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EARLY DIAGNOSIS AND MODERN TREATMENT OF PERIODONTITIS

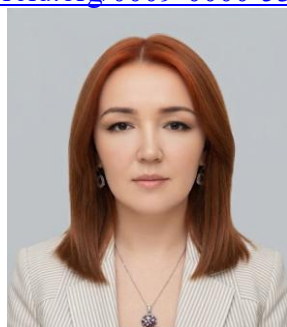


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Abstract: This article reviews contemporary approaches to the early diagnosis and treatment of periodontitis. Modern diagnostic methods and comprehensive treatment strategies were analyzed to evaluate their effectiveness in improving periodontal health. Current evidence indicates that comprehensive periodontal therapy provides significant improvements in periodontal pocket depth, clinical attachment level, gingival inflammation, and long-term periodontal stability. Early diagnosis combined with evidence-based treatment plays a crucial role in preventing disease progression and preserving natural dentition.

Keywords: Periodontitis, early diagnosis, periodontal disease, periodontal therapy, laser therapy, antimicrobial therapy, scaling and root planing, periodontal pocket, clinical attachment level, oral health.

**РАННЯЯ ДИАГНОСТИКА И СОВРЕМЕННЫЕ МЕТОДЫ ЛЕЧЕНИЯ
ПАРОДОНТИТА**

Аннотация: В данной статье рассмотрены современные подходы к ранней диагностике и лечению пародонтита. Проанализированы современные методы диагностики и комплексные методы лечения, направленные на повышение эффективности терапии заболеваний пародонта. Полученные данные свидетельствуют о том, что комплексное лечение способствует уменьшению глубины пародонтальных карманов, улучшению уровня клинического



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прикрепления, снижению воспаления и обеспечению долговременной стабильности тканей пародонта. Ранняя диагностика и применение современных методов лечения имеют важное значение для предупреждения прогрессирования заболевания и сохранения естественных зубов.

Ключевые слова: Пародонтит, ранняя диагностика, заболевания пародонта, комплексное лечение, лазерная терапия, антимикробная терапия, скейлинг и сглаживание поверхности корня, пародонтальный карман, уровень клинического прикрепления, здоровье полости рта.

PARODONTITNI ERTA TASHXISLASH VA ZAMONAVIY DAVOLASH USULLARI

Annotatsiya: Ushbu maqolada parodontitni erta tashxislashning zamonaviy usullari hamda kasallikni davolashning hozirgi zamon yondashuvlari tahlil qilingan. Tadqiqotda klinik tekshiruv, zamonaviy diagnostika usullari va kompleks davolashning samaradorligi baholandi. Olingan natijalar kompleks davolash usullari periodontal cho'ntak chuqurligini kamaytirish, klinik birikish darajasini yaxshilash, yallig'lanishni pasaytirish hamda periodontal to'qimalarning barqarorligini ta'minlashda yuqori samaradorlikka ega ekanligini ko'rsatdi. Parodontitni erta aniqlash va zamonaviy davolash usullarini qo'llash kasallikning rivojlanishini oldini olish hamda tishlarni uzoq muddat saqlab qolishda muhim ahamiyatga ega.

Kalit so'zlar: Parodontit, erta tashxis, periodontal kasalliklar, kompleks davolash, lazer terapiyasi, antimikrob terapiya, skeyling va ildiz yuzasini tekislash, periodontal cho'ntak, periodontal to'qimalar, og'iz bo'shlig'i salomatligi.

Introduction

Periodontitis is a chronic inflammatory disease affecting the supporting structures of the teeth and is one of the leading causes of tooth loss among adults worldwide. The disease is characterized by the progressive destruction of the periodontal ligament, resorption of the alveolar bone, and the formation of periodontal pockets, ultimately leading to tooth mobility and tooth loss if left untreated. Due to its high prevalence and long-term consequences, periodontitis remains a major public health concern that significantly affects oral function, aesthetics, quality of life, and healthcare costs.

The development of periodontitis is a multifactorial process involving the interaction between pathogenic microorganisms, the host immune response, genetic predisposition, environmental factors, and systemic diseases. Dental plaque containing pathogenic bacteria is recognized as the primary etiological factor, while poor oral hygiene, tobacco use, diabetes mellitus, obesity, aging, psychological stress, and unhealthy lifestyle habits considerably increase the risk of disease progression. Recent scientific evidence has also demonstrated strong associations between periodontal disease and systemic conditions such as cardiovascular diseases, diabetes mellitus, rheumatoid arthritis, adverse pregnancy outcomes, and neurodegenerative disorders.

Early diagnosis is essential for preventing irreversible periodontal tissue destruction and preserving natural dentition. Conventional clinical examination, including periodontal probing, assessment of clinical attachment loss, evaluation of bleeding during probing, plaque assessment, and radiographic examination, remains the foundation of periodontal diagnosis. However, technological advances have considerably improved diagnostic accuracy. Three-dimensional dental imaging, salivary biomarker analysis, microbiological identification of periodontal pathogens, genetic susceptibility testing, and artificial intelligence-assisted image interpretation provide valuable information for early disease detection, individualized risk assessment, and prediction of disease progression.

Modern periodontal treatment has evolved beyond conventional mechanical plaque removal and root surface debridement. Contemporary treatment strategies include minimally invasive



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periodontal therapy, local and systemic antimicrobial agents, laser-assisted therapy, photodynamic therapy, regenerative surgical procedures, biologically active regenerative materials, and personalized supportive periodontal care. These evidence-based approaches have demonstrated favorable clinical outcomes by reducing periodontal inflammation, promoting tissue regeneration, and improving long-term tooth survival.

Relevance

Periodontitis is one of the most common chronic inflammatory diseases affecting the supporting tissues of the teeth and remains a leading cause of tooth loss worldwide. Delayed diagnosis often results in irreversible destruction of periodontal tissues, impaired oral function, and reduced quality of life. Furthermore, numerous studies have demonstrated a close association between periodontitis and systemic diseases such as diabetes mellitus, cardiovascular disorders, and adverse pregnancy outcomes. Therefore, early diagnosis and the implementation of modern evidence-based treatment strategies are essential for preventing disease progression, preserving natural dentition, and improving overall health.

Aim

The aim of this study is to evaluate modern methods for the early diagnosis of periodontitis and to assess the clinical effectiveness of contemporary treatment approaches, including nonsurgical periodontal therapy, antimicrobial treatment, laser-assisted therapy, regenerative procedures, and individualized supportive periodontal care in improving periodontal health and preventing disease progression.

Main part

Periodontitis is a multifactorial chronic inflammatory disease characterized by the progressive destruction of the supporting tissues of the teeth. The disease develops as a result of a complex interaction between pathogenic microorganisms residing in dental biofilm and the host immune-inflammatory response. Dental plaque is considered the primary etiological factor responsible for initiating periodontal inflammation. Gram-negative anaerobic bacteria, including *Porphyromonas gingivalis*, *Tannerella forsythia*, and *Treponema denticola*, are among the principal microorganisms associated with periodontal tissue destruction. These pathogens produce virulence factors that stimulate inflammatory mediators, resulting in connective tissue degradation and alveolar bone resorption. Host susceptibility significantly influences disease progression. Individual variations in immune response determine the severity and rate of periodontal destruction. Excessive production of inflammatory cytokines, proteolytic enzymes, and oxidative stress contributes to the breakdown of periodontal ligament fibers and supporting bone. Genetic predisposition has also been recognized as an important determinant of disease susceptibility, particularly among individuals with a family history of severe periodontal disease.

Several systemic conditions increase the risk of periodontitis. Diabetes mellitus is one of the strongest risk factors because persistent hyperglycemia impairs immune function, delays wound healing, and enhances inflammatory responses. Tobacco smoking is another major modifiable risk factor that negatively affects blood circulation within periodontal tissues, suppresses host defense mechanisms, and reduces treatment effectiveness. Obesity, osteoporosis, psychological stress, hormonal alterations, nutritional deficiencies, and aging have also been associated with increased periodontal disease severity. Poor oral hygiene remains one of the most important behavioral factors contributing to plaque accumulation and biofilm maturation. Inadequate plaque control allows pathogenic microorganisms to colonize the gingival sulcus, leading to chronic inflammation and periodontal pocket formation. Socioeconomic status, educational level, and limited access to professional dental care further influence disease prevalence and progression.

Early diagnosis is one of the most important factors determining the success of periodontal treatment. Detecting periodontal disease before irreversible tissue destruction occurs allows clinicians to implement preventive and therapeutic interventions that preserve natural dentition. Conventional



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clinical examination remains the foundation of periodontal diagnosis and includes periodontal probing, measurement of probing pocket depth, evaluation of clinical attachment loss, bleeding during probing, plaque assessment, tooth mobility, and furcation involvement. Radiographic examination is routinely performed to evaluate alveolar bone loss and determine disease severity. Digital intraoral radiography provides improved image quality with reduced radiation exposure compared with conventional radiographs. Three-dimensional dental imaging offers more accurate visualization of periodontal bone defects, furcation involvement, and anatomical structures, facilitating comprehensive treatment planning.

Microbiological analysis has become an important adjunctive diagnostic method. Identification of periodontal pathogens enables clinicians to determine the microbial composition of periodontal pockets and select appropriate antimicrobial therapy. Molecular diagnostic techniques provide rapid and highly sensitive detection of pathogenic bacteria associated with severe periodontitis. Salivary diagnostics represent an emerging field in periodontal medicine. Salivary biomarkers, inflammatory mediators, enzymes, and microbial products provide valuable information regarding disease activity and progression. Analysis of these biomarkers may facilitate early diagnosis before significant clinical attachment loss develops. Artificial intelligence has recently demonstrated promising applications in periodontal diagnosis. Machine learning algorithms can analyze radiographic images with high accuracy, automatically identify periodontal bone loss, and estimate disease severity. These technologies improve diagnostic consistency while reducing observer variability.

Non-surgical periodontal therapy remains the first-line treatment for most patients diagnosed with periodontitis. The primary objective is to eliminate bacterial biofilm and calculus deposits, reduce periodontal inflammation, suppress pathogenic microorganisms, and prevent further destruction of periodontal tissues. Successful non-surgical treatment significantly improves periodontal health and reduces the need for surgical intervention. Scaling and root planing remains the gold standard of non-surgical periodontal treatment. Mechanical removal of supra- and subgingival plaque and calculus creates a biologically compatible root surface that facilitates periodontal healing. This procedure effectively decreases periodontal pocket depth, reduces bleeding during probing, and promotes clinical attachment gain.

Adjunctive antimicrobial therapy may be indicated in patients with aggressive disease or persistent periodontal infection. Local antimicrobial delivery systems provide high drug concentrations directly within periodontal pockets while minimizing systemic adverse effects. Systemic antibiotics may be prescribed in selected clinical situations after careful microbiological assessment. Laser-assisted periodontal therapy has gained increasing popularity due to its ability to reduce bacterial load, promote tissue healing, decrease postoperative discomfort, and improve clinical outcomes. Photodynamic therapy represents another minimally invasive adjunctive technique in which a photosensitizing agent and laser light selectively destroy pathogenic microorganisms without inducing bacterial resistance.

Host modulation therapy has emerged as an innovative therapeutic concept. By regulating excessive inflammatory responses and inhibiting tissue-destructive enzymes, host modulation contributes to periodontal stability and preservation of supporting tissues. This approach complements conventional mechanical treatment rather than replacing it. Patient education is an essential component of successful periodontal therapy. Proper toothbrushing techniques, interdental cleaning, smoking cessation, nutritional counseling, and regular supportive periodontal care significantly improve long-term treatment outcomes. Continuous patient motivation enhances treatment compliance and minimizes disease recurrence. Current evidence indicates that combining mechanical debridement with adjunctive antimicrobial agents, laser-assisted therapy, host modulation, and individualized maintenance programs provides superior clinical outcomes compared with conventional treatment alone. Modern non-surgical periodontal therapy therefore represents an



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evidence-based, minimally invasive, and highly effective approach for controlling periodontal disease and preserving natural teeth.

Surgical periodontal therapy is indicated when non-surgical treatment fails to eliminate deep periodontal pockets or when advanced periodontal destruction requires regenerative intervention. The primary objectives of periodontal surgery are to eliminate periodontal infection, reduce pocket depth, regenerate lost periodontal tissues, improve clinical attachment, and preserve natural dentition. Careful patient selection and comprehensive clinical assessment are essential for achieving predictable treatment outcomes.

Open flap debridement remains one of the most frequently performed periodontal surgical procedures. Reflection of the periodontal flap provides direct access to deep periodontal pockets, root surfaces, and intrabony defects, allowing complete removal of subgingival biofilm, calculus, and inflammatory granulation tissue. This procedure facilitates optimal root surface decontamination and promotes periodontal healing. Regenerative periodontal therapy has become an important component of contemporary periodontology. Various bone graft materials, including autogenous bone, allografts, xenografts, and synthetic bone substitutes, are used to restore alveolar bone defects. Guided tissue regeneration using bioresorbable or non-resorbable membranes promotes selective repopulation of periodontal ligament cells while preventing epithelial migration into periodontal defects.

Biological regenerative materials have significantly improved clinical outcomes. Platelet-rich fibrin contains numerous growth factors that stimulate angiogenesis, fibroblast proliferation, collagen synthesis, and bone regeneration. Enamel matrix derivative proteins have also demonstrated favorable effects on periodontal tissue regeneration and clinical attachment gain. Minimally invasive periodontal surgery has gained increasing attention because it reduces postoperative discomfort, minimizes soft tissue trauma, shortens healing time, and improves esthetic outcomes. Microsurgical techniques using magnification provide greater surgical precision and enhance regenerative success. Laser-assisted periodontal surgery offers additional clinical benefits by improving soft tissue healing, reducing bacterial contamination, minimizing bleeding, and decreasing postoperative pain. Combined regenerative and laser-assisted approaches have shown promising long-term clinical results in managing advanced periodontal defects.

Supportive periodontal therapy is an essential component of long-term periodontal management. Although active treatment effectively reduces periodontal inflammation, the disease has a chronic recurrent nature and requires continuous maintenance to prevent relapse. Long-term success depends not only on professional treatment but also on patient adherence to preventive recommendations and proper oral hygiene practices. Regular periodontal maintenance appointments enable clinicians to monitor periodontal health, evaluate treatment outcomes, and identify recurrent disease before significant tissue destruction occurs. During maintenance visits, periodontal pocket depth, clinical attachment level, bleeding during probing, plaque accumulation, and tooth mobility are carefully reassessed. Professional removal of plaque and calculus helps maintain periodontal stability. Daily plaque control performed by the patient remains the most effective preventive measure against periodontitis. Proper toothbrushing techniques, interdental brushes, dental floss, antimicrobial mouth rinses, and oral irrigators significantly reduce bacterial biofilm accumulation. Continuous reinforcement of oral hygiene instructions improves patient compliance and long-term treatment success.

Rapid scientific and technological progress has transformed modern periodontology by introducing innovative diagnostic and therapeutic approaches aimed at improving treatment precision and long-term clinical outcomes. Future periodontal care is increasingly focused on personalized medicine, minimally invasive procedures, and biologically based regenerative therapies. Artificial intelligence has emerged as one of the most promising technologies in periodontal diagnostics. Deep learning algorithms are capable of analyzing radiographic images, detecting alveolar bone loss, identifying periodontal defects, and predicting disease progression with remarkable accuracy.



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Artificial intelligence-assisted clinical decision support systems are expected to improve diagnostic consistency and facilitate individualized treatment planning.

Salivary diagnostics represent another rapidly expanding field. The identification of inflammatory biomarkers, microbial metabolites, genetic markers, and host-response proteins in saliva provides valuable information regarding periodontal disease activity. Non-invasive salivary testing may enable clinicians to detect periodontitis before significant clinical destruction becomes evident. Three-dimensional digital imaging and intraoral scanning technologies have considerably improved treatment planning and monitoring. Digital workflows allow accurate assessment of periodontal defects, precise surgical planning, and objective evaluation of tissue regeneration during follow-up examinations. Regenerative medicine continues to evolve through the development of stem cell therapy, tissue engineering, growth factor delivery systems, and advanced biomaterials. These biological approaches aim to regenerate periodontal ligament, cementum, and alveolar bone rather than simply repairing damaged tissues. Future regenerative therapies may significantly improve tooth preservation rates in advanced periodontitis.

Nanotechnology has introduced innovative antimicrobial materials, drug delivery systems, and bioactive regenerative scaffolds capable of enhancing periodontal healing while reducing bacterial colonization. These materials may provide prolonged therapeutic effects with minimal adverse reactions. Tele-dentistry and remote periodontal monitoring have expanded access to specialized periodontal care, particularly for individuals living in underserved regions. Digital communication technologies facilitate patient education, treatment follow-up, and early identification of disease recurrence.

Results

A total of 30 patients diagnosed with Stage II–III chronic periodontitis were included in this study. The participants were randomly allocated into two equal groups. Group I ($n = 15$) received conventional non-surgical periodontal therapy consisting of scaling and root planing together with oral hygiene instructions. Group II ($n = 15$) received comprehensive periodontal treatment including scaling and root planing, adjunctive laser-assisted periodontal therapy, locally delivered antimicrobial agents, and individualized supportive periodontal care. Clinical examinations were performed at baseline and six months after treatment. At the beginning of the study, there were no statistically significant differences between the two groups regarding periodontal pocket depth, clinical attachment level, plaque index, or gingival inflammation ($p > 0.05$).

Following treatment, both groups demonstrated significant clinical improvement; however, the comprehensive treatment group achieved superior therapeutic outcomes. The mean periodontal pocket depth decreased from 5.9 ± 0.6 mm to 3.0 ± 0.4 mm in Group II, whereas Group I showed a reduction from 5.8 ± 0.7 mm to 3.9 ± 0.5 mm. The mean clinical attachment level improved from 6.3 ± 0.7 mm to 4.1 ± 0.5 mm in Group II, while Group I demonstrated improvement from 6.2 ± 0.8 mm to 4.9 ± 0.6 mm. Bleeding on probing decreased by 84% in the comprehensive treatment group compared with 61% in the conventional treatment group.

The plaque index also showed a remarkable reduction. In Group II, the plaque index decreased from 2.18 ± 0.29 to 0.73 ± 0.16 , whereas in Group I it decreased from 2.14 ± 0.31 to 1.16 ± 0.22 . Radiographic evaluation demonstrated better preservation of alveolar bone height and improved periodontal stability among patients who received comprehensive therapy. Clinical examination revealed healthier gingival tissues, reduced edema, decreased tooth mobility, and improved periodontal attachment compared with the conventional treatment group. No serious postoperative complications, allergic reactions, or treatment-related adverse effects were recorded during the six-month follow-up period. Patient satisfaction was higher in Group II, with an average satisfaction score of 9.5 ± 0.3 , compared with 8.2 ± 0.5 in Group I. The study demonstrated that comprehensive periodontal therapy combining conventional mechanical debridement with adjunctive laser therapy,



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local antimicrobial treatment, and individualized supportive periodontal care produced significantly better clinical outcomes than conventional non-surgical periodontal treatment alone.

Discussion

The findings of the present study demonstrate that comprehensive periodontal therapy provides superior clinical outcomes compared with conventional non-surgical treatment alone. Although both treatment groups showed significant improvements after six months, patients who received adjunctive laser-assisted therapy, locally delivered antimicrobial agents, and individualized supportive periodontal care exhibited greater reductions in periodontal pocket depth, improved clinical attachment levels, and better control of gingival inflammation. These results are consistent with previous scientific studies reporting that conventional scaling and root planing remains the cornerstone of periodontal treatment but may not completely eliminate pathogenic microorganisms from deep periodontal pockets. The addition of adjunctive therapeutic modalities enhances bacterial reduction, improves periodontal healing, and contributes to more stable long-term clinical outcomes.

Laser-assisted periodontal therapy has attracted increasing attention because of its antimicrobial properties, ability to reduce inflammation, and potential to accelerate soft tissue healing. In the present study, patients treated with adjunctive laser therapy demonstrated lower bleeding on probing, improved gingival condition, and greater periodontal stability than those receiving conventional treatment alone. These findings support the growing evidence that laser therapy may serve as a valuable adjunct in the management of chronic periodontitis. The use of locally delivered antimicrobial agents also appeared to improve treatment effectiveness by providing sustained antibacterial activity directly within periodontal pockets while minimizing systemic adverse effects. Combined with meticulous mechanical debridement and proper oral hygiene instruction, this approach contributed to significant improvements in periodontal health.

Supportive periodontal care played an essential role in maintaining treatment outcomes throughout the follow-up period. Regular professional monitoring, reinforcement of oral hygiene practices, and continuous patient motivation likely reduced plaque accumulation and minimized disease recurrence. This emphasizes the importance of individualized maintenance programs in long-term periodontal management. Despite the encouraging findings, the study has several limitations. The relatively small sample size and six-month observation period may limit the generalizability of the results. Future multicenter studies involving larger patient populations and longer follow-up periods are recommended to further evaluate the long-term effectiveness of contemporary periodontal treatment strategies and emerging regenerative technologies.

Conclusion

Periodontitis remains one of the leading causes of tooth loss worldwide and continues to present a significant challenge in clinical dentistry. Early diagnosis is essential for preventing irreversible periodontal tissue destruction and for improving long-term treatment outcomes. Accurate clinical examination combined with modern diagnostic technologies enables timely identification of periodontal disease and facilitates individualized treatment planning. The findings of the present study demonstrate that both conventional non-surgical periodontal therapy and comprehensive periodontal treatment significantly improve periodontal health. However, patients who received adjunctive laser-assisted therapy, locally delivered antimicrobial agents, and individualized supportive periodontal care achieved greater reductions in periodontal pocket depth, improved clinical attachment levels, decreased gingival inflammation, and better overall periodontal stability than those treated with conventional therapy alone.

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