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Radiographic Bone Fill in Molar Furcations Following Nonsurgical Treatment of Stage III, Grade C Periodontitis: A Four-Year Follow-Up Case Report

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Abstract

Stage III, grade C periodontitis is characterized by severe periodontal tissue destruction and a high risk of disease progression. Although nonsurgical periodontal therapy is effective in controlling periodontal inflammation, radiographic bone fill in advanced periodontal defects, particularly in molar furcation regions, represents a clinically relevant outcome. This case report describes the clinical and radiographic outcomes of nonsurgical periodontal treatment performed exclusively with piezoelectric ultrasonic instrumentation in a 28-year-old female patient diagnosed with stage III, grade C periodontitis. Treatment consisted of full-mouth ultrasonic subgingival instrumentation combined with adjunctive systemic amoxicillin and metronidazole, followed by regular supportive periodontal therapy (SPT). At baseline, the mean probing pocket depth (PPD) was 4.8 mm, with a plaque score of 86% and bleeding on probing (BOP) of 82%. At the two-year reevaluation, the mean PPD decreased to 2.0 mm, while the plaque and BOP scores declined to 14% and 19%, respectively. At the three-year reevaluation, these improvements were largely maintained, with a mean PPD of 2.1 mm, a plaque score of 6%, and BOP of 7%. Comparative intraoral radiographs obtained at baseline and approximately 31 months after the initial presentation suggested bone fill in selected posterior periodontal defects, including regions adjacent to molar furcations, without surgical intervention. These findings suggest that exclusively ultrasonic subgingival instrumentation, as part of a comprehensive nonsurgical treatment approach incorporating adjunctive systemic antibiotics and sustained supportive periodontal care, may be associated with substantial clinical improvement and favorable radiographic bone changes in advanced periodontitis. However, radiographic bone fill does not establish true periodontal regeneration, and the contribution of individual treatment components cannot be determined from a single case.

Categories: Radiology, Medical Education, Dentistry
Keywords: grade c periodontitis, molar furcation involvement, nonsurgical periodontal therapy, scaling and root planing, stage 3, supportive periodontal therapy

Introduction

Periodontitis is a chronic multifactorial inflammatory disease associated with dysbiotic dental biofilms and characterized by the progressive destruction of tooth-supporting tissues, including the periodontal ligament and alveolar bone. According to the 2018 classification of periodontal and peri-implant diseases, stage III periodontitis is characterized by severe periodontal attachment loss and may involve deep periodontal pockets, vertical bone defects, and molar furcation involvement. Grade C indicates evidence of rapid disease progression or an elevated risk of future progression. These characteristics present considerable therapeutic challenges, particularly when advanced periodontal destruction involves multirooted teeth [1].

Nonsurgical periodontal therapy, primarily based on subgingival instrumentation and biofilm disruption, represents a cornerstone of periodontal treatment. Its principal objectives are to reduce periodontal inflammation, decrease probing pocket depths (PPDs), and establish favorable conditions for periodontal healing. The European Federation of Periodontology (EFP) S3-level clinical practice guideline recommends a stepwise therapeutic approach incorporating risk-factor control, subgingival instrumentation, periodontal reassessment, and supportive periodontal therapy (SPT). Adjunctive systemic antibiotics may be considered in selected clinical circumstances, although their routine administration is not recommended [2]. The management of advanced periodontal defects, particularly those involving molar furcations, remains challenging because of complex root anatomy and limited accessibility for effective subgingival instrumentation. Surgical procedures, including regenerative or resective approaches depending on defect morphology and clinical characteristics, may be considered for selected periodontal defects. Nevertheless, nonsurgical periodontal approaches offer the advantages of reduced invasiveness, preservation of periodontal tissues, and avoidance of surgical morbidity while providing substantial improvements in PPD and periodontal inflammation. Surgical treatment may provide improved access to deep and anatomically

complex defects, including molar furcations. Regenerative procedures may offer additional clinical attachment gains in appropriately selected intrabony defects, whereas resective approaches may facilitate access and plaque control in selected anatomically complex sites. Consequently, treatment selection should consider defect morphology, anatomical accessibility, expected clinical benefits, and individual patient-related factors [2,3].

Recent investigations have highlighted the potential of nonsurgical periodontal instrumentation to produce not only improvements in clinical inflammatory parameters but also favorable radiographic changes in periodontal bone defects. Reported outcomes include reductions in PPD, clinical attachment gains, and radiographically detectable bone fill. Ultrasonic instrumentation, using inserts of different dimensions and angulations, may facilitate access to anatomically challenging periodontal sites, including molar furcation regions. Nevertheless, radiographic bone fill must be distinguished from true periodontal regeneration, which requires the formation of new cementum, periodontal ligament, and alveolar bone [4].

The present case report describes the clinical and radiographic outcomes of nonsurgical periodontal treatment performed exclusively with piezoelectric ultrasonic instrumentation, without manual periodontal instruments or surgical intervention, in a patient diagnosed with stage III, grade C periodontitis. Treatment included adjunctive systemic amoxicillin and metronidazole, followed by regular SPT. Particular attention is given to the apparent radiographic bone fill observed in posterior periodontal defects, including regions adjacent to molar furcations, and to the sustained clinical improvements documented during longitudinal follow-up. The report aims to illustrate the clinical and radiographic outcomes of nonsurgical periodontal therapy performed exclusively with piezoelectric ultrasonic instrumentation, without the use of manual periodontal instruments, while emphasizing the importance of SPT and cautious interpretation of radiographic findings.

Case Presentation

On day 1, a 28-year-old female patient presented to San Damiano Dental Clinic, Rome, Italy, for a comprehensive periodontal evaluation. Her medical history was unremarkable, with no reported systemic diseases or medical conditions known to affect periodontal health. At baseline, the patient reported smoking approximately two to three cigarettes per day (fewer than 10 cigarettes daily) and described excellent oral hygiene habits. Smoking was recognized as a relevant periodontal risk factor. During the subsequent follow-up period, she stopped smoking but experienced occasional relapses.

The patient did not report any oral discomfort, pain, or gingival bleeding during toothbrushing. However, she stated that during a routine professional dental cleaning appointment, her dental hygienist had identified the presence of periodontal pockets and recommended a specialized periodontal evaluation. The patient was subsequently referred to our clinic for further diagnostic assessment.

At the initial visit (day 1), a panoramic radiograph was obtained as part of the diagnostic assessment, considering the patient's clinical presentation, suspected periodontal disease, and lack of previous panoramic imaging. The examination provided an overview of the dentition and alveolar bone structures, revealing periodontal bone loss and bilateral impacted mandibular third molars. Subsequent radiographic examinations were selected according to specific diagnostic and follow-up needs, with the aim of minimizing unnecessary radiation exposure in accordance with the as low as diagnostically acceptable (ALADA) principle (Figure *1*).



FIGURE 1: Panoramic radiograph obtained at the initial examination (day 1), providing an overview of the dentition and alveolar bone structures

The image reveals localized alveolar bone loss, with more pronounced periodontal destruction in the posterior regions. Bilateral impacted mandibular third molars are also visible. Given the inherent limitations of panoramic radiography in assessing interproximal bone defects and molar furcation involvement, a full-mouth intraoral radiographic examination, including periapical and bitewing radiographs, was performed to provide a more detailed evaluation of periodontal bone loss.

The panoramic radiograph provided an overall view of the dentition and suggested localized alveolar bone loss, with more pronounced periodontal destruction in the posterior regions. Given the inherent limitations of panoramic imaging in assessing periodontal bone defects and molar furcation involvement, a full-mouth intraoral radiographic examination was performed on day 1. The series consisted of 14 periapical and four bitewing radiographs, providing a more detailed assessment of periodontal destruction. These images demonstrated generalized alveolar bone loss, particularly affecting the posterior teeth, with interproximal bone defects and radiographic evidence of molar furcation involvement. These regions were subsequently monitored to assess radiographic changes following nonsurgical periodontal therapy (Figure *2*).

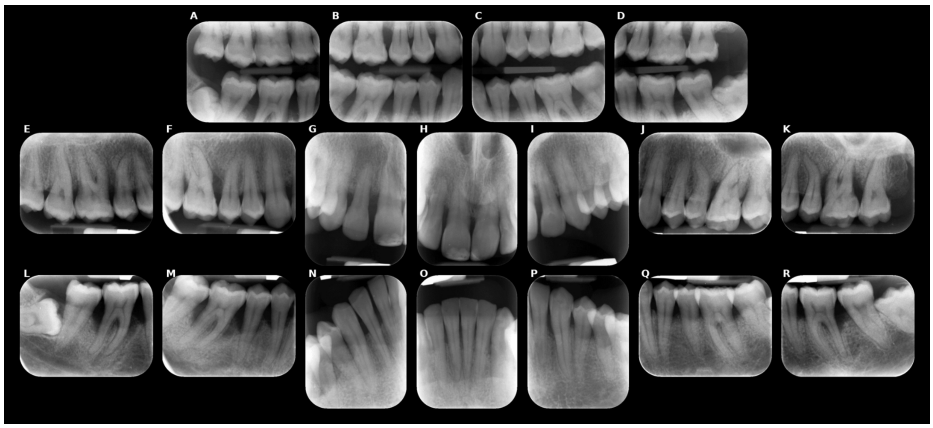


FIGURE 2: Full-mouth intraoral radiographic series obtained at the initial examination (day 1), consisting of 14 periapical and four bitewing radiographs (panels A-R)

Panels A-D represent the four posterior bitewing radiographs. Panels E-K represent the seven maxillary periapical radiographs, arranged sequentially from posterior to anterior and back to posterior regions. Panels L-R represent the seven mandibular periapical radiographs, similarly arranged from posterior to anterior and back to posterior regions.

The radiographs demonstrate generalized alveolar bone loss, with particularly pronounced periodontal destruction in the posterior regions. Findings include interproximal osseous defects and radiographic evidence suggestive of molar furcation involvement, particularly in the right posterior regions (panels A, B, E, F, L, and M) and left posterior regions (panels C, D, J, K, Q, and R).

Periodontal assessment, treatment, and follow-up

On day 36 (week 6) following the initial presentation, a comprehensive periodontal examination was performed, including full-mouth periodontal charting. The assessment revealed generalized periodontal inflammation and multiple deep periodontal pockets, with probing depths reaching 12 mm and class II and III molar furcation involvement. The mean PPD was 4.8 mm, with a plaque score of 86% and bleeding on probing (BOP) of 82%, indicating substantial plaque accumulation and widespread gingival inflammation despite the absence of subjective symptoms.

The clinical and radiographic findings supported a diagnosis of stage III, grade C periodontitis, according to the 2018 classification of periodontal and peri-implant diseases [1]. The stage III classification was supported by the severity and complexity of periodontal destruction, including PPDs reaching 12 mm and class II and III molar furcation involvement, irrespective of the mean full-mouth PPD of 4.8 mm. Grade C was supported by the extent of radiographic bone destruction relative to the patient's age of 28 years, consistent with the bone loss-to-age criterion described in the 2018 classification [1]. The baseline full-mouth periodontal examination documented the distribution and severity of periodontal pockets and provided reference measurements for subsequent longitudinal evaluations.

Nonsurgical periodontal treatment was performed in two sessions, on day 36 (week 6) and day 43 (week 7), involving all six periodontal sextants. Subgingival instrumentation was carried out exclusively using a piezoelectric ultrasonic device (Multipiezo, Mectron S.p.A., Carasco, Italy), equipped with the Perio Treatment insert set (P2, P3, P15, P16R, and P16L). No manual periodontal instruments, including hand curettes or scalers, were used during either treatment session. The first session involved the first, second, and third sextants, while the remaining three sextants were treated during the second session.

Adjunctive systemic antibiotic therapy was initiated on day 36 (week 6), concurrently with the first ultrasonic instrumentation session. The regimen consisted of oral amoxicillin (Zimox; Pfizer Italia S.r.l., Latina, Italy), administered at a dose of 1 g every eight hours, and oral metronidazole (Flagyl; Teofarma S.r.l., Valle Salimbene, Italy), administered at a dose of 500 mg every eight hours (two 250 mg tablets per dose). Antibiotic treatment was completed on day 43 (week 7), after eight calendar days of therapy.

Following completion of active periodontal treatment, the patient was enrolled in a structured SPT program. The first maintenance appointment was performed on day 68 (week 10). Subsequent maintenance visits were initially scheduled at approximately two-month intervals and later extended to approximately three-month intervals according to the patient's periodontal condition and clinical response.

At month 25, approximately two years after the initiation of nonsurgical periodontal therapy, the patient underwent a comprehensive periodontal reevaluation. Following exclusively piezoelectric ultrasonic subgingival instrumentation, adjunctive systemic antibiotic therapy with amoxicillin and metronidazole, and regular SPT, a marked improvement in periodontal clinical parameters was observed. The mean PPD decreased from 4.8 mm at baseline to 2.0 mm, while the mean clinical attachment level (CAL), as recorded by the periodontal charting software, changed from −5.2 mm to −2.4 mm. Furthermore, the plaque score decreased substantially from 86% to 14%, and BOP was reduced from 82% to 19%.

The marked reduction in probing depths and inflammatory indices reflected a favorable clinical response to nonsurgical periodontal treatment, despite the severity of the initial periodontal destruction. These findings also highlighted the importance of continued supportive periodontal care in maintaining the clinical improvements achieved during active treatment.

A comparative radiographic assessment was performed using intraoral radiographs obtained at baseline (day 1) and during follow-up at month 31, approximately 30 months after the initiation of nonsurgical periodontal therapy. Comparison of corresponding posterior regions suggested favorable radiographic changes, characterized by an apparent increase in alveolar bone radiopacity and partial filling of previously identified interproximal osseous defects. These changes were particularly noticeable in selected posterior sites, where the follow-up images suggested increased radiographic bone support adjacent to molar roots, including regions of furcation involvement.

The radiographic findings were consistent with the substantial clinical improvements documented during the periodontal reevaluation at month 25, including reductions in mean PPD, plaque accumulation, and BOP. Notably, these favorable clinical and radiographic changes occurred following exclusively piezoelectric ultrasonic subgingival instrumentation combined with adjunctive systemic antibiotic therapy and regular SPT, without periodontal surgical intervention.

Although differences in radiographic projection and angulation may influence the apparent bone levels and radiopacity, the comparative images suggest radiographic bone fill in selected posterior periodontal defects. These observations support a favorable periodontal response to comprehensive nonsurgical treatment but do not constitute histological evidence of true periodontal regeneration (Figure 3).



FIGURE 3: Comparative intraoral radiographs obtained at baseline (day 1, upper row) and at month 31 (lower row), approximately 30 months after the initiation of nonsurgical periodontal therapy

Each radiograph is identified by a unique panel letter (A-H). Panels A and E show the maxillary right first molar (tooth 16); panels B and F show the mandibular right first molar (tooth 46); panels C and G show the maxillary left first molar (tooth 26); and panels D and H show the mandibular left first molar (tooth 36). Panels A-D represent the baseline examination (day 1), while panels E-H represent the corresponding follow-up examination (month 31).

A further comprehensive periodontal reevaluation was performed at month 38, approximately three years after the initial nonsurgical treatment. The examination documented the maintenance of the clinical improvements observed at month 25, with a mean PPD of 2.1 mm, compared with 4.8 mm at baseline and 2.0 mm at the previous reevaluation. The mean CAL, as reported by the periodontal charting software, was −2.5 mm, while the plaque and BOP scores had further decreased to 6% and 7%, respectively. Although isolated residual probing depths of up to 5 mm were recorded, the overall periodontal condition remained favorable, without evidence of generalized recurrence of deep periodontal pockets.

Particular attention was directed toward the posterior molar regions, where the initial clinical and radiographic examinations had documented advanced periodontal destruction and furcation involvement. Comparison of the baseline radiographs obtained on day 1 with those obtained at month 31 suggested increased radiopacity and apparent bone fill in selected interproximal defects and regions adjacent to molar furcations. These radiographic changes were accompanied by sustained reductions in probing depths and periodontal inflammatory indices, as documented at the subsequent reevaluation at month 38. However, because standardized site-specific horizontal and vertical furcation measurements were not consistently available across all examinations, a definitive reduction in furcation involvement could not be established. The findings therefore suggest favorable clinical outcomes and radiographic changes in anatomically challenging posterior regions rather than confirmed anatomical resolution of the furcation defects.

The longitudinal changes in periodontal clinical parameters recorded at baseline (day 36, week 6), at the two-year reevaluation (month 25), and at the three-year reevaluation (month 38) are summarized in Table *1*. These findings demonstrate substantial improvements in PPD, plaque control, and BOP following nonsurgical periodontal therapy and continued supportive periodontal care.

Clinical parameter	Baseline (day 36, week 6)	2-year follow-up (month 25)	3-year follow-up (month 38)
Mean PPD (mm)	4.8	2	2.1
Mean CAL (mm)*	−5.2	−2.4	−2.5
Plaque score (%)	86	14	6
BOP (%)	82	19	7

TABLE 1: Longitudinal changes in full-mouth periodontal chart parameters from pretreatment baseline to follow-up assessments

*Mean CAL indicates that CAL values are reported according to the original periodontal charting software conventions. Changes in these values should not be interpreted as direct evidence of true periodontal regeneration.

PPD: probing pocket depth; CAL: clinical attachment level; BOP: bleeding on probing; SPT: supportive periodontal therapy

The patient remains enrolled in a structured SPT program at San Damiano Dental Clinic, with maintenance appointments currently scheduled approximately every three months. Throughout the follow-up period, she has demonstrated good adherence to scheduled visits and sustained motivation, supported by continuous professional guidance, individualized oral hygiene instructions, and preventive care provided by the clinic's dental hygienists. Despite occasional smoking relapse and minor fluctuations in plaque control, her overall periodontal condition has remained clinically favorable, without clinically documented evidence of generalized periodontal recurrence.

At the most recent documented maintenance appointment at month 51, approximately four years after the initial nonsurgical treatment, periodontal status was assessed through direct clinical examination and periodontal probing during SPT. The clinical findings were compared with those documented at previous periodontal reevaluations, and no clinically significant changes were identified during this examination. The findings were therefore considered consistent with continued clinical stability, with satisfactory oral hygiene and localized gingival bleeding in some mandibular regions. However, no additional standardized full-mouth periodontal measurements comparable to those obtained at months 25 and 38 were recorded.

The sustained clinical improvement, together with the radiographic changes observed in posterior periodontal defects and regions adjacent to molar furcations, highlights the importance of continued SPT, patient adherence, and ongoing monitoring of periodontal risk factors in maintaining favorable outcomes following nonsurgical treatment.

Discussion

The present case report describes substantial clinical improvement and favorable radiographic changes following nonsurgical periodontal treatment in a patient diagnosed with stage III, grade C periodontitis. The most noteworthy finding was the apparent radiographic bone fill observed in posterior periodontal defects, including regions adjacent to molar furcations, without surgical intervention. These outcomes followed exclusively piezoelectric ultrasonic subgingival instrumentation, adjunctive systemic antibiotic therapy, and regular SPT. Although advanced periodontal destruction presents significant therapeutic challenges, these observations suggest that comprehensive nonsurgical management may be associated with favorable clinical and radiographic outcomes in selected patients, particularly when followed by sustained professional maintenance and effective plaque control [2,4].

Clinical response to nonsurgical periodontal therapy

The clinical response observed in this patient was particularly favorable considering the severity of the initial periodontal condition. Mean PPD decreased from 4.8 mm at baseline to 2.0 mm at the month 25 reevaluation, while plaque scores decreased from 86% to 14% and BOP decreased from 82% to 19%. These improvements were largely maintained at the month 38 reevaluation, when the mean PPD was 2.1 mm, the plaque score was 6%, and BOP was 7%. The sustained reduction in probing depths and inflammatory indices indicates a favorable response to nonsurgical treatment and subsequent periodontal maintenance, consistent with the established effectiveness of subgingival instrumentation in the management of advanced periodontitis [2].

An additional finding was the change in mean CAL, as recorded by the periodontal charting software, from −5.2 mm at baseline to −2.4 mm at month 25 and −2.5 mm at month 38. Although these measurements suggest favorable changes in periodontal clinical parameters, their interpretation requires consideration of the software's recording conventions. Furthermore, reductions in probing depth may result from decreased

gingival inflammation, soft-tissue shrinkage, and clinical attachment improvement rather than complete restoration of previously destroyed periodontal tissues.

A distinctive feature of the present treatment protocol was the exclusive use of piezoelectric ultrasonic instrumentation, employing periodontal inserts of different sizes and angulations to facilitate access to deep periodontal pockets and anatomically complex regions, particularly molar furcations, without the use of manual periodontal scalers or curettes. Comprehensive subgingival instrumentation was completed during two sessions, treating all six periodontal sextants. This approach is of particular clinical interest because access to deep periodontal pockets and anatomically complex posterior regions may represent a significant challenge during nonsurgical instrumentation. Although minimally invasive nonsurgical periodontal techniques have demonstrated promising outcomes in intrabony defects, the present treatment should not automatically be classified as a formal minimally invasive nonsurgical therapy (MINST) protocol, since the procedural characteristics required for that designation were not specifically documented [4].

The initial treatment was supplemented with systemic amoxicillin and metronidazole, administered concurrently with ultrasonic subgingival instrumentation. Adjunctive systemic antibiotics may provide additional clinical benefits in selected patients with severe periodontal disease; however, their routine administration is not recommended by the EFP because of potential adverse effects and concerns regarding antimicrobial resistance. Consequently, the favorable response observed in this patient cannot be attributed exclusively to ultrasonic instrumentation or antibiotic administration. Rather, the outcome should be interpreted as the result of a comprehensive therapeutic approach incorporating mechanical biofilm disruption, adjunctive antimicrobial treatment, and sustained supportive periodontal care [2].

Radiographic bone fill and molar furcation involvement

The radiographic findings represent the most distinctive aspect of this report. Comparison of the baseline intraoral radiographs obtained on day 1 with those acquired at month 31 suggested favorable changes in selected posterior periodontal defects, including an apparent reduction in interproximal defect dimensions and increased radiopacity in regions adjacent to molar roots and furcations. These observations were accompanied by substantial clinical improvements and occurred without periodontal surgical or regenerative procedures. Although the radiographic appearance suggests partial bone fill, the magnitude of these changes cannot be precisely established without standardized quantitative radiographic measurements.

Radiographic bone fill following nonsurgical periodontal treatment has been described in previous investigations, particularly in studies evaluating minimally invasive subgingival instrumentation. Ribeiro et al. reviewed the potential benefits of minimally invasive nonsurgical approaches and highlighted favorable clinical outcomes in intrabony periodontal defects, including PPD reduction, clinical attachment gains, and radiographic improvements in defect morphology [4]. Although the extent of periodontal healing may depend on defect configuration, treatment approach, and individual biological factors, these findings support the possibility of radiographically detectable changes in osseous defects following effective nonsurgical periodontal instrumentation [4].

Molar furcation involvement represents a particularly challenging aspect of advanced periodontal disease because of complex root anatomy, restricted access for instrumentation, and difficulties in maintaining adequate plaque control. These anatomical characteristics may influence both treatment outcomes and long-term tooth prognosis. Nevertheless, furcation involvement does not necessarily imply an unfavorable prognosis or an inevitable need for tooth extraction. In a systematic review and meta-analysis, Nibali et al. demonstrated that molars with furcation involvement have an increased risk of tooth loss compared with those without furcation involvement, while also reporting that many affected molars can be successfully retained following appropriate periodontal treatment and supportive care [5].

In the present case, the apparent radiographic improvement in selected molar furcation regions is particularly noteworthy because it followed exclusively nonsurgical periodontal management. However, radiographic bone fill adjacent to a furcation cannot be interpreted as definitive evidence of reduced clinical furcation involvement. Such confirmation would require standardized, site-specific horizontal and, where appropriate, vertical furcation measurements obtained at baseline and during subsequent evaluations. Therefore, the observed changes should be described as apparent radiographic bone fill in regions adjacent to molar furcations rather than complete anatomical resolution of the furcation defects.

Importance of SPT

The favorable clinical course observed in this patient was accompanied by sustained participation in a structured SPT program. Maintenance appointments were initially performed predominantly at approximately two-month intervals and subsequently adapted according to the patient's periodontal condition, with the current schedule consisting of approximately three-month intervals. Throughout follow-up, the patient demonstrated good adherence to scheduled appointments and received continuous oral hygiene reinforcement, professional monitoring, and motivational support from the clinic's dental hygienists.

The importance of regular SPT has been demonstrated by Lee et al., who reported a lower risk of tooth loss among patients adhering to periodontal maintenance compared with those exhibiting irregular compliance [6]. These findings emphasize that long-term periodontal outcomes depend not only on the effectiveness of initial treatment but also on sustained professional monitoring and patient cooperation [6].

In the present patient, the substantial reduction in periodontal inflammatory indices was maintained over successive reevaluations, despite occasional fluctuations in oral hygiene conditions. BOP decreased from 82% at baseline to 19% at month 25 and 7% at month 38, while mean PPD remained close to 2 mm during both follow-up examinations. These findings indicate sustained overall clinical improvement rather than complete elimination of periodontal risk. Regular reassessment, personalized plaque-control instructions, and timely management of residual periodontal inflammation remain essential for maintaining favorable outcomes, particularly in patients with a history of severe periodontal destruction. This approach is consistent with the EFP guidelines, which identify supportive periodontal care as an integral component of comprehensive periodontal treatment [2].

Smoking as a modifying risk factor

Smoking is an established risk factor for periodontal disease progression and may adversely influence the response to periodontal treatment. In a systematic review and meta-analysis, Chang et al. reported that smokers generally experience less favorable clinical improvements following nonsurgical periodontal therapy than nonsmokers, including smaller reductions in PPD and lower clinical attachment gains [7]. These observations reinforce the importance of smoking cessation counseling as an essential component of periodontal risk-factor management [7].

The patient was a light smoker at baseline, reporting fewer than 10 cigarettes per day, and subsequently experienced intermittent smoking relapse during the maintenance period. Despite this exposure, periodontal inflammatory indices remained substantially improved compared with baseline, without documented generalized recurrence of deep periodontal pockets at the available reevaluations. Nevertheless, these observations should not be interpreted as evidence that intermittent smoking has negligible periodontal consequences. Rather, they emphasize the importance of continued smoking cessation counseling, individualized supportive periodontal care, and patient motivation in individuals at increased risk of periodontal disease progression [2,7].

Radiographic findings in the context of current evidence

Recent systematic evidence provides further support for radiographically detectable bone changes following nonsurgical periodontal treatment. Lipovec et al., in a systematic review and meta-analysis including 46 studies, investigated radiographic changes in periodontal bone defects following nonsurgical therapy [8]. The authors reported reductions in radiographic defect depth and evidence of bone fill, including findings involving class II furcation defects. Although minimally invasive nonsurgical approaches generally demonstrated greater radiographic improvements than conventional treatment protocols, the evidence was characterized by substantial heterogeneity and low certainty, highlighting the need for additional controlled investigations [8].

A particularly relevant clinical observation was reported by El Mobadder et al. in a case report published in Cureus, describing the nonsurgical management of mandibular molar furcation involvement through minimally invasive periodontal instrumentation combined with photoactivated disinfection [9]. Their treatment protocol incorporated both manual and ultrasonic instrumentation, and the authors documented a reduction in PPD from 7 to 3 mm, accompanied by radiographic changes suggestive of bone repair after six months [9].

Unlike the protocol described by El Mobadder et al., the present case employed exclusively piezoelectric ultrasonic instrumentation, without manual periodontal instruments or adjunctive photoactivated disinfection [9]. Treatment was combined with systemic amoxicillin and metronidazole, followed by sustained SPT. The clinical improvements were maintained over successive periodontal reevaluations, while comparative radiographs obtained at month 31, approximately 30 months after the initiation of treatment, suggested bone fill in selected posterior periodontal defects, including regions adjacent to molar furcations. Nevertheless, differences in treatment protocols, adjunctive interventions, and follow-up duration preclude direct comparisons of therapeutic effectiveness or conclusions regarding the superiority of either approach.

The clinical relevance of these findings is further supported by Peeran et al., who reviewed the anatomical, diagnostic, and therapeutic challenges associated with molar furcation involvement [10]. Their analysis emphasized the importance of accurate furcation assessment, individualized treatment planning, and long-term periodontal maintenance in determining the prognosis of multirooted teeth [10].

In this context, the sustained clinical improvement and apparent radiographic bone fill observed in the present patient suggest that comprehensive nonsurgical periodontal therapy may represent a valuable initial therapeutic approach in selected patients with furcation-associated periodontal defects, provided that careful clinical reassessment and regular supportive periodontal care are maintained.

Nevertheless, radiographic bone fill must be clearly distinguished from true periodontal regeneration. An apparent increase in radiopacity or reduction in radiographic defect dimensions cannot demonstrate the formation of new cementum, periodontal ligament, and functionally organized alveolar bone. Furthermore, differences in radiographic projection, angulation, and exposure may influence the apparent morphology and density of osseous structures. Accordingly, the changes observed in the present report should be interpreted as radiographic findings suggestive of bone fill rather than histological evidence of periodontal regeneration [4,8].

Clinical implications

The findings suggest that advanced periodontal destruction, including molar furcation involvement, does not necessarily preclude a favorable response to nonsurgical periodontal treatment. Exclusively ultrasonic subgingival instrumentation, combined with adjunctive systemic antibiotic therapy and sustained supportive periodontal care, was followed by substantial reductions in periodontal inflammatory indices and favorable radiographic changes in selected posterior defects. However, the observations do not establish the independent effectiveness or superiority of ultrasonic instrumentation over conventional manual approaches, nor do they eliminate the potential need for periodontal surgery in other clinical circumstances. Treatment decisions should remain individualized and guided by residual PPDs, BOP, anatomical defect characteristics, furcation involvement, and the patient's overall periodontal risk profile [2].

Periodontal charting and longitudinal clinical assessment

Standardized periodontal charting plays an important role in documenting disease severity, evaluating treatment outcomes, and monitoring periodontal stability during long-term supportive care. In the present case, comprehensive full-mouth periodontal examinations performed at pretreatment baseline (day 36), month 25, and month 38 allowed longitudinal comparison of clinical parameters and provided objective documentation of the patient's response to nonsurgical periodontal therapy. The clinical measurements were recorded using Periodontal Chart Online, developed by Ramseier, which facilitated the systematic documentation of site-specific periodontal parameters, including PPD, gingival margin position, BOP, plaque accumulation, tooth mobility, and furcation involvement [11]. The longitudinal changes in the principal clinical parameters are summarized in Table *1*. Although the original full-mouth periodontal charts formed part of the clinical documentation, their graphical reproduction was omitted from this publication because the software's copyrighted chart template and tooth illustrations were not licensed for redistribution under the journal's Creative Commons Attribution 4.0 (CC BY 4.0) license. This consideration highlights the importance of verifying image reproduction and licensing permissions when incorporating software-generated clinical charts into open-access scientific publications. The underlying clinical measurements can nevertheless be reported independently of the copyrighted graphical template. The sequential examinations demonstrated substantial reductions in mean PPD, plaque accumulation, and BOP, together with improved periodontal conditions during supportive care. As emphasized by Ramseier, systematic periodontal examination and longitudinal monitoring are essential components of periodontal diagnosis and follow-up [12]. The integration of longitudinal periodontal measurements with comparative intraoral radiographic examinations provided complementary information on treatment outcomes. While the clinical assessments documented changes in periodontal inflammatory parameters and probing depths, the radiographic examinations suggested favorable changes in selected osseous defects. Importantly, these findings should be interpreted together, as neither clinical improvement nor radiographic bone fill alone can establish true periodontal regeneration.

Limitations

Several limitations should be acknowledged. First, the single-case design limits the generalizability of the findings. Second, the combined use of ultrasonic instrumentation, systemic antibiotics, and SPT prevents attribution of the observed outcomes to any individual treatment component. Third, radiographic comparisons were based on conventional two-dimensional intraoral images without standardized quantitative measurements, and variations in projection geometry may have influenced the apparent extent of bone fill. Furthermore, although favorable radiographic changes were observed in regions adjacent to molar furcations, the absence of consistently documented site-specific horizontal and vertical furcation measurements prevents confirmation of anatomical resolution or a reduction in furcation classification. Consequently, the radiographic findings cannot be considered definitive evidence of true periodontal regeneration. Variations in smoking behavior and oral hygiene during follow-up may also have influenced periodontal outcomes. Additionally, the most recent maintenance assessment at month 51 did not include a comprehensive full-mouth periodontal examination comparable with those performed at months 25 and 38, limiting objective confirmation of periodontal stability at the final follow-up. Although sustained clinical improvement was documented during supportive periodontal care, additional standardized clinical and radiographic assessments would be valuable to further characterize the long-term stability of the observed changes.

Conclusions

Nonsurgical periodontal therapy performed exclusively with piezoelectric ultrasonic instrumentation was associated with apparent radiographic bone fill in regions adjacent to molar furcations in a patient with

stage III, grade C periodontitis. These favorable radiographic changes occurred without surgical or regenerative periodontal procedures. Treatment included adjunctive systemic antibiotics and regular SPT. Substantial clinical improvements were documented through month 38, while the subsequent maintenance assessment at month 51 suggested continued clinical stability, highlighting the importance of patient adherence and long-term periodontal maintenance. Although radiographic bone fill does not establish true periodontal regeneration, this case suggests that comprehensive nonsurgical periodontal treatment may be associated with favorable radiographic bone changes even in anatomically challenging molar furcation regions. Further controlled clinical studies are needed to investigate these findings.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

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