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Case Report

Management of pathologic migration with clear aligners in an adult orthodontic patient: A case report

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Abstract

In adult patients, the manifestation of pathologic tooth migration (PTM) can lead to significant issues related to misalignment of the teeth, spacing discrepancies, or problems with the bite, all of which can consequently result in both functional impairments and aesthetic concerns that may affect the individual's quality of life. The occurrence of PTM is frequently linked to an overall weakening of the periodontal support structures that are essential for maintaining the teeth in their proper positions, thereby causing them to shift in ways that deviate from their normal alignment. Specifically, aligners such as Flexialigners or other forms of clear aligner systems have proven to be particularly advantageous in the treatment of adult cases with PTM, given that they provide a minimally invasive, aesthetically pleasing, and comfortable solution for individuals seeking to correct their dental alignments. These innovative devices are designed to facilitate controlled tooth movement, which is accomplished while concurrently promoting better oral hygiene practices, a factor that is critically important in scenarios where periodontal health has already been compromised due to various underlying issues. The present case report highlights the importance of aligners in the treatment of PTM in a 38-year-old female patient in 11 months, with controlled tooth movement.

Keywords: Pathologic, Tooth migration, Case report, Orthodontic treatment, Adult.

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1. Introduction

Pathologic tooth migration (PTM) refers to the abnormal drifting or displacement of teeth caused by periodontal disease, occlusal trauma, or tooth loss. This condition typically affects adults, particularly those with advanced periodontal involvement, and results in functional and aesthetic concerns.[1,2] The incidence of pathologic tooth migration is reported to increase with age, especially in individuals with untreated periodontal disease. Studies estimate that pathologic migration occurs in 30% to 56% of adults suffering from moderate to severe periodontitis, making it a prevalent concern in orthodontic and periodontal care.[3,4]

The etiological factors contributing to pathologic migration are multifactorial and include periodontal attachment loss, occlusal imbalances, missing teeth, and parafunctional habits such as bruxism.[5,6] Inflammation and destruction of the supporting tissues in periodontitis often weaken the stability of teeth, allowing them to drift out of position.[7] Additionally, bone loss from periodontal disease exacerbates tooth mobility and migration. From an orthodontist's perspective, managing pathologic migration is crucial not only for restoring proper occlusion and aesthetics but also for halting further periodontal damage.[8]

The management of pathologic tooth migration presents a complex challenge, requiring a multidisciplinary approach. Treatment options typically include periodontal therapy to control inflammation, prosthetic rehabilitation to restore missing teeth, and orthodontic intervention to reposition migrated teeth.[3,6,8] Traditional orthodontic techniques such as fixed braces have long been used to treat pathologic migration, but they may not be suitable for all adult patients, particularly those with compromised periodontal health.

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In recent years, clear aligners have emerged as a viable alternative for treating pathologic migration in adult patients. Clear aligners, employed for supplementary or restricted orthodontic intervention of post-treatment malocclusion, were first presented as a gingival stimulating device in the year 1926, with Kesling documenting its application for the purpose of facilitating dental movement.[9] Clear aligners offer a less invasive, aesthetically pleasing solution with the added benefit of easier oral hygiene maintenance, which is critical in managing periodontal disease.[10] Clear aligners, in particular, provide controlled tooth movement while minimizing the risk of exacerbating periodontal conditions, making them a valuable tool in the orthodontic management of pathologic migration.[11]

Nevertheless, owing to its elasticity and propensity for deformation, the orthodontic appliance necessitates reconstruction on a tri-weekly basis. The application of clear aligners may be warranted for minimal dental movement (≤4 mm), encompassing procedures such as space closure, extrusion and intrusion, arch expansion and contraction, relapse of previous orthodontic interventions, as well as the regulation of the rotational axis of the teeth to alleviate crowding.[12] This case study highlights the successful use of clear aligners in treating an adult patient with pathologic migration.

2. Case Report

A 38-year-old female patient presented to our Orthosquare clinic for Flexismile clear aligners in Mumbai on July 14, 2021, with concerns regarding the malalignment of her maxillary and mandibular anterior teeth. The patient had no systemic health issues.

2.1 Clinical examination

Clinical and radiographic examinations revealed a diagnosis of chronic localized periodontitis in the maxillary anterior region, coupled with PTM. Contributing factors included poor oral hygiene and traumatic occlusal forces from the misaligned teeth, exacerbating disease progression and increasing incisor irregularity. On examination, the patient had a symmetrical face and a straight facial profile. Dental evaluation showed a Class I canine relationship on the right side and end-on on the left side. The patient had a mutilated occlusion with missing lower left first molar and a Class I molar relationship on right side. Model analysis revealed 1mm of Bolton's anterior mandibular excess, whereas Careys and Arch perimeter analysis showed no discrepancy. The patient was dentoskeletal class I with ANB angle of 2^0 and an average growth pattern with SN-GoGn angle of 32^0. The upper and lower incisors were proclined and forwardly placed (U1-NA angle/linear: 34^0, 6mm; L1/NB angle/linear: 28^0/6mm) with an edge-to-edge overbite leading to trauma from occlusion. The patient had 4 mm of spacing in the maxillary arch and 6 mm in the mandibular arch. The overjet was 1mm. Additionally, generalized gingival recession was evident, particularly in the anterior region, contributing to thermal sensitivity and aesthetic concerns (**Figure 1**). Flap surgery was done before starting the orthodontic treatment to address periodontal problems. As patient had a mutilated dentition with PTM, therefore, it was decided to just close the anterior spaces, relieve trauma from occlusion, and not correct the canine relationship on left side.

Initial periodontal assessment indicated that the patient's periodontal disease was under control. No tooth had a probing depth greater than 4 mm; the full-mouth plaque index was 15%, and bleeding on probing was positive at 12% of sites.

2.2 *Treatment plan*

The patient was given the option of closure of space with fixed mechanotherapy, for which the patient refused due to aesthetics concerns. Therefore, it was decided to do the treatment with aligners, for which patient agreed and gave her consent to proceed. A thorough oral prophylaxis was carried out, followed by orthodontic intervention using clear aligners (Flexismile, Mumbai, and Maharashtra). The intraoral scans of the patient were taken with an intra-oral scanner (TRIOS 4 intraoral scanner, 3Shape, Copenhagen, Denmark) and send for planning for aligners (**Figure 2**,**Figure 3**).

The attachments were bonded as planned (3M Transbond XT, Minnesota, USA) and Zero flexismile clear aligners were delivered to the patient, which were devoid of any incorporated tooth movements, thereby facilitating the patient's acclimatization to the process of wearing these aligners. The initial series of upper and lower aligners, designated as U1 and L1 respectively, were provided to the patient on the fifth day, thereafter, with explicit instructions for the patient to wear them for a substantial duration of approximately 22 hours each day over the course of three consecutive weeks, with the sole exception of during meal times. In order to ensure optimal treatment outcomes, the patient was scheduled for follow-up consultations every three weeks, during which assessments were conducted to evaluate the fit of the aligners, address any potential breakage, monitor the progress of the treatment, and ascertain the patient's compliance with the prescribed regimen of regular aligner wear. Ultimately, the comprehensive duration of the entire treatment process extended over a total timeframe of 11 months, illustrating the commitment required for effective orthodontic management. To preserve the corrections that were successfully achieved throughout the treatment, bonded fixed retainers were strategically placed from canine to canine in both the upper and lower arches, thereby reinforcing the alignment obtained through the use of the aligners. This careful approach underscores the importance of retention in orthodontic practices to prevent any potential relapse of the corrected dental positions. The implementation of such a methodical treatment plan not only exemplifies the advancements in orthodontic technology but also highlights the necessity of patient cooperation in achieving satisfactory

results. 22 sets of aligners were delivered to the patient where the tooth movement was intentionally kept slow, with only 0.1 mm of movement per aligner. During this time, slower tooth movement minimized the risk of exacerbating periodontal damage. The patient was highly satisfied with the outcome. Post-treatment orthopantomogram (OPG) revealed parallelism of roots and lower left first molar was replaced with a three-unit bridge. Post-treatment lateral cephalogram showed competent lips, normally positioned upper and lower incisors, and a straight profile (**Figure 4**). Post-treatment intra-oral pics showed properly aligned upper and lower incisors with all spaces closed (**Figure 5**).

Figure 1: Intraoral pics of the patient.

Figure 2: Pre-treatment virtual set-up with attachments.

Figure 3: Post-treatment virtual set-up.

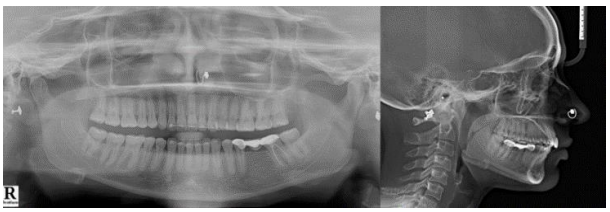

Figure 4: Post-treatment OPG and lateral cephalogram.

Figure 5: Post-treatment intra-oral pics

The overall treatment resulted in improved aesthetics, stable occlusion, and preservation of periodontal health.

3. Discussion

PTM is a condition often associated with periodontal disease, where inflammation and loss of supporting structures such as bone and periodontal ligament cause teeth to drift or become displaced.[2,4] In the case of this 38-year-old female patient, PTM presented as anterior flaring of the maxillary and mandibular teeth, exacerbated by poor oral hygiene and traumatic occlusal forces. Treatment of PTM in orthodontic cases can be challenging, especially when periodontal disease is present. A multidisciplinary approach, involving both orthodontists and periodontists, is essential to achieve long-term stability and periodontal health, particularly when clear aligners are used.

In recent years, studies have shown that orthodontic treatment for PTM, when guided by periodontal principles, can effectively reposition teeth while preventing further periodontal damage.[8,10] According to studies, a critical factor in the success of such treatments is maintaining periodontal stability throughout the treatment.[2] In a study by Alassfar A et al., patients with treated periodontal disease who underwent orthodontic intervention showed stable results, with no significant periodontal attachment loss, provided the orthodontic forces applied were light and controlled.[13] This was reflected in our case, where clear aligners were chosen due to their ability to provide controlled, precise tooth movement, and minimize periodontal strain. The use of clear aligners allowed for slow and gradual tooth movement, reducing the risk of exacerbating bone resorption or gingival recession. Meticulously devised designs played a significant role in promoting the patient's optimal occlusion and periodontal well-being. An appliance with a thickness of 0.75 mm was utilized to facilitate minimal tooth displacements of 0.10 mm and 1 degree per incremental step, in contrast to the greater movements of 0.25 mm and 2 degrees per step observed in patients exhibiting no periodontal disease.

In this case, the patient had several important factors that influenced treatment outcomes. Firstly, the anterior flaring of the maxillary and mandibular incisors was a key concern, contributing to poor aesthetics and occlusal imbalance. Space closure was achieved by applying light forces through clear aligners, which allowed for controlled tooth movement without causing further periodontal damage. This approach aligns with literature findings that emphasize the need for light forces in orthodontic treatment of periodontally compromised patients. In a review by Katib HS et al. highlighted that clear aligners can be beneficial in such cases due to their ability to distribute forces evenly, thus preventing excessive stress on any one tooth.[14]

Another significant aspect of this case was the presence of a fixed bridge at the 45, 46, and 47 positions. Fixed prostheses can sometimes complicate orthodontic treatment

by limiting the movement of adjacent teeth. However, in this case, the bridge did not impede treatment, as aligners were carefully designed to work around it, ensuring that the natural teeth adjacent to the prosthesis could be moved without compromising the stability of the bridge. This highlights the adaptability of clear aligners in complex cases where fixed prosthetic elements are present.

Additionally, the patient had a good periodontal index, with no tooth mobility or attachment loss, which is a crucial factor in determining treatment success in cases of PTM. Several studies, such as those by Melsen, emphasize that orthodontic treatment should only be initiated in periodontally stable patients, as active periodontal disease can lead to further deterioration of the supporting structures.[2,5] In our case, the patient's controlled periodontal status, demonstrated by low plaque and bleeding indices, allowed for safe orthodontic intervention.

The absence of tooth mobility and tissue attachment loss in this patient further contributed to the positive treatment outcome. According to research, tooth mobility is a significant predictor of orthodontic treatment prognosis in periodontally compromised patients.[1,6] In our case, the absence of mobility allowed for a more predictable tooth movement and a reduced risk of relapse. Moreover, the patient's gingival recession was addressed by using clear aligners, which facilitated oral hygiene maintenance, a crucial factor in preserving periodontal health during orthodontic treatment.

4. Conclusion

In conclusion, the successful management of PTM in this case demonstrates the effectiveness of Flexismile clear aligners in managing complex cases when coupled with proper periodontal care. The interdisciplinary approach ensured that the patient's periodontal health was maintained while achieving the desired tooth alignment, consistent with findings from recent literature on the subject.

5. Declaration of Patient Consent

The author confirms that all necessary patient consent forms have been obtained. The patient has provided consent for the use of their images and clinical information in the journal. It has been made clear to the patient that their name and initials will not be published, and every effort will be made to maintain their anonymity.

6. Author Contribution

Both author equally contributed to the manuscript.

7. Source of Funding

None.

8. Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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