

# Optimization of the Treatment of Chronic Generalized Periodontitis in Postmenopausal Women

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**Annotation:** Chronic generalized periodontitis is a multifactorial inflammatory disease that significantly affects postmenopausal women due to estrogen deficiency, increased bone turnover, and alterations in immune response. These physiological changes exacerbate periodontal tissue destruction, alveolar bone loss, and compromise treatment outcomes. This study aims to evaluate and optimize therapeutic approaches for postmenopausal women with chronic generalized periodontitis by integrating conventional nonsurgical therapy, adjunctive local and systemic antimicrobial agents, host-modulation strategies, and regenerative periodontal procedures. Sixty postmenopausal women with moderate to severe chronic generalized periodontitis were recruited and followed for 12 months. Clinical parameters assessed included probing depth, clinical attachment level, bleeding on probing, plaque index, and gingival index. Radiographic evaluation was conducted using periapical radiographs and cone-beam computed tomography to monitor alveolar bone height and

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density. Biochemical analysis of gingival crevicular fluid quantified inflammatory cytokines including IL-1 $\beta$ , TNF- $\alpha$ , and MMP-8. Patient-centered outcomes including pain, comfort, mastication efficiency, and oral health-related quality of life were evaluated using OHIP-14 and visual analog scales. Results demonstrated that integrating scaling and root planing with local antimicrobial therapy and systemic host-modulation treatment significantly improved clinical parameters, reduced inflammatory markers, and stabilized alveolar bone compared with conventional therapy alone. Regenerative interventions such as guided tissue regeneration and enamel matrix derivative application provided further benefit in sites with localized severe bone defects. These findings emphasize that optimization of periodontal therapy in postmenopausal women requires individualized, multifactorial strategies targeting both local periodontal factors and systemic influences, combined with strict maintenance protocols and patient adherence for sustained long-term outcomes.

**Keywords:** Chronic generalized periodontitis, Postmenopausal women, Scaling and root planing, Host modulation therapy, Local antimicrobial therapy, Guided tissue regeneration, Enamel matrix derivative, Inflammatory cytokines, Alveolar bone preservation, Oral health-related quality of life.

**Introduction:** Chronic generalized periodontitis is characterized by progressive destruction of the supporting structures of teeth including gingiva, periodontal ligament, and alveolar bone. Postmenopausal women are particularly susceptible due to decreased estrogen levels, which influence bone density, inflammatory response, and tissue regeneration, contributing to more severe periodontal destruction and delayed healing. Periodontal therapy in this population presents unique challenges, necessitating approaches that address both local etiologic factors and systemic changes related to menopause. Conventional nonsurgical periodontal therapy, including scaling and root planing, is the first-line approach to reduce microbial biofilm and control inflammation. Adjunctive therapies such as locally delivered antimicrobials and systemic host-modulation agents aim to enhance therapeutic outcomes by controlling microbial load and regulating inflammatory pathways. Regenerative procedures including guided tissue regeneration and enamel matrix derivative application facilitate the restoration of periodontal structures in sites with extensive attachment loss. Understanding the interaction between hormonal status, bone metabolism, and periodontal disease progression is crucial for designing effective individualized treatment protocols. The objective of this study was to evaluate the clinical,

biochemical, radiographic, and patient-centered outcomes of combined therapeutic strategies in postmenopausal women with chronic generalized periodontitis and to establish an optimized treatment protocol for long-term periodontal stability.

**Materials and Methods:** A prospective randomized clinical study included 60 postmenopausal women aged 50–65 with moderate to severe chronic generalized periodontitis. Participants were allocated to three treatment groups: conventional nonsurgical therapy (scaling and root planing), nonsurgical therapy with adjunctive local antimicrobial therapy (chlorhexidine gel or minocycline microspheres), and nonsurgical therapy combined with systemic host-modulation agents (sub-antimicrobial dose doxycycline) and regenerative procedures for sites with localized severe defects. Clinical assessments of probing depth, clinical attachment level, bleeding on probing, plaque index, and gingival index were performed at baseline, 3, 6, and 12 months. Radiographic evaluation was carried out using periapical radiographs and CBCT to assess alveolar bone height and density. Gingival crevicular fluid was collected for ELISA-based quantification of inflammatory cytokines IL-1 $\beta$ , TNF- $\alpha$ , and MMP-8. Patient-centered outcomes were measured using OHIP-14 and visual analog scales for pain, comfort, and mastication efficiency. Statistical analysis included repeated measures ANOVA, paired t-tests, and multivariate regression to assess the efficacy of each treatment modality and identify factors associated with favorable outcomes. Ethical approval was obtained and all participants provided informed consent prior to inclusion in the study.

**Materials:** 1. Ultrasonic scalers with titanium and stainless-steel tips for effective calculus removal, sterilized and maintained in instrument cassettes. 2. Manual periodontal instruments including Gracey curettes and universal scalers for precise subgingival debridement, sterilized and stored in protective trays. 3. Local antimicrobial agents such as 2% chlorhexidine gel and minocycline microspheres for targeted biofilm suppression, stored according to manufacturer recommendations. 4. Systemic host-modulation therapy using sub-antimicrobial dose doxycycline capsules, stored under controlled temperature conditions. 5. Resorbable collagen membranes for guided tissue regeneration, preserved in sterile packaging to maintain structural integrity. 6. Enamel matrix derivative for regenerative application, refrigerated to retain bioactivity. 7. Cone-beam computed tomography (CBCT) system calibrated for precise radiographic assessment of alveolar bone morphology. 8. Standardized periodontal probes with millimeter markings for reproducible clinical measurements, sterilized after each use. 9. ELISA kits for quantification of gingival crevicular fluid cytokines IL-1 $\beta$ , TNF- $\alpha$ , and MMP-8, stored refrigerated. 10. Patient-reported outcome measurement instruments including OHIP-14 questionnaires and visual analog scales, digitally stored and coded for longitudinal analysis.

**Results:** All treatment groups exhibited improvement in clinical periodontal parameters after 12 months. Scaling and root planing combined with local antimicrobial therapy resulted in greater reductions in probing depth and bleeding on probing compared with conventional therapy alone. Adjunctive systemic host-modulation therapy further improved clinical attachment levels and reduced inflammatory cytokine levels. Radiographic assessment revealed alveolar bone stabilization in regenerative sites, while non-regenerative sites maintained baseline bone height without further loss. Patient-centered outcomes demonstrated enhanced comfort, mastication efficiency, and oral health-related quality of life, with the highest scores in participants receiving combined host-modulation and regenerative therapy. Statistical analysis confirmed significant correlations between adjunctive interventions and improved clinical, biochemical, and radiographic outcomes. Patient compliance and adherence to oral hygiene protocols were positively associated with long-term treatment success.

**Discussion:** Postmenopausal estrogen deficiency contributes to increased susceptibility to periodontal tissue destruction, altered bone metabolism, and impaired healing capacity, necessitating optimization of treatment protocols. Conventional nonsurgical therapy effectively reduces biofilm and inflammation, but adjunctive local antimicrobials enhance microbial control, while host-modulation therapy addresses dysregulated inflammatory response. Regenerative

techniques restore lost attachment and alveolar bone, improving functional and esthetic outcomes. Integrated, individualized treatment planning considering systemic hormonal influences, local periodontal conditions, and patient adherence is essential for sustained periodontal stability. Patient education, continuous monitoring, and structured maintenance care further optimize long-term outcomes and prevent recurrence of disease. Early identification of high-risk postmenopausal patients allows for timely intervention and improved prognosis.

**Conclusion:** Effective management of chronic generalized periodontitis in postmenopausal women requires a comprehensive approach combining conventional nonsurgical therapy, adjunctive antimicrobial and host-modulation strategies, and regenerative interventions for localized severe defects. Tailoring treatment plans based on hormonal status, systemic health, and individual clinical presentation enhances periodontal stability, reduces inflammatory activity, preserves alveolar bone, and improves patient-reported outcomes. Structured maintenance therapy and patient adherence are critical to achieving long-term success. Optimized multifactorial protocols provide a framework for evidence-based, patient-centered care, ensuring functional preservation, improved quality of life, and sustained periodontal health in postmenopausal women.

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