment and at one and three months after therapy. Sampling was carried out at least three hours after oral hygiene procedures to minimize the influence of recent plaque removal on microbial composition. Gingival crevicular

fluid and subgingival plaque were collected using sterile excavators from periodontal pockets or gingival sulci in four to six representative teeth from each patient. Samples were transferred onto sterile glass slides, air-dried for 24 hours, and subsequently processed in the pathology laboratory. Smears were stained using the Pappenheim panoptic staining technique after fixation with 95% methanol and 0.1% Azure II. Microbial composition was evaluated by light microscopy, and microorganisms were quantified per microscopic field. Statistical Analysis distribution was assessed using the Shapiro–Wilk test. Continuous variables are presented as the median with the interquartile range (25th–75th percentile). Comparisons among independent groups were performed using the Kruskal–Wallis test followed by Bonferroni-adjusted post hoc analysis where appropriate. Logistic regression results are reported as β coefficients with corresponding 95% confidence intervals. Statistical significance was defined as a two-sided p value of less than 0.05. Statistical analyses were performed using Stata version 14 (StataCorp LP, College Station, Texas, United States).

Results and Discussion.

The initial periodontal status is determined based on a combination of clinical data and instrumental parameters. All patients in groups I and II had clinically hyperemic (red or cyanotic) gingival mucosa, with decreased hydration in areas of inflammation due to existing edema and impaired microcirculation, particularly in areas of periodontal cysts formed during periodontitis. Most patients with aggressive periodontitis had fibrous bands or their thickening at the gingival margin. Moderate tension of the frenulum of the upper and lower lips, as well as the tongue, was present without significant pathological changes, but could contribute to gingival recession. Signs of gingival hyperplasia (growth) were noted in the active phase of the disease; erosion and ulceration were absent.

Oral examinations of patients in groups I and II revealed overhanging filling margins (in up to 20–30% of cases, respectively), which contributed to plaque accumulation and exacerbation of periodontitis. Crowns recessed subgingivally (up to 1–2 mm deep) were found in 15–20% of patients, respectively. Wedge-shaped defects and carious cavities were detected in 25–35% of patients. On average, 1–2 teeth had been extracted. Patients had a neutral bite.

Oral Hygiene Index OHI-S in groups I and II - 2.0-3.0 (poor hygiene) due to accumulation of tartar and plaque. Bleeding Index according to HR Mühlemann (1971) as modified by I. Cowell (1975): in groups I and II - 2.0-2.5 (moderate to severe bleeding on probing) [11].

Depth of the periodontal tissue: 5–7 mm in groups I and II. Loss of clinical attachment in groups I and II up to 6 mm and more. Gingival recession in groups I and II up to 2-3 mm in 50-60% of cases, especially in the area of the anterior teeth. Tooth mobility in groups I and II of grade I-II (according to the Miller classification) in 60-70% of patients. Grade I-II lesions of furcations in 20-30% of patients, especially in the area of multi-rooted teeth in groups I and II. Dysphagia and bruxism were detected in 15 patients of group I and 23% of patients of group II, which aggravated the load on the periodontium.

Orthopantomography was performed using a Planmeca ProMax system. In 90–95% of patients, inflammatory bone resorption of the interalveolar septum, extending up to half the root length, was detected.

Based on the initial periodontal assessment of patients with aggressive periodontitis, signs of severe inflammation, increased aggressive periodontitis depth, clinical attachment loss, and grade I–II tooth mobility with bone resorption up to half the root length were identified. These data serve as a benchmark for evaluating the effectiveness of the treatment.

Initially, all patients underwent professional oral hygiene, training and monitoring of individual oral hygiene, selective grinding of teeth, correction of fillings and orthopedic structures, local (applications with gel containing metronidazole for 30 minutes 2 times a day for 10 days) and systemic antibacterial therapy (amoxicillin 500 mg + metronidazole 250–500 mg 3 times a day for 7 days), periodontal pockets treatment with removal of biofilms and tartar with root polishing using the Vector device, Photodynamic therapy of periodontal pockets using the FotoSan system, with a wavelength of 625–635 nm and a power of 2.5 W was used in a course of 15 5-minute sessions. After isolating the gingival margin with cotton swabs, a 1% gel based on chlorine E6 “Geleofor” (Russia) was applied from a syringe for 5 minutes. The gel was then rinsed off and the laser was applied in continuous mode using a periodontal “arc” tip. The light dose for each session was 6 J/cm². Upon completion of the procedure, any unbound product was removed from the oral cavity with water. The procedure was repeated two days later in the same sequence on a different area, for a course of 4 sessions.

The treatment effectiveness criteria were dynamic data from clinical and microbiological studies, which were performed on all patients before treatment and after 1 and 3 months. The timing of microbiological assessment was determined in accordance with the recommendations proposed for assessing the overall microbial count and monitoring the dynamics of microflora changes in response to treatment. Intervals of 1 and 3 months allow for the evaluation of both the short-term effect of therapy and the sustainability of the achieved results, which is consistent with the standards

for assessing antimicrobial efficacy in periodontology [12]. Biomaterial sampling began at least 3 hours after oral hygiene procedures. This is in accordance with guidelines and prevents distortion of the microbial profile due to mechanical plaque removal, ensuring repopulation of the bacterial flora to a stable level suitable for reliable microscopic analysis. Using a sterile spatula/excavator #1, biomaterial was collected from the gingival crevicular ridge or gingival sulcus from each quadrant of 4–6 teeth. The periodontal pockets or gingival sulcus contents were transferred to sterile microscope slides in three swabs. The samples were dried in a sterile laboratory for 24 hours. After 24–25 hours, the dried and labeled samples were sent to the laboratory or stored in a closed, dry, sterile cabinet at room temperature for up to one month. In the pathology laboratory, panoptic staining was performed using the Pappenheim method, for which the samples were fixed with 95% CH₃OH and 0.1% Azure II as a fixative. Microorganisms in the biomaterial obtained from the periodontal pockets were assessed in the field of view.

An assessment of the microbial content in the periodontal pockets revealed an increase in their number in groups I and II by 97% and 90%, respectively (80%, $p < 0.05$). Clusters of microorganisms in the form of dense groups of cells in the field of view were detected more often in patients of group I (75%) ($p < 0.05$), in group II 67% ($p < 0.05$) (Table 1).

After performing photodynamic therapy of periodontal pockets, the content of the main microorganisms statistically significantly changed in patients of group I at all stages of the study; in patients of group II, not all indicators showed a significant decrease in indicators (cell group clusters, filamentous, mixed microorganisms, protozoa), while at all stages from the start of treatment, a significantly significant difference was revealed in intergroup comparison (Table 2, Table 3).

Assessing the microbial potential of the oral cavity allows us to evaluate not only the effectiveness of combination therapy but also predict the future course of the disease [13]. The highest number of microbial colonies is initially detected in patients with aggressive periodontitis, which is most likely due to the prolonged presence of microbial persistence foci from the moment primary teeth are replaced by permanent ones [14].

Table 1

Quantities of microorganisms

Таблица 1

Количественный состав микроорганизмов

Microorganisms	Control group	Group I	Group II	Kruskal – Wallis, p
There are microorganisms	80 (78;82)	97.0 (96;98)*	90.0 (89;92)*/**	<0.001
There are no microorganisms	12(11;14)	6.8(5;7)*	2.1(1;3)*/**	<0.001
M/org. single	40(38;43)	16.9(16;18)*	29.2(28;30)*/**	<0.001
Dense groups of cells	1(0;2)	75(73;76)*	67(65;70)*/**	<0.001
Filamentous microorganisms	50(49;52)	51(50;52)	66.1(65;70)*	0.011
Mushrooms	0(0;1)	3(2;4)*	5.1(4;7)*/**	<0.001
Mixed flora	41(40;42)	44.3(40;45)	35(32;37)*	0.049
Amoebas (protozoa)	0(0;1)	54.1(52;56)*	63.2(61;65)*/**	<0.001

* – statistically significant differences with the control group; **statistically significant differences between groups (Kruskal–Wallis test with Bonferroni correction $p < 0.05$).

* – статистически значимые отличия от контрольной группы; **статистически значимые различия между группами (критерий Краскела-Уоллиса с поправкой Бонферрони $p < 0.05$).

Table 2

Indicators of the quantitative composition of microorganisms 1 month after the start of treatment

Таблица 2

Количественный состав микроорганизмов через 1 месяц после начала лечения

Microorganisms	Control group	Group I	Group II	Kruskal – Wallis, p
There are microorganisms	80 (78;82)	76.0 (65;91)*	95.0 (89;92)*/**	<0.001
There are no microorganisms	12(11;14)	6.0(5;7)*	2.1(1;3)*/**	<0.001
M/org. single	40(38;43)	13.9(16;18)*	27.2(22;30)*/**	<0.001
Dense groups of cells	1(0;2)	70(65;76)*	65(60;70)*/**	<0.001
Filamentous microorganisms	50(49;52)	43(30;52)	62.1(60;70)*	0.011
Mushrooms	0(0;1)	1(2;4)*	4.1(4;7)*/**	<0.001
Mixed flora	41(40;42)	41.3(40;45)	33(30;37)*	0.049
Amoebas (protozoa)	0(0;1)	50.1(49;56)*	62.2(61;65)*/**	<0.001

* – statistically significant differences with the control group; **statistically significant differences in comparison between groups (criterionKruskal–Wallis with Bonferroni correctionp<0.05).

* – статистически значимые отличия от контрольной группы; **статистически значимые различия между группами (критерий Краскела-Уоллиса с поправкой Бонферрони p<0.05).

Table 3

Quantities of microorganisms 3 months after the start of treatment

Таблица 3

Количественный состав микроорганизмов через 3 месяца после начала лечения

Microorganisms	Control group	Group I	Group II	Kruskal – Wallis, p
There are microorganisms	80 (78;82)	75.0 (65;91)*	93.0 (89;92)*/**	<0.001
There are no microorganisms	12(11;14)	5.0(4;7)*	2.1(1;4)*/**	<0.001
M/org. single	40(38;43)	13.0(16;18)*	28(25;30)*/**	<0.001
Dense groups of cells	1(0;2)	50(32;76)*	64(60;70)*/**	<0.001
Filamentous microorganisms	50(49;52)	45(30;52)	62.0(60;68)*	0.011
Mushrooms	0(0;1)	1.1(1;3)*	3(4;7)*/**	<0.001
Mixed flora	41(40;42)	41.0(38;45)	30(30;37)*	0.048
Amoebas (protozoa)	0(0;1)	24(20;56)*	60(61;65)**	<0.001

* – statistically significant differences with the control group; **statistically significant differences in comparison between groups (criterionKruskal–Wallis with Bonferroni correctionp<0.05).

* – статистически значимые отличия от контрольной группы; **статистически значимые различия между группами (критерий Краскела-Уоллиса с поправкой Бонферрони p<0.05).

However, during treatment with photodynamic therapy of periodontal pockets, a positive therapeutic effect is observed due to the fact that during the photodynamic reaction, molecular oxygen dissociates into reactive ions and free radicals, providing an antiseptic and destructive effect at the site of inflammation, without significant damage to healthy tissue. This has allowed for a significant reduction in the pathogenic microbial population in the oral cavity [15].

Conclusions.

The findings of the present study demonstrate that the incorporation of photodynamic therapy into comprehensive treatment for aggressive periodontitis provides a pronounced antimicrobial effect, resulting in a significant reduction in the microbial burden of periodontal pockets and suppression of pathogenic microflora. The therapeutic effect remained stable throughout the three-month follow-up period and was most pronounced in younger patients with juvenile aggressive periodontitis. Patients with rapidly progressive forms of the disease also showed favorable microbiological changes; however, the magnitude and persistence of the therapeutic response were less pronounced. These findings indicate that, although photodynamic therapy is an effective adjunct to

comprehensive periodontal treatment, long-term disease control in rapidly progressive aggressive periodontitis may require additional therapeutic interventions and individualized maintenance protocols to achieve sustained clinical remission and prevent disease recurrence.

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ЛИТЕРАТУРА / REFERENCES

1. Yudina NA, Yakovleva-Malykh MO. Cytokine profile of gingival fluid in patients with various forms of periodontal diseases. Modern Dentistry. 2021;(2):58-62.
2. Romanov AE, Tsarev VN, Rudneva EV. Antibacterial therapy in the comprehensive treatment of periodontitis. Dentistry. 2000;(1):23-25.
3. Chawla K, Lamba AK, Verma M. Antimicrobial photodynamic therapy and erbium, chromium: yttrium-scandium-gallium-garnet laser-assisted periodontal pocket therapy for the treatment of

- aggressive periodontitis: a randomized controlled clinical trial. *World J Dent.* 2022;13(5):473-478.
DOI:10.5005/jp-journals-10015-2081
4. Schär D, Ramseier CA, Eick S, et al. Transgingival photodynamic therapy adjunctive to subgingival mechanical instrumentation in supportive periodontal therapy: a randomized controlled clinical study. *Photodiagnosis Photodyn Ther.* 2020; 32: 101971.
DOI: 10.1016/j.pdpdt.2020.101971
 5. Derikvand N, Ghasemi SS, Safiaghdam H, et al. Antimicrobial photodynamic therapy with diode laser and methylene blue as an adjunct to scaling and root planing: a clinical trial. *Photodiagnosis Photodyn Ther.* 2020;31:101818.
DOI:10.1016/j.pdpdt.2020.101818
 6. Nie X, Jiang C, Wu S, et al. Photodynamic therapy in periodontitis: a narrative review. *Photodiagnosis Photodyn Ther.* 2024;41:103257.
DOI:10.1111/phpp.12946
 7. Fekrazad R, Khoei F, Bahador A, et al. Comparison of different modes of photo-activated disinfection against *Porphyromonas gingivalis*: an in vitro study. *Photodiagnosis Photodyn Ther.* 2020;31:101818.
DOI:10.1016/j.pdpdt.2020.101818
 8. Pinheiro SL, Santos PH, Silva TL, et al. The efficiency of photodynamic therapy in the bacterial reduction of periodontal pockets: a clinical study. *Diagnostics (Basel).* 2022;12(12):3026.
DOI:10.3390/diagnostics12123026
 9. Sgolastra F, Petrucci A, Gatto R, et al. Photodynamic therapy in the treatment of chronic periodontitis: a systematic review and meta-analysis. *Lasers Med Sci.* 2013;28(2):669-682.
DOI:10.1007/s10103-012-1127-4
 10. AlAhmari F, Ahmed HB, Al-Kheraif AA, et al. Effectiveness of scaling and root planing with and without adjunctive antimicrobial photodynamic therapy in the treatment of chronic periodontitis among cigarette smokers and never-smokers: a randomized controlled clinical trial. *Photodiagnosis Photodyn Ther.* 2019;25:247-252.
DOI:10.1016/j.pdpdt.2019.01.006
 11. Gholami L, Shahabi S, Jazaeri M, et al. Clinical applications of antimicrobial photodynamic therapy in dentistry. *Front Microbiol.* 2023;13:1020995.
DOI:10.3389/fmicb.2022.1020995
 12. GaybullaeV EA. Etiotropic therapy of aggressive periodontitis: contemporary antibiotic regimens and their effectiveness. *The Bulletin of Contemporary Clinical Medicine.* 2026; 19 (1): 118-122.
DOI: 10.20969/VSKM.2026.19(1).118-122
 13. Haffajee AD, Socransky SS. Microbial etiological agents of destructive periodontal diseases. *J Periodontology.* 2016; 20(1): 36-47.
DOI: 10.1111/prd.12135
 14. Mombelli A, Cionca N, Almaghlouth A. Does adjunctive systemic antibiotic therapy reduce the recurrence of periodontitis in patients treated by mechanical debridement? A systematic review and meta-analysis. *J Clin Periodontol.* 2015; 42(Suppl 16): S104-S118.
DOI: 10.1111/jcpe.12336 26
 15. Koluboğlu S, Akalin FA. Antibiotics in the Treatment of Periodontitis: A Systematic Review of the Literature. *J Basel.* 2021; 10(11): 1312.
DOI: 10.3390/antibiotics10111312

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