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INTERDISCIPLINARY PERIODONTAL-ORTHODONTIC MANAGEMENT OF PATHOLOGICAL TOOTH MIGRATION: A NARRATIVE REVIEW

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ABSTRACT

Pathological tooth migration (PTM) is a common complication of advanced periodontitis that can impair aesthetics, function, and quality of life. Management frequently requires interdisciplinary collaboration between periodontics and orthodontics; however, several aspects of treatment remain controversial.
Aim: This narrative review aimed to summarise the current evidence on the relationship between periodontal disease and PTM, evaluate the role of orthodontic treatment in periodontally compromised patients, and highlight key clinical considerations for interdisciplinary management.
Materials and method: A narrative literature review was conducted using PubMed, Scopus, and Google Scholar. English-language publications published between 2015 and 2026 were identified using the keywords periodontics, orthodontics, and pathological tooth migration. Additional relevant studies were identified through manual screening of reference lists.
Conclusions: Current evidence indicates that periodontal stabilization is the cornerstone of PTM management. Although spontaneous correction may occur following successful periodontal therapy, orthodontic treatment is frequently required to restore function and aesthetics. Orthodontic tooth movement can be performed safely in patients with stabilized periodontal disease when inflammation is controlled, plaque control is maintained, and light, carefully planned biomechanical forces are applied. Long-term success depends on supportive periodontal care, appropriate retention, and patient compliance. However, evidence regarding the optimal timing of orthodontic intervention, biomechanical protocols, and long-term stability remains limited.

KEYWORDS
Pathological Tooth Migration, Periodontitis, Orthodontics, Periodontal Therapy

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Introduction

Periodontitis is a global oral disease with a multifactorial etiology. The main pathological mechanism of periodontitis is the continuous accumulation of dental plaque, which leads to gingival inflammation, the formation of periodontal pockets, resorption of the alveolar bone and can result in the instability of the teeth . However, it has been suggested that external factors can predispose individuals to the progression of the disease. One of these factors is occlusal trauma, defined as the injury of the attachment apparatus of the periodontium resulting from functional or parafunctional occlusal forces that exceed its adaptive capacity. It is characterized by a widened periodontal ligament space, bone resorption, fremitus, progressive tooth mobility, pathologic tooth migration and pain .

Occlusal trauma can be divided into primary (abnormal forces on sound periodontal structure) and secondary (physiologic or abnormal forces on weakened periodontal structure) . An anterior malocclusion, characterized by an edge-to-edge bite results in a lack of anterior guidance and an increased occlusal load on the involved teeth . This occlusal trauma can disrupt the forces that maintain teeth in their normal position, leading to pathological tooth migration . A few forms of pathological tooth migration exist, including extrusion and facial flaring . These can often become an aesthetic and functional concern, motivating patients to seek dental advice.

It has been found that spontaneous correction of spacing between migrated teeth is possible with periodontal treatment alone . When this is unsuccessful, orthodontic therapy, frequently combined with bone grafting and initiated as early as three months after surgery, can promote periodontal attachment and improve pathological tooth migration outcomes . It is however emphasized that good oral hygiene and an absence of active periodontitis are crucial for successful treatment .

Although combined periodontal and orthodontic therapy has become increasingly accepted in the management of pathological tooth migration, questions remain regarding the optimal timing of orthodontic intervention, appropriate biomechanics, long term periodontal stability and the predictability of treatment outcomes.

The aim of this narrative review is to summarise the current evidence regarding the relationship between periodontal disease and pathological tooth migration, discuss the role of orthodontic treatment in periodontally compromised patients and highlight key clinical considerations for interdisciplinary management.

Methodology

A narrative literature review was conducted using the databases: PubMed, Scopus, and Google Scholar. The search included publications from 2015 to 2026 and was carried out using the following keywords: “periodontics”, “orthodontics” and “pathological tooth migration”. Articles published in English were selected for analysis. Additional relevant studies were identified by screening the reference lists of included articles.

Results

Etiology and Characteristics of Pathological Tooth Migration

Pathological tooth migration (PTM) is a common clinical manifestation of advanced periodontal disease and results from the progressive destruction of the periodontal supporting tissues. Current evidence consistently indicates that the prevalence and severity of PTM increase with worsening periodontal disease, while local mechanical factors may further contribute to its development (Khorshidi et al., 2016; Salavadhi et al., 2018; Ahmed & Dinesh, 2021; Mallik et al., 2025).

Loss of periodontal support appears to be the principal determinant of PTM. In a cross-sectional study of 314 patients with periodontitis, Khorshidi et al. (2016) reported an overall PTM prevalence of 11.1%, with no cases observed in patients with mild chronic periodontitis. The prevalence increased to 5.2% in moderate chronic periodontitis, 51% in severe chronic periodontitis and 50% in aggressive periodontitis, indicating a strong association between disease severity and tooth migration. Patients with a greater number of missing teeth were also more likely to exhibit PTM, suggesting that loss of periodontal support and occlusal stability contribute to its development.

These findings are supported by Mallik et al. (2025), who demonstrated significantly greater periodontal destruction in migrated teeth than in non-migrated controls. Teeth affected by PTM exhibited almost threefold greater alveolar bone loss (45.65% vs. 16.94%), together with significantly higher clinical attachment loss,

tooth mobility and Periotest values ($P < 0.001$). Maxillary central incisors were the most frequently affected teeth, with distolabial displacement representing the predominant migration pattern, followed by extrusion, rotation, labial migration and mesiolabial migration. Collectively, these findings reinforce the role of periodontal attachment loss and alveolar bone resorption as the primary biological mechanisms underlying PTM.

Although periodontal destruction provides the biological basis for PTM, several local mechanical factors may accelerate its progression. Salavadhi et al. (2018) identified tongue thrusting, trauma from occlusion and loss of posterior teeth as significant risk factors, whereas Class II malocclusion and aberrant frenum attachment were not significantly associated with migration. These observations suggest that disruption of the normal balance of forces acting on the dentition may exacerbate tooth displacement in patients with reduced periodontal support.

Patient characteristics have also been investigated. In a retrospective review of 7,386 patient records, Ahmed and Dinesh (2021) found that PTM occurred most frequently in adults aged 31–50 years, with no significant difference between sexes. Only 27.4% of affected patients subsequently underwent orthodontic treatment, as many were either unsuitable because of moderate-to-severe periodontal destruction or declined treatment. This highlights the importance of early diagnosis and periodontal intervention before advanced tissue destruction limits treatment options.

Spontaneous Correction of Pathological Tooth Migration

Successful periodontal therapy may result in spontaneous correction of pathological tooth migration (PTM) in carefully selected patients, potentially reducing or delaying the need for orthodontic intervention. Although the current evidence is largely limited to case reports, the available literature consistently demonstrates that resolution of periodontal inflammation, elimination of traumatic occlusal forces, and restoration of periodontal support can facilitate spontaneous repositioning of migrated teeth (Lee et al., 2021; Jain et al., 2022; Pang et al., 2025).

The primary objective of periodontal therapy in patients with PTM is the elimination of inflammation and the establishment of periodontal stability. Across the available studies, improvements in periodontal health consistently preceded spontaneous tooth movement, suggesting that restoration of the periodontal supporting tissues is required for repositioning. Lee et al. (2021) demonstrated that intensive non-surgical periodontal therapy, combined with optimisation of systemic risk factors, resulted in marked reductions in probing depths, resolution of drug-induced gingival enlargement, and spontaneous closure of anterior spacing without periodontal surgery or orthodontic treatment. Similarly, Pang et al. (2025) reported significant improvements following non-surgical periodontal therapy and occlusal adjustment, with bleeding on probing decreasing from 17% to 5% and the proportion of periodontal pockets greater than 4 mm reducing from 14% to 6%. Notably, early reductions in interdental spacing and correction of the dental midline were already evident before regenerative surgery, suggesting that initial control of periodontal inflammation alone may contribute to spontaneous tooth repositioning.

Additional periodontal regeneration may further enhance spontaneous correction in patients presenting with advanced periodontal defects. In the case reported by Pang et al. (2025), guided tissue regeneration resulted in progressive closure of the mandibular anterior diastema, with complete space closure achieved 27 months after surgery and maintained throughout a 46-month follow-up period. Similarly, Jain et al. (2022) described complete spontaneous closure of a maxillary anterior diastema following cause-related periodontal therapy, open flap debridement, and bone grafting, with clinical and radiographic evidence of satisfactory periodontal healing and improved tooth stability. Therefore, regenerative periodontal procedures may restore sufficient periodontal support to permit spontaneous repositioning in selected patients with severe attachment loss.

Although the precise biological mechanisms underlying spontaneous correction remain incompletely understood, all three studies attributed this phenomenon to the elimination of inflammation and restoration of the periodontal supporting apparatus. Jain et al. (2022) proposed that regeneration of gingival collagen fibres, re-establishment of supracrestal periodontal fibre function, and removal of traumatic occlusal forces contributes to spontaneous tooth movement. Likewise, Pang et al. (2025) emphasised the importance of eliminating inflammation and occlusal trauma before considering orthodontic intervention, while Lee et al. (2021) highlighted that optimisation of systemic health and control of medication-induced gingival enlargement may also improve periodontal stability and facilitate spontaneous repositioning.

Despite these encouraging findings, the evidence supporting spontaneous correction of PTM remains limited. All three publications represent single-patient case reports, restricting the generalisability of their findings and precluding conclusions regarding the predictability of treatment outcomes. Furthermore, the degree of spontaneous correction varied between cases and appeared to depend on the extent of periodontal destruction, the presence of bone defects, elimination of local and systemic risk factors, and the patient's response to periodontal therapy. Consequently, spontaneous repositioning should be regarded as a potential outcome rather than an expected consequence of periodontal treatment alone.

Orthodontic treatment following periodontal stabilization

Although spontaneous correction of pathological tooth migration (PTM) may occur following successful periodontal therapy, complete resolution is unpredictable, particularly in patients with severe migration, advanced attachment loss or significant functional and aesthetic concerns. Consequently, orthodontic treatment is frequently required once periodontal health has been re-established. Current evidence consistently indicates that orthodontic tooth movement can be safely performed in periodontally compromised patients, provided that active inflammation has been eliminated, adequate plaque control is maintained and patients remain compliant with supportive periodontal therapy (Jepsen et al., 2021; Gehlot et al., 2022; Tu et al., 2022).

One of the principal considerations is the timing of orthodontic intervention following periodontal treatment. Traditionally, orthodontic tooth movement has been delayed for several months after regenerative surgery to allow periodontal healing. However, a multicentre randomised clinical trial by Jepsen et al. (2021) demonstrated comparable clinical attachment gain, probing pocket depth reduction and pocket closure whether orthodontic treatment was initiated four weeks or six months after regenerative surgery in patients with stage IV periodontitis. No increase in bleeding on probing, recurrent inflammation or postoperative complications was observed in the early treatment group, and adjusted analyses indicated greater clinical attachment gain following earlier intervention. These findings suggest that, in carefully selected patients, orthodontic treatment may be initiated earlier than previously recommended without compromising periodontal healing.

The safety of orthodontic treatment following periodontal stabilization is supported by both prospective and retrospective clinical studies. Gehlot et al. (2022) reported that the addition of fixed orthodontic appliances to periodontal therapy did not adversely affect plaque control, gingival health, probing depth, clinical attachment level or radiographic alveolar bone support compared with periodontal maintenance alone. Han (2015) and Zasčiurinskienė et al. (2018) reported significant improvements in periodontal attachment and pocket depth following interdisciplinary treatment, demonstrating that orthodontic correction of pathologically migrated teeth can be achieved without further attachment loss when periodontal inflammation has been successfully controlled.

Similarly, Tu et al. (2022) demonstrated that orthodontic tooth movement performed after regenerative treatment maintained the clinical and radiographic improvements achieved during periodontal therapy, indicating that regenerated periodontal tissues remain stable throughout orthodontic treatment when inflammation is effectively controlled.

Improved tooth stability following orthodontic realignment is another consistent finding. Han (2015) reported reduced mobility of pathologically migrated anterior teeth after combined periodontal and orthodontic treatment, reflecting improved occlusal stability following correction of tooth position. Across the available clinical studies, orthodontic treatment was not associated with increased gingival recession, recurrent periodontal inflammation or deterioration of periodontal attachment, provided patients maintained good oral hygiene and remained enrolled in supportive periodontal care programmes (Gehlot et al., 2022; Han, 2015; Zasčiurinskienė et al., 2018). Together, these findings suggest that controlled orthodontic forces do not compromise periodontal healing and may contribute to improved tooth alignment without increasing the risk of disease recurrence.

Although appliance type was not the primary focus of most investigations, Han (2015) observed lower plaque accumulation and gingival inflammation in patients treated with clear aligners than in those receiving fixed appliances. However, favourable periodontal outcomes were achieved with both appliance systems, indicating that treatment success is more dependent on plaque control and periodontal maintenance than on appliance selection.

Adjunctive therapies may further enhance treatment outcomes. Ren et al. (2020) found that repeated low-level laser irradiation during orthodontic treatment reduced pain, accelerated recovery of bite force and lowered early plaque and gingival index scores compared with conventional treatment alone. The authors also reported reduced concentrations of inflammatory mediators, including interleukin-1β, prostaglandin E_2 and

substance P, suggesting that laser therapy may attenuate the transient inflammatory response associated with orthodontic tooth movement. Although promising, these findings require confirmation in larger clinical studies.

Long-term prognosis remains dependent on baseline periodontal status and patient-related factors. Jiang et al. (2026) identified periodontal phenotype as an important predictor of treatment outcome, with patients exhibiting extensive inflammatory and structural periodontal destruction showing a greater risk of disease recurrence and reduced regenerative potential than those with milder disease. This association was particularly evident in women and patients aged 40 years or older, emphasising the importance of careful case selection and ongoing periodontal maintenance.

Biomechanics in the reduced periodontium

Orthodontic treatment in patients with reduced periodontal support requires careful biomechanical planning because loss of alveolar bone and periodontal attachment alters the centre of resistance of the tooth, increasing the risk of uncontrolled tipping and excessive stress within the remaining periodontal tissues. Orthodontic mechanics should be modified to minimise tissue overload while achieving controlled tooth movement.

The greatest limitation in the treatment of patients with stabilized periodontitis is the reduction in vertical height of the alveolar bone. The center of resistance becomes more apical so it is suggested to bond the orthodontic brackets as cervically as possible to account for this .

Both experimental and clinical studies recommend to apply light, continuous orthodontic forces in periodontally compromised patients. Finite element analysis by Wang et al. (2021) demonstrated that reducing aligner displacement significantly decreased stress within the periodontal ligament, particularly in teeth with moderate and severe alveolar bone loss. The authors concluded that orthodontic activation should be adjusted according to the degree of periodontal destruction to minimise stress concentrations and improve the predictability of tooth movement.

Clinical studies support these biomechanical principles. Although none directly quantified the magnitude of the orthodontic forces applied, all employed light continuous forces following successful periodontal therapy and reported favourable treatment outcomes (Zasčiurinskienė et al., 2018; Tu et al., 2022; Dung et al., 2025). Intrusion is a common approach for managing pathological tooth migration associated with periodontal disease. It improves periodontal parameters such as clinical crown length and marginal bone levels by reshaping the alveolar process .

Unfortunately, current recommendations regarding optimal force magnitude rely largely on biomechanical modelling, as clinical studies have not directly compared different force systems or quantified force levels. Further prospective investigations are therefore required to establish evidence-based biomechanical protocols for orthodontic treatment in periodontally compromised patients.

Long-term stability and retention

Long-term stability following orthodontic correction of pathological tooth migration (PTM) depends on the interaction between mechanical retention, periodontal health and patient compliance. Although orthodontic alignment can be maintained successfully in periodontally compromised patients, the available evidence consistently indicates that retention should be regarded as a long-term, and often lifelong, component of interdisciplinary care (Han, 2015; Al-Moghrabi et al., 2018; Abbas et al., 2025)

Bonded fixed retainers remain the most commonly recommended method of maintaining orthodontic alignment in patients with reduced periodontal support because they provide continuous stabilisation and do not rely on patient compliance. Han (2015) reported stable alignment over a mean follow-up of 5.3 years in patients receiving fixed retention combined with regular supportive periodontal therapy. Similarly, Al-Moghrabi et al. (2018) demonstrated that both fixed and removable retainers maintained satisfactory alignment over four years, with no significant difference in long-term stability between the two approaches despite minor relapse occurring in both groups.

More recent evidence suggests that increasing retainer length alone does not eliminate post-treatment tooth movement. Abbas et al. (2025) observed measurable three-dimensional positional changes during the first year following treatment despite the use of extended eight-unit bonded retainers, indicating that physiological tooth movement continues even in the presence of fixed retention. They likewise reported favourable periodontal outcomes and high patient satisfaction with eight-unit fixed retainers but emphasised that regular follow-up remains necessary because retainers minimise, rather than prevent, biological adaptation

and orthodontic relapse. Therefore, while fixed retainers provide effective long-term stabilisation, no retention strategy completely eliminates the risk of post-treatment tooth movement.

Mechanical retention alone is insufficient to ensure long-term stability. Across the available studies, successful outcomes were consistently associated with regular supportive periodontal therapy and effective plaque control (Han., 2015; Abbas et al., 2025). Patients who attended regular appointments maintained stable periodontal parameters throughout follow-up, reinforcing the importance of continued interdisciplinary care after completion of active orthodontic treatment. Nevertheless, Han (2015) reported persistent calculus accumulation around bonded retainers despite improvements in plaque and gingival indices, highlighting the need for meticulous oral hygiene instruction and professional maintenance in patients wearing fixed retention appliances.

Long-term stability is influenced by both biological and mechanical factors. Han (2015) identified advanced periodontal disease, poor oral hygiene and increased calculus accumulation as significant predictors of retainer failure. Abbas et al. (2025) demonstrated that minor tooth movement may occur despite intact retainers, suggesting that relapse reflects ongoing periodontal remodelling rather than mechanical failure alone. Similarly, Al-Moghrabi et al. (2018) attributed the small degree of relapse observed in both fixed and removable retainer groups to normal post-treatment physiological adaptation. These findings indicate that maintenance of treatment outcomes depends not only on the retainer itself but also on the stability of the periodontal tissues and the patient's long-term adherence to supportive care.

Discussion

Pathologic tooth migration (PTM) represents one of the most challenging sequelae of advanced periodontitis, resulting from a complex interaction between biological deterioration of the periodontal supporting tissues and altered mechanical equilibrium. The available evidence consistently demonstrates that loss of periodontal attachment and alveolar bone is the primary prerequisite for PTM, whereas occlusal trauma, parafunctional habits, tongue thrusting and posterior tooth loss appear to accelerate or exacerbate tooth displacement rather than act as independent etiological factors (Khorshidi et al., 2016; Salavadhi et al., 2018; Mallik et al., 2025). This multifactorial nature supports the current concept that successful management of PTM requires not only elimination of periodontal inflammation but also correction of functional and occlusal disturbances.

Although the association between periodontal destruction and PTM is well established, the available evidence remains predominantly observational. Both Khorshidi et al. (2016) and Mallik et al. (2025) reported a strong relationship between increasing periodontal attachment loss and the prevalence of PTM; however, their cross-sectional designs prevent determination of temporal or causal relationships. Whether severe periodontal destruction directly initiates tooth migration or whether progressive migration further contributes to localized periodontal deterioration cannot be fully elucidated from these studies. Similarly, retrospective analyses identifying tongue thrusting, traumatic occlusion or posterior tooth loss as risk factors are inherently susceptible to selection bias, incomplete documentation and uncontrolled confounding variables, limiting the strength of the proposed etiological model (Salavadhi et al., 2018; Ahmed & Dinesh, 2021). Furthermore, considerable variation in the diagnostic criteria used to define PTM across studies complicates comparisons and may partially explain differences in reported prevalence.

A recurring finding throughout the literature is that periodontal stabilization should precede any orthodontic intervention. Resolution of inflammation restores periodontal tissue homeostasis, reduces tooth mobility and creates the biological conditions necessary for controlled orthodontic tooth movement (Chambrone & Avila-Ortiz, 2021). Interestingly, several authors reported spontaneous repositioning of migrated teeth following periodontal therapy alone (Lee et al., 2021; Jain et al., 2022; Pang et al., 2025), suggesting that inflammatory resolution and re-establishment of periodontal fiber tension may partially restore tooth position in selected cases. However, this phenomenon should be interpreted cautiously. The evidence supporting spontaneous correction is based exclusively on isolated case reports, which inherently represent the lowest level of clinical evidence. In addition, the substantial heterogeneity of periodontal interventions—including non-surgical therapy, open flap debridement, regenerative procedures and adjunctive bone augmentation—makes it impossible to determine which therapeutic approach most effectively facilitates spontaneous tooth movement.

The safety of orthodontic treatment in patients with reduced but healthy periodontal support is supported by an increasing number of prospective clinical studies and randomized controlled trials. Contemporary

evidence indicates that controlled orthodontic tooth movement does not increase clinical attachment loss provided that inflammation has been adequately controlled and supportive periodontal therapy is maintained throughout treatment (Gehlot et al., 2022; Jepsen et al., 2021).

One of the principal controversies concerns the optimal timing of orthodontic treatment following periodontal therapy. Jepsen et al. (2021) demonstrated that orthodontic treatment initiated only four weeks after regenerative surgery produced outcomes comparable to, or even exceeding, those observed after a six-month delay. Similar findings by Tu et al. (2022) suggest that orthodontic tooth movement may positively influence bone remodeling within regenerated intrabony defects. Conversely, Zasčiurinskienė et al. (2018) reported greater reductions in probing pocket depth when orthodontic treatment was postponed. These apparently conflicting findings likely reflect substantial differences in study design rather than genuine disagreement. The investigated populations differed considerably with respect to baseline periodontal status, surgical versus non-surgical periodontal therapy, defect morphology, and orthodontic treatment protocols. Such clinical heterogeneity limits direct comparison between studies and precludes definitive recommendations regarding treatment timing.

The altered biomechanics associated with reduced periodontal support constitute another important consideration during interdisciplinary treatment. Finite element analyses consistently demonstrate increased stress concentration within the periodontal ligament as alveolar bone height decreases, supporting the clinical recommendation to employ lighter orthodontic forces and modify appliance design (Wang et al., 2021; Choi et al., 2016; Zasčiurinskienė et al., 2019). Clinical studies likewise report favorable outcomes when light continuous forces are applied (Zasčiurinskienė et al., 2018; Tu et al., 2022; Dung et al., 2025).

Another aspect receiving increasing attention is the influence of patient-related factors on treatment prognosis. Jiang et al. (2026) demonstrated that baseline inflammatory burden, extensive periodontal destruction, older age and female sex were associated with increased risk of periodontal recurrence during orthodontic treatment. Although these findings emphasize the importance of individualized risk assessment, they originate from observational data and therefore cannot establish independent causal relationships.

Long-term stability remains one of the least investigated aspects of PTM management. Most authors advocate lifelong retention following orthodontic correction in periodontally compromised patients (Garbo et al., 2022; Han., 2015; Al-Moghrabi et al., 2018). Nevertheless, the evidence supporting specific retention strategies is relatively weak. Conflicting findings regarding fixed retainers likely reflect differences in oral hygiene protocols rather than retainer design alone. While Han (2015) reported increased plaque accumulation around bonded retainers, Abbas et al. (2025) observed no adverse periodontal effects in patients enrolled in intensive supportive periodontal care. These findings suggest that retention success depends as much on long-term maintenance as on appliance selection. However, most retention studies are characterized by limited follow-up, relatively small sample sizes and substantial heterogeneity regarding retainer design, orthodontic appliances and maintenance protocols. Even the longest available studies include relatively few patients, making it difficult to identify uncommon complications or accurately estimate relapse rates over decades.

Conclusions

Pathological tooth migration is a multifactorial consequence of advanced periodontal disease that requires an interdisciplinary treatment approach. Current evidence indicates that periodontal stabilization should be the primary therapeutic objective, with orthodontic treatment reserved for patients in whom spontaneous correction is incomplete or functional and aesthetic concerns persist. When active inflammation has been eliminated and supportive periodontal care is maintained, orthodontic treatment can be performed safely using carefully controlled biomechanics without compromising periodontal health. Nevertheless, the available evidence remains limited by heterogeneous study designs, predominantly observational data and a lack of long-term prospective clinical trials. Future well-designed randomized and longitudinal studies are needed to establish evidence-based recommendations regarding the optimal timing of orthodontic intervention, biomechanical protocols, retention strategies and long-term treatment stability in patients with pathological tooth migration.

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