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Case Report

Ramal TADs for traction and up righting impacted mandibular 2nd and 3rd molars in a 16 year old female patient with Skeletal Class III maxillomandibular relationship: A Unique and rare case report

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Abstract

16 year old female patient having Skeletal Class III maxillomandibular relationship reported with anterior crossbite and impacted 37 and 38. The proximity of roots of 37 and 38 to Inferior alveolar nerve necessitated need for uprighting 37 and 38 and bringing them into occlusion. The decision to defer from extraction of these aforementioned teeth was to prevent any iatrogenic damage to the patient post extraction. Ramal TADs served absolute anchorage for traction and uprighting of these impacted teeth. This case report presents as a myriad of challenges encompassing skeletal class III with impacted 37 and 38 to be uprighted. Thorough planning and meticulous execution of the treatment mechanics helped establish correction of anterior cross bite and sound occlusion with 37 and 38 respectively.

Keywords: Ramal TADs, traction, anterior cross bite, impacted mandibular 2nd molar, Impacted mandibular 3rd molar.

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1. Introduction

Incidence of mandibular second molar impaction accounts to 0.03%[1] and often pose problems during uprighting like chances of root resorption of adjacent teeth, lower anterior crowding, development of cyst and peri coronal inflammation[2]. Management of impacted mandibular 2nd molar includes uprighting springs and judicious use of orthodontic biomechanics for bringing them in occlusion, tooth transplantation and surgical disimpaction[3]. Anchorage planning is of importance in this context, as excessive brunt of forces applied for traction of the impacted teeth could lead to lingual rolling of adjacent molars which eventually leads to round tripping and prevent undue movement of anchorage teeth[4]. One needs to take cognizance of the time invested in uprighting such teeth with unusual inclinations. Failure to cater the aforementioned issues could lead to patient burn out. For uprighting multiple impacted teeth, Temporary Anchorage Devices (TADs) could be a viable option. TADs provide valuable insights for achieving absolute anchorage. In recent years, the use of Temporary Anchorage Devices (TADs) has emerged as a promising alternative for addressing this clinical concern. Surgical uncovering of impacted teeth, TAD insertion and the orthodontic traction can be performed without the negative impact on Oral Health related quality of life.[5]

Uprighting of these impacted molars is important to achieve optimal occlusion, restore normal function, prevent extrusion of the antagonist and prevent periodontal problems due to food impaction. TADs provide a new horizon of absolute anchorage and thereby allows for precise tooth movement without relying on adjacent natural teeth. The most preferred and predictable approach to treat impacted second molar is uprighting them using orthodontic appliance with possible extraction of third molars.[6]

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Temporary Anchorage Devices, comprising mini-implants or mini-screws strategically placed into bone, offer orthodontists a means to achieve controlled and predictable tooth movement without relying on conventional anchorage methods. In the context of second molar impaction, TADs present a compelling solution by providing stable and localized anchorage, thereby facilitating efficient uprighting of the impacted molars while minimizing undesirable side effects.

Although the use of TADs for second molar uprighting is gaining traction in orthodontic practice, a comprehensive understanding of the techniques, outcomes, and clinical considerations associated with this approach is essential for informed decision-making and optimal patient care. Ramal Screws could be used with a comfortable margin of safety in relation to proximity with underlying neurovascular bundle.[7] In this study (or review), we aim to explore the current literature on second molar up righting with TADs, evaluate the efficacy and safety of this technique, and discuss practical considerations for its implementation in clinical practice.

2. Case History

A 16-year-old female patient presented to the Department of Orthodontics and Dentofacial Orthopedics with skeletal class III maxillomandibular relationship with retrognathic maxilla and prognathic mandible with horizontal growth pattern (**Table 1**, **Figure 1**), Angles Class I molar relationship and class I canine relationship bilaterally with anterior cross bite, crowding in the maxillary dentition (7.5 mm) and mandibular dentition (1 mm) with reverse overjet (2 mm) and overbite (4 mm) (**Figure 2**), impacted 37 and 38 (**Figure 3**, **Figure 4**), concave profile, average nasolabial angle and potentially competent lips.

Figure 1: Pre-treatment extra oral photos

Figure 2: Pre-treatment intra oral photos

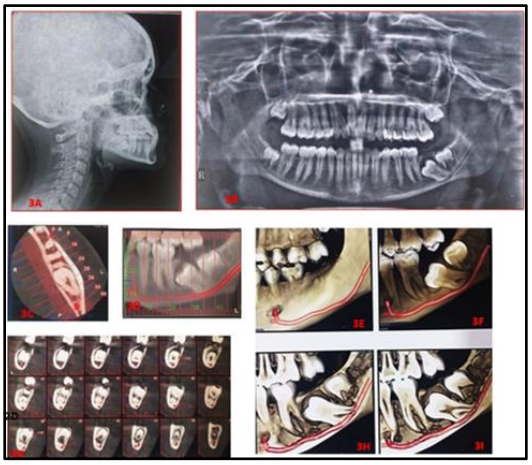

Figure 3: Pre-treatment radiographs

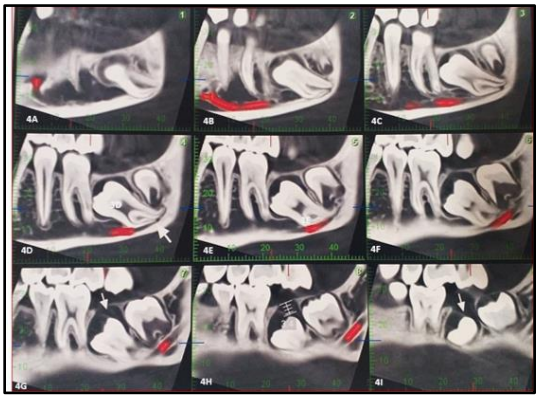

Figure 4: CBCT images of impacted 37

Figure 5: Mid treatment extra oral photos

Figure 6: Mid treatment intraoral photos

Figure 7: Tration to impacted 37, 38 from raman TAD

Figure 8: Mid treatment extra oral photographs

Figure 9: Post treatment extra oral photographs

Figure 10: Post treatment intra oral photographs

Figure 11: Post treatment extra oral radiographs

Table 1: Pre-treatment cephalometric analysis

Parameter	Range	Pre-Tx	Inference
SNA angle	82˚	79˚	Retrognathic Maxilla
SNB angle	80˚	83˚	Prognathic Mandible
ANB angle	2˚	-4˚	Skeletal Class III malocclusion
Go-Gn to SN	32˚	28˚	Horizontal Growth Pattern
FMA	25	21˚	Horizontal Growth Pattern
Jarabak ratio	62-65%	67%	Average Growth pattern
IMPA	90º	86º	Retroclined lower incisors

Table 2: Problem List

Skeletal Problems	Dental Problems	Soft Tissue Problems
Class III maxillomandibular relationship	1.Anterior cross bite 2.Impacted 37 and 38 3. Crowding in upper and lower arch 4. Rotations with 12,13, 23	Mild protrusion of lower lip

Table 3: Treatment objectives

Skeletal objectives	Dental objectives	Soft tissue objectives
1. Camouflage treatment option	1.Correction of anterior cross bite 2.Traction of 37 and 38 with Ramal TADs 3.Correction of crowding in upper and lower arch 4.Correction of rotations with 12,13, 23 5.Achieving ideal overjet and overbite	Correction of retroclined anteriors will help mask upper lip retrusion and compensate the protrusion of lower lip

2.1. Treatment plan

Following treatment plan was decided for the patient:

1. Fixed Orthodontic Mechanotherapy (0.022”x0.028”). Placement of GIC Bite turbos on posterior teeth for correction of anterior cross bite (**Figure 5**,**Figure 6**)
2. Ramal TADs for traction and up righting of 37 and 38 (**Figure 7**,**Figure 8**)
3. Treatment alternative: The following were the alternatives suggested to aforementioned treatment plan.

Extraction of 37 and 38 and prosthetic replacement of 37 with Implant supported prosthesis

Based on initial assessment of pre-treatment records a problem list was developed **Figure 2**), the treatment objectives were enlisted (). The first treatment plan was prioritized over the second treatment plan considering the risk of iatrogenic damage to inferior alveolar nerve and subsequent paraesthesia following surgical extraction. Also, the alveolar bone defect after surgical extraction of 37 and 38 would require placement of alveolar bone graft.[8]The risks associated with both the treatment plans were explained to

the patient and consent was obtained for the same from the patient as per her will.

3. Treatment Summary

Following clinical procedures were undertaken in a sequential manner for correction of malocclusion:

3.1. Correction of anterior cross bite

GIC Bite turbos were placed on posteriors bilaterally to unlock the upper anteriors for correction of anterior cross bite. Archwires were gradually shifted from 0.014 Niti, 0.016x0.022 Niti, 0.07x0.025 Niti, 0.019x 0.025 Niti and 0.019x0.025 SS respectively. GIC Bite Blocks were gradually reduced after correction of anterior cross bite.

4. Placement of Ramal TAD

2% Lignox (Lignocaine with Adrenaline) was administered using inferior alveolar nerve block to facilitate placement of Ramal TAD facilitating placement of attachment on the buccal surface of 37 after surgical exposure of 37. Medical history was carefully evalutated at the ouset, before performing any surgical procedure. The following steps were adopted during the procedure:

1. **Pre procedural rinse:** The patient was administered a pre procedural mouthrinse prior to placement of Ramal TAD.
2. **Mopping of the placement site:** The area for placement of Ramal TAD was cleaned using gauze piece dipped in betadine.
3. **Insertion:** The ramal surface area was carefully palpated and analyzed by the operator before placement of Ramal TAD. Using the Bone Screw placement driver, the operator carefully inserted the Ramal TAD into the selected site.
4. **Evaluation:** Once the Ramal TAD was inserted, the operator verified its stability and position using clinical examination, followed by radiographic assessment using Orthopanthgram (OPG)
5. **Post-operative Instructions:** The operator had reinforced the patient with instructions for care and maintenance of the Ramal TAD, including dietary restrictions and oral hygiene practices.

It's essential for patients to follow the operators instructions closely regarding the care and maintenance of Ramal TADs to ensure the success of their orthodontic treatment. Additionally, regular follow-up appointments were scheduled to monitor progress and make any necessary adjustments to the treatment plan.

4.1. Exposure of buccal surface of 37 and placement of attachment:

The buccal surface was etched using 37% phosphoric acid followed by application of moisture insensitive primer. Beggs bracket was positioned on the buccal surface of 37 using bracket positioning tweezer. 3M Transbond XT Adhesive was used for bonding the attachment. J Hook type of ligature tie was passed from the vertical slot of beggs attachment. Traction was applied using E-chain attached from beggs bracket to the Ramal TAD. **Eruption of 38**:

The roots of 38 were in bud stage at the time of attachment placement with 37. Following traction of 37, eruptive force was directed for 38 as well. Since, 38 was in bud stage, it facilitated easy eruption of 38. The patient was instructed to avoid eating hard and sticky food stuffs to prevent accidental debonding of bonded attachments.

5. Treatment Result

At the end of the treatment, the occlusion was settled with class I canine relation bilaterally with 2mm of overjet and overbite (**Figure 9**). 37,38 were established in occlusion (**Figure 10**, **Figure 11**)

6. Discussion

To optimize the aesthetics and results based on facial profile analysis and taking cognizance of soft tissue profile, non extraction treatment plan was executed for correction of anterior cross bite and alignment of 37, 38 in occlusion. Use of Closed coil springs, helical springs, nitanium (nickel-titanium) up righting springs have been used conventioanally for molar urpighting. Success of these hinges on skill in fabrication of these springs, adequate maintenance by the patient and reinforcement of dietary restrictions to prevent accidental breakage and untoward tooth movement. Tooth transplantation could also be considered as a viable option for management of impacted molars. The procedure requires precise surgical skills and careful handling of the donor tooth. Potential complications of tooth transplantation include root resorption, infection, and failure of the tooth to integrate into the recipient site. Tooth transplantation in the aforementioned case would have been invasive with questionable prognosis if not handled properly.

Timing of molar uprighting is crucial especially when uprighting lower 2nd molars.[9] The root formative stage is a critical parameter to decide the success of molar uprighting. One half to two third root formation is important for tooth to be subjected to orthodontic forces for uprighting. An age of 11years could be treated as ideal age for initiating mandibular second molar uprighting. Better prognosis is found for teeth with incomplete root formation as greater vascularity is still being maintained through the open apices, irrespective of they being subjected to orthodontic forces.[10]

Success of molar uprighting depends on various factors which include root angulation, bone density , periodontal health, proximity with vital structures and adjacent teeth,

anchorage control, patients age and compliance on patients side. Type of root angulation is an inevitable factor deciphering the prognosis and ultimate success of molar uprighting. Molars with minimal accentuation of distal root angulation require less force application to upright than those which are having pronounced accentation of distal root angulation. Type of bone density is also a factor amenable for deciding on the rapidilty of molar uprighting. Root configuration and anatomy is also a factor to cater on the time required for molar uprighting .Roots which are parallel to each other and to the long axis of the tooth require minimal efforts for uprighting. Availability of space to facilitate third molar eruption before and after second molar protraction is not associated with uprighting of erupting third molar. Mesial tipping of third molar could occur due to protraction of 2nd molar. [11] Hence timely monitoring of the case is required to ensure that there is no advertent mesial tipping of mandibular third molar following movement of impacted mandibular second molar. Pre-operative radiographs of the aforementioned case revealed considerable curvature of mesial root of mandibular 37 and presence of developing tooth bud of 38 in the immediate vicinity of 37 increasing the difficulty index of the case. Also one nedds to take cognizance of the type of tilt exhibited by the molar. Molars having buccal tilt are easier to upright as foeces are directed directly towards buccal surface of the teeth.

Apart from thorough planning and meticulous execution of the decided treatment mechanics, one needs to take cognizance of complications associated with Ramal TADs placement and measures to effectively manage it. These could be enlisted as follows:

Complications of Ramal TADs

1. **Inflammatory response due to soft tissue irritation:** inflammation of the gum tissue around the TAD can occur, leading to discomfort and potential infection. **Soft Tissue Overgrowth** may grow over the TAD, necessitating additional treatment to expose it.

2. **TAD Failure:** The TAD can become loose if it does not achieve primary stability or if subjected to excessive forces. Loose Ramal TADs are ineffective and might need requirement for repositioning. Such TADs can sometimes fracture, requiring removal and replacement.

3. **Bone-Related Issues:** Improper site of placement of Ramal TAD can cause the TAD to not integrate adequately with the bone, leading to instability and failure of the anchorage. Over time, bone loss around the Ramal TAD can occur, compromising its stability and effectiveness.

4. **Damage to Adjacent Structures:** Improper placement of TADs can damage the roots of adjacent teeth, leading to root resorption or other dental issues. Placement in the mandibular ramus carries a risk of damaging the inferior alveolar nerve[12], which can cause temporary or permanent numbness, tingling, or pain.

6.1. Pain and discomfort

1. **Post-Insertion Pain**: Patients may experience pain and discomfort after TAD insertion, which typically subsides within a few days but can sometimes persist.
2. **Masticatory Discomfort**: Placement of TADs in the ramal region may cause discomfort during chewing.

6.2. Technical difficulties

1. **Skill and precision in placement**: Insertion of TADs in the ramal area can be technically challenging due to the dense bone and anatomical variations, requiring precise technique and experience.

2. **Removal Issues**: Removing TADs can sometimes be problematic, particularly if they have integrated well with the bone.

6.3. Inflammatory responses

1. **Localized Inflammation**: Mild inflammation around the TAD is common initially but should resolve with proper care.
2. **Systemic Reactions**: Though rare, systemic inflammatory responses or allergic reactions to the materials used in TADs can occur.

7. Prevention and Management

1. **Oral Hygiene reinforcement**: Soft tissue inflammation is an important factor for causing Ramal TAD Failure. It is pivotal to reinforce the importance of oral hygiene to the patient to minimize the risk of infection.
2. **Precision in placement of Ramal TAD**: Skill and expertise is required to place TADs. At times use of appropriate imaging techniques (e.g., CBCT) to plan and guide the insertion of Ramal TADs is required.
3. **Regular Monitoring**: Regular follow-up appointments to check the stability and health of the TAD and surrounding tissues.
4. **Counselling of patients**: Educating patients about the signs of complications (e.g., persistent pain, swelling, loosening of the TAD) so they can seek timely intervention.
5. **Appropriate Medications**: In some cases, the use of prophylactic antibiotics may be recommended to reduce the risk of infection, especially in high-risk patients.

6. **Optimum Forces for traction**: Applying controlled and appropriate orthodontic forces to the TAD to prevent overloading and potential failure.

By understanding these potential complications and implementing preventive measures, the success rate of ramal TADs can be maximized, and adverse outcomes can be minimized.

7.1. Novelty of the treatment plan

Extraction of mandibular third molar adjacent to impacted second molar was eliminated by using aforementioned treatment mechanics. The traction applied from Ramal TAD facilitated extrusion of impacted second molar. Since roots of mandibular 3rd molar were partially developed, eruptive force of mandibular second molar eventually led to eruption of mandibular 3rd molar.

7.2. Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the formthe patient has given consent for her image and other clinical information to be reported in this journal.

8. Source of Funding

None.

9. Conflict of Interest

None.

10. Conclusion

This case report concludes by highlighting the advantages of Ramal TAD in effectively obtaining impacted 37, 38 in occlusion. The invasiveness of surgical disimpaction of 37, 38 followed by prosthodontic rehabilitation with implants was totally eliminated by judicious use of Ramal TADs in urpighting impacted 37,38.

11. List of Abbreviations

1. Temporary Anchorage Devices (TADs)
2. Orthopanthogram (OPG)

12. Source of Funding

None.

13. Conflict of Interest

None.

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