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Enhanced Orthodontic Acceleration Using Piezo-Assisted Corticotomy Combined with Bone Graft and aPRF: A Clinical Case Report

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Abstract:

This case report presents the combined periodontal and orthodontic approach for the management malocclusion in a older patient through piezosurgically assisted corticotomy. The procedure included periodontal surgery with alveolar corticotomy, placement of Advanced Platelet-Rich Fibrin (A-PRF), and bone grafting to facilitate rapid tooth movement and simultaneous periodontal regeneration [1]. The post operative review showed significant clinical improvement, demonstrating the efficacy of this technique in managing complex cases efficiently.

Key Words: Wilkodontics, Piezosurgery, Corticotomy, Platelet rich fibrin

Introduction

Traditional orthodontic treatment in older individuals poses several challenges due to age related changes in bone and periodontal health. Bone metabolism and remodeling rates decline with age, resulting in slower tooth movement and prolonged treatment duration [2, 3]. The alveolar bone becomes denser and less responsive, increasing the risk of root resorption and making orthodontic forces less effective. Additionally, older individuals often have reduced periodontal support, gingival recession, or pre-existing bone loss, which heightens the risk of dehiscence and fenestration during tooth movement [4]. These factors collectively make conventional orthodontic treatment more time-consuming and potentially compromising to periodontal health, highlighting the advantage of procedures like Periodontally Accelerated Osteogenic Orthodontics (PAOO) that enhance bone remodeling and treatment efficiency in

such cases [5,6]. PAOO exemplifies the close interrelationship between periodontics and orthodontics, as it integrates principles and techniques from both specialties to achieve optimal functional and esthetic outcomes. The periodontal component involves selective alveolar decortication and bone grafting to stimulate the regional acceleratory phenomenon, which enhances bone remodeling and regeneration [7]. The orthodontic component utilizes this transient phase of increased bone turnover to move teeth more rapidly and safely within the alveolar housing [8]. Thus, PAOO not only accelerates tooth movement but also improves periodontal support, minimizes risks of root resorption and dehiscence, and ensures long term stability, demonstrating how coordinated periodontal and orthodontic interventions can complement each other for comprehensive patient care [9].

The molecular basis of PAOO lies in the activation of the Regional Acceleratory Phenomenon (RAP), a localized biological response to surgical injury of bone [7]. Following selective alveolar decortication, there is a transient burst of inflammatory cytokines and growth factors such as InterLeukins such as (IL-1, IL-6), Tumor Necrosis Factor-α (TNF-α), Transforming Growth Factor-β (TGF-β), Vascular Endothelial Growth Factor (VEGF), and Bone Morphogenetic Proteins (BMPs). These mediators stimulate osteoclastogenesis and osteoblastic activity, enhancing bone resorption and formation simultaneously. The increased expression of RANKL and osteoprotegerin (OPG) regulates this bone remodeling process, resulting in temporary osteopenia that allows faster and safer tooth movement [4]. As healing progresses, bone density and volume are restored, especially when bone grafts are used [5]. Thus, the molecular mechanism of PAOO integrates inflammatory, osteogenic, and angiogenic pathways to accelerate orthodontic tooth movement while maintaining or improving alveolar bone quality.

In this case report, we present a clinical scenario in which Wilkodontics [5] was utilized to manage a older patient with significant bone loss in the anterior teeth and malalignment. Through this study, we seek to contribute to the growing body of evidence supporting the integration of orthodontics and periodontics, ultimately improving patient care and treatment outcomes in complex periodontal cases [6, 1, 10].

Case Presentation

A 33 year old female patient was referred from the Department of Orthodontics to the Department of Periodontics for aiding in accelerated tooth movement. She presented with a history of proclined teeth, spacing, and lip incompetence in the upper and lower anterior regions for the past eight years. Past dental history revealed incomplete orthodontic treatment with a removable appliance. She is systemically healthy, with no medications, and reports a tongue thrusting habit with mature swallow. Oral hygiene practices are limited to brushing once daily with paste and brush. Family history shows her sister also has proclination and spacing, suggesting a possible genetic predisposition.

On examination, all 28 teeth were present, with no caries or restorations. The patient exhibited Angle's Class I malocclusion with proclination, spacing, and increased overjet. There was no fremitus, indicating no trauma from occlusion. Gingival examination showed bluish pink, firm, and resilient gingiva with blunt interdental papillae, loss of scalloping, and apical migration of marginal gingiva in both maxillary and mandibular anterior teeth (Figure 1). Bleeding on probing was noted in the lower anterior region, with inadequate width of attached gingiva and shallow vestibular depth in the same area. Radiographically, the OPG revealed moderate horizontal bone loss in the anterior maxillary and mandibular regions. Overall, findings indicate periodontal involvement associated with malocclusion and parafunctional tongue-thrusting habit, warranting a periodontally assisted orthodontic approach for accelerated and stable tooth movement [1, 5].

Interdisciplinary treatment approach

The treatment plan for the patient was carried out in three phases. Phase I therapy involved ultrasonic scaling to remove plaque and calculus deposits, followed by oral hygiene instructions to improve the patient's maintenance practices. After a period of healing and oral hygiene reinforcement, a re-evaluation was done to assess tissue response and readiness for surgical intervention.

In Phase II, the patient underwent Periodontally Accelerated Osteogenic Orthodontics (PAOO) [5] in the maxillary anterior region to facilitate accelerated and safe tooth movement. Under local anesthesia, full thickness mucoperiosteal flaps were elevated to expose the alveolar bone. Selective alveolar corticotomy was performed using piezosurgery tips [8], ensuring minimal trauma and precise control (Figure 2). To enhance bone remodeling and healing, OsseoGraf bone graft material and Advanced Platelet-Rich Fibrin (A-PRF) was placed over the decorticated area (Figure 3 & 4), to augment bone volume and stimulate the regional acceleratory phenomenon [1]. The flaps were repositioned and secured with sling sutures, ensuring primary closure. A re-evaluation after healing confirmed satisfactory soft tissue response.

In Phase III, the patient was referred back to the orthodontic department for space closure and alignment correction using orthodontic appliances (Figure 5). A final reevaluation was planned after completion of orthodontic therapy to assess periodontal stability, bone remodeling, and overall treatment success.

Results & Discussion

The post-operative healing phase in this case was smooth and uneventful, with no signs of infection, flap dehiscence, or significant edema. Soft tissue healing progressed exceptionally well, demonstrated by minimal scarring and healthy, pink gingival tissues at re-evaluation. Once orthodontic forces were activated in Phase III, tooth movement occurred at an accelerated rate, allowing efficient space closure and correction of proclination within a markedly reduced treatment timeframe compared with conventional orthodontic therapy alone [6, 9].

The final clinical outcome reflected a harmonious occlusion with corrected overjet and well-aligned anterior teeth. Periodontal parameters also showed substantial improvement, with complete resolution of bleeding on probing in the lower anterior region. The gingiva appeared firm, closely adapted, and displayed improved contour, correlating with the patient's enhanced oral hygiene practices. Radiographic assessments taken at the completion of orthodontic treatment revealed encouraging signs of bone fill in areas previously exhibiting moderate horizontal bone loss. The alveolar crest appeared more apical and well-defined, suggesting successful augmentation and improved periodontal support around the treated teeth.

These favourable results were significantly influenced by the combined use of Advanced Platelet-Rich Fibrin (A-PRF) and a bone graft material (OsseoGraf) [1]. A-PRF, enriched with platelets, leukocytes, and a dense fibrin network, acted as a sustained-release reservoir of growth factors such as VEGF, TGF-β, and PDGF. Its placement over the decorticated bone enhanced soft tissue healing, moderated inflammation through leukocyte-mediated immunomodulation, and stimulated angiogenesis, thereby improving blood supply and creating optimal conditions for regeneration. The subsequent placement of the bone graft provided an essential scaffold that maintained regenerative space, facilitated osteoconduction, and augmented alveolar bone volume [5]. Together, A-PRF and the graft produced a synergistic effect in which A-PRF accelerated early healing and vascularisation, while the graft established the long-term structural foundation for new bone formation.

The biological rationale underlying the Periodontally Accelerated Osteogenic Orthodontics (PAOO) approach explains the clinical efficiency observed in this case. The piezosurgically assisted corticotomy intentionally induced a controlled injury that triggered the Regional Acceleratory Phenomenon (RAP) [7, 4]. The increased release of mediators such as IL-1, IL-6, TNF-α, and BMPs promoted both osteoclastic and osteoblastic activity, leading to transient osteopenia and reducing resistance to orthodontic tooth movement [2, 4]. This biological window permitted the rapid movement observed, significantly shortening overall treatment duration [6].

Beyond accelerated tooth movement, this integrated PAOO protocol offered several advantages that contributed to its success. By combining corticotomy with bone grafting, the procedure not only prevented additional bone loss but actively enhanced alveolar bone volume and thickness, thereby reducing risks such as dehiscence and fenestration—concerns frequently encountered in periodontally compromised patients undergoing orthodontics [5, 4]. The newly formed, remodelled bone provided strengthened periodontal support and improved the long-term stability of the orthodontic outcome, decreasing the likelihood of relapse [6]. Additionally, the use of piezosurgery ensured precision and minimized trauma to adjacent tissues, supporting an efficient and biologically favourable healing response [8].

Overall, this case highlights how a carefully integrated PAOO approach—supported by A-PRF and bone grafting—can generate superior periodontal health, faster orthodontic results, and improved stability, particularly in patients with pre-existing periodontal compromise [1, 5, 6].

Conclusion:

This case report successfully demonstrates the efficacy of an interdisciplinary approach combining periodontics and orthodontics through the PAOO protocol [5,6]. The integration of piezosurgery [8], A-PRF [1], and a bone graft facilitated not only rapid and safe orthodontic tooth movement but also simultaneous periodontal regeneration in an adult patient with pre-existing bone loss. The significant clinical and radiographic improvements underscore the paradigm shift from simply moving teeth to actively sculpting and fortifying their supporting structures. PAOO, therefore, stands as a powerful tool in modern dentistry, enabling clinicians to predictably manage complex malocclusions with enhanced efficiency, safety, and long-term stability [5,6,10].

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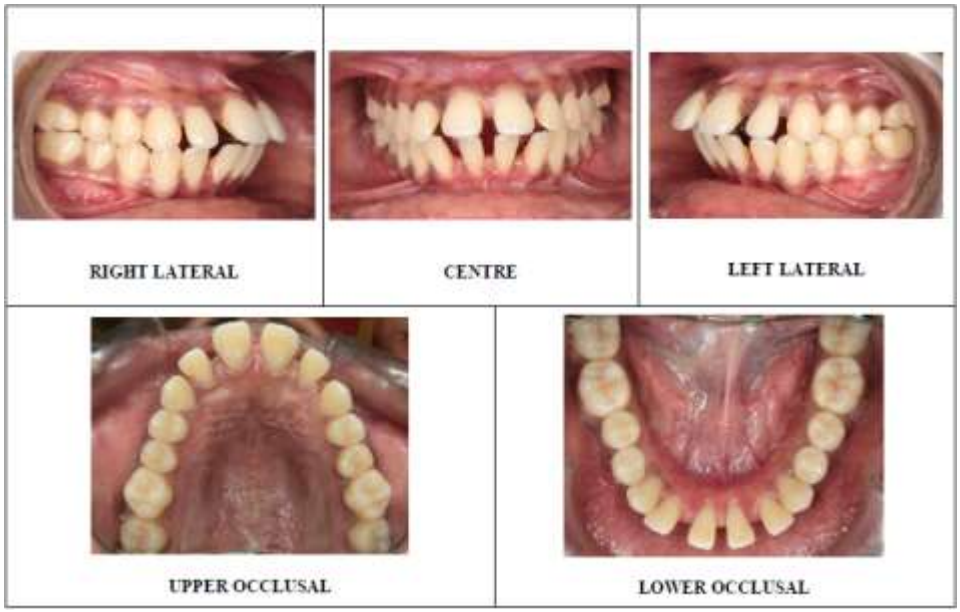

FIGURE 1 - PREOPERATIVE

FIGURE 2 – CORTICORTOMY DONE WITH PIEZOSURGERY TIPS

FIGURE 3 – BONE GRAFT PLACED

FIGURE 4 – A-PRF PLACED

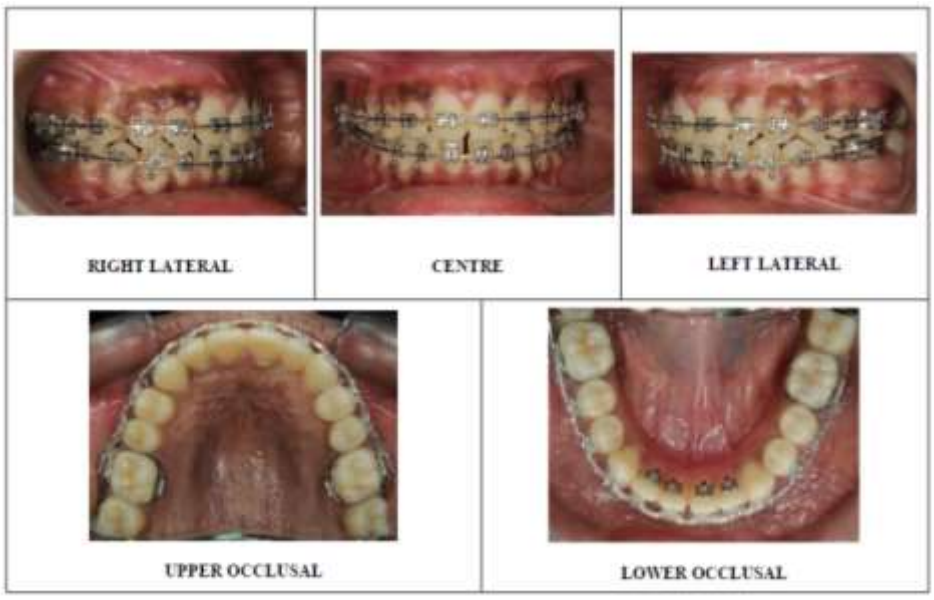

FIGURE 5 – ORTHODONTIC TREATMENT POST SURGERY