

Uniarch Treatment of a Horizontally Impacted Mandibular Third Molar Using Long-Arm Buccal Tube, Uprighting Spring, and Miniscrew Implant: A Case Report

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Abstract

This article reports a case in which a horizontally impacted wisdom tooth was orthodontically uprighted to replace a missing molar. Through mandibular single-arch treatment utilizing a long-arm buccal tube, uprighting auxiliary spring, and miniscrew implant, the impacted wisdom tooth was successfully uprighted and mesialized to substitute for the missing molar, effectively restoring occlusal function in the edentulous area. Written informed consent was obtained from the patient, and the treatment protocol was approved by the institutional ethics committee.

Keywords

Horizontally Impacted, Long-Arm Buccal Tube, Uprighting Spring, Miniscrew Implant, Molar Substitution

1. Introduction

The third molar (wisdom tooth) is the last permanent tooth to erupt in the human oral cavity [1]. Due to insufficient space resulting from modern human jaw evolution, third molars frequently become impacted due to abnormal eruption position or direction [2]. Impacted wisdom teeth have a high incidence rate, with mesially impacted cases being most common [3]. The orthodontic treatment of such

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cases has attracted considerable attention due to their unique anatomical position and treatment complexity [4]. Impacted wisdom teeth may cause various oral health problems, including pericoronitis and infection, adjacent tooth damage, cyst and tumor risks, and occlusal disorders [5]-[7]. Despite the numerous disadvantages of wisdom teeth, they possess potential value in restoring dentition defects and can serve as substitute teeth for reconstructing the occlusal function of missing first or second molars [8]. This article presents a case of uprighting a horizontally impacted wisdom tooth to replace a missing molar.

2. Materials and Methods

2.1. Basic Information

Patient: Female, 25 years old. Chief complaint: Using wisdom tooth to replace carious molar. General health condition was good, with no history of systemic diseases, family genetic history, allergies, or previous orthodontic treatment. Clinical examination: 1) Intraoral examination: Permanent dentition 17 - 27, 37 - 47. Tooth 23 missing (1 mm space between 22 - 23), tooth 46 retained root. Normal overjet, Class I deep bite, molar distal relationship, upper midline normal, lower midline deviated 3 mm to the right. No erupted third molars visible intraorally. 2) Facial examination: Straight profile, basically symmetrical face, mandibular retrusion (showing in **Figure 1**). 3) Temporomandibular joint examination: No abnormalities detected. Radiographic examination: Teeth 18, 28 vertically impacted; 38, 48 horizontally impacted; tooth 36 with large filling; small condyles. Cephalometric analysis showed: SNA 78.6°, SNB 71.2°, ANB 7.4°, FH-MP 37.6°, SN-MP 46.9°, Wits 2.4°, U1-SN 91.4°, IMPA 90.6°, U1-L1 135.3°, Z-Angle 64.1° (showing in **Table 1**). Periodontal Assessment: Baseline periodontal examination of teeth 47 and 48 showed probing depths of 3 - 4 mm and normal mobility (Grade 0) for tooth 47. Tooth 48 was unerupted and required surgical exposure for assessment.



Figure 1. Pretreatment facial photograph, intraoral photograph, and X-ray image.

Table 1. Cephalometric data before and after treatment.

Measurement	Norm \pm SD	Pre-treatment	Post-treatment
SNA ($^{\circ}$)	83.0 \pm 4.0	78.6	78.9
SNB ($^{\circ}$)	80.0 \pm 3.0	71.2	71.9
ANB ($^{\circ}$)	3.0 \pm 2.0	7.4	7.0
Wits (mm)	0 \pm 2.0	2.39	2.2
SN-MP ($^{\circ}$)	33.0 \pm 4.0	46.9	46.6
FH-MP	28.0 \pm 4.0	37.6	37.2
U1/L1 ($^{\circ}$)	127.0 \pm 9.0	135.3	125.3
U1/SN ($^{\circ}$)	105.0 \pm 6.0	91.4	91.4
IMPA ($^{\circ}$)	96.7 \pm 6.4	90.6	100.6
Upper lip (mm)	2.0 \pm 2.0	0.04	0.03
Lower lip (mm)	3.0 \pm 2.0	1.31	1.38
Z-Angle	71.0 \pm 5.0	64.1	65.7

2.2. Diagnosis

Angle Class II, skeletal Class II, high angle.

2.3. Treatment Plan and Patient Demands

Plan 1: Wisdom tooth substitution treatment. Extract tooth 46, upright tooth 48, move teeth 47 and 48 mesially to replace teeth 46 and 47.

Plan 2: Combined orthodontic-implant treatment. Extract teeth 46 and 48, place implant in the 46 edentulous area.

Patient demands: 1) Preserve natural teeth as much as possible; 2) Refused to wear upper arch appliance; 3) Accepted non-perfect upper and lower midline symmetry; 4) Accepted miniscrew placement.

2.4. Treatment Design

Considering the patient's oral condition and specific demands, Plan 1 was selected: 1) Extract retained root of tooth 46; 2) Apply straight-wire ceramic bracket system to mandibular arch; 3) Place miniscrew between teeth 15 and 16; 4) Use long-arm buccal tube (A molar attachment with an extended arm for connecting orthodontic headgear). And uprighting spring with miniscrew to upright and move teeth 47 and 48 mesially.

2.5. Treatment Process

1) Initial stage: Bond straight-wire ceramic brackets to mandibular arch, change archwires sequentially to align and level the dentition; 2) Alignment and space

closure stage (month 12): Mandibular dentition preliminarily aligned, space at site 46 reduced; 3) Molar uprighting stage: Incise buccal gingival mucosa of tooth 48, bond buccal tube on exposed crown. Place push spring between teeth 47 and 48 (showing in **Figure 2(a)** and **Figure 2(b)**) to move tooth 47 mesially and tooth 48 distally; 4) At month 18, space appeared between teeth 47 and 48, removed push spring, bonded uprighting spring to tooth 48 for continued uprighting adjustment (showing in **Figure 2(c)**); 5) Placed miniscrew in maxillary vestibule (between roots of teeth 15 - 16), bonded long-arm buccal tube to tooth 47, applied traction using 150 g (3.5 OZ, 3/16 inch) elastic connecting miniscrew and long-arm buccal tube traction hook with continuous wear protocol (24 hours/day, replaced every-day, **Figure 2(d)**); 6) At month 22, mesial inclination of teeth 47 and 48 resolved, removed long-arm buccal tube and uprighting spring; 7) Due to lingual inclination of tooth 48 crown, bonded lingual button on lingual side for cross-arch traction with maxillary miniscrew (showing in **Figure 2(e)** and **Figure 2(f)**); 8) Retention stage (month 25): Lingual inclination of tooth 48 corrected, maintained mandibular brackets with figure-eight ligation ligation; 9) Treatment completion (month 27): Removed brackets and miniscrew, retention with retainer, treatment completed.

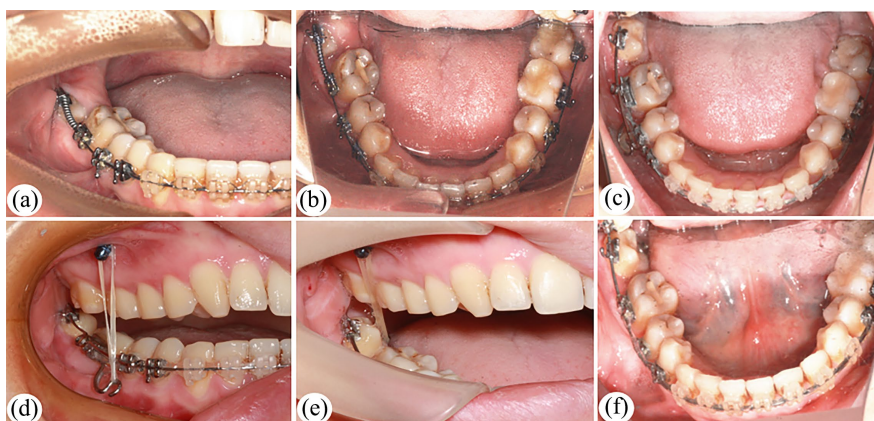


Figure 2. The Orthodontic Treatment Process.

3. Results

Total treatment time was 27 months. After treatment completion, the patient's soft tissue profile and facial symmetry remained essentially unchanged. Upper and lower jaw occlusal relationship was good. Tooth 48 was successfully uprighted, and teeth 47 and 48 were effectively moved mesially to replace teeth 46 and 47 (showing in **Figure 3** and **Figure 4**). Tooth 47 achieved 4.2 mm of mesial movement over 15 months (0.28 mm/month), while tooth 48 achieved 6.8 mm of mesial movement over 18 months (0.38 mm/month) as measured on panoramic radiographs using the adjacent tooth roots as reference points. Final periodontal examination showed probing depths of 2 - 3 mm for both teeth 47 and 48, with normal mobility (Grade 0) maintained throughout treatment, indicating periodontal safety during the protraction process.



Figure 3. Post-treatment facial photograph, intraoral photograph, and X-ray image.

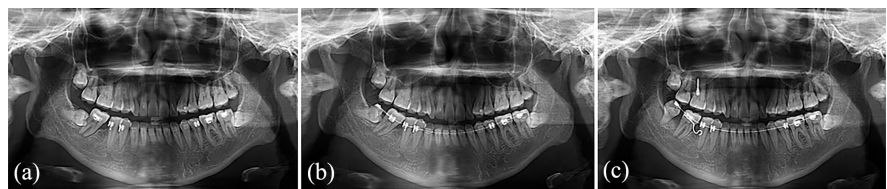


Figure 4. X-ray images in orthodontic treatment.

4. Discussion

This case did not use conventional upper arch appliances due to patient's specific request. It should be particularly noted that single-arch treatment, lacking inter-arch interaction, does not reduce clinical treatment difficulty in achieving three-dimensional tooth control. Instead, it requires construction of a more precise bio-mechanical system with strict control of force timing. Based on case understanding, the following insights are offered:

4.1. Push Spring Application

After initial alignment, tooth 48 crown remained gingiva-covered and in tight contact with the distal crown of tooth 47. To establish necessary treatment space, the following interventions were taken: 1) Performed surgical exposure of tooth 48 crown and bonded buccal tube; 2) Placed push spring in the contact area between teeth 47 and 48. For tooth 47, the push spring had both advantages and disadvantages: the spring moved tooth 47 mesially without requiring anterior-posterior tooth traction for space closure, avoiding further midline deviation; however, it caused tooth 47 to tip mesially. For tooth 48, the push spring moved it distally and uprighted it, increasing the space between teeth 47 and 48 to provide movement space for crown uprighting (showing in **Figure 5(a)**).

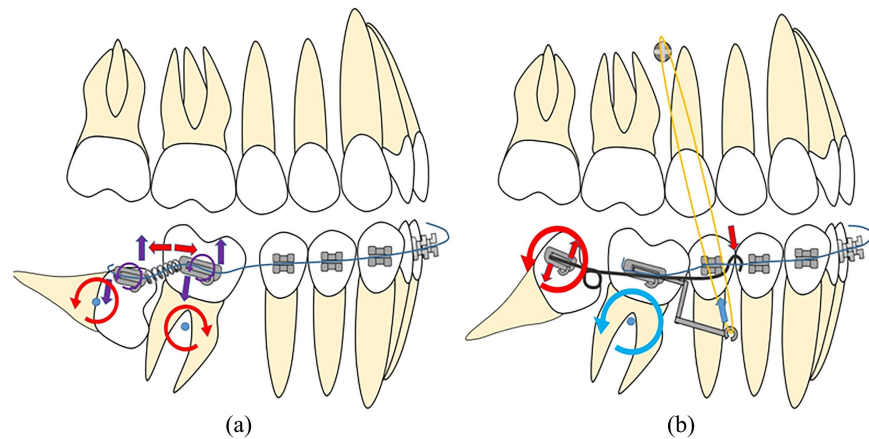


Figure 5. Mechanical schematic diagram.

4.2. Uprighting Spring Application

Although uprighting spring effectiveness has been confirmed in multiple previous studies, this case did not use this device in early treatment based on the following clinical considerations: first, the early tight contact between teeth 47 and 48 might cause crown movement obstruction with direct force application; second, insufficient bonding area on the exposed crown of tooth 48 limited device placement space. Additionally, when clinically applying uprighting springs, attention must be paid to side effects, as the spring's anterior end contact with the mandibular archwire inevitably produces vertical intrusive force on the mid-arch segment (showing in **Figure 5(b)**) [9].

4.3. Long-Arm Buccal Tube and Miniscrew Application

As mentioned above, tooth 47 developed mesial inclination during treatment. For this problem, uprighting spring was not used simultaneously because: spring side effects would intrude the right mandibular mid-arch segment, creating open bite [10]. Since this was single-arch treatment, open bite would be difficult to resolve once developed. Therefore, a long-arm buccal tube was designed for tooth 47, working with opposing miniscrew and elastic for traction. This design advantage included: providing distal rotation force for tooth 47 to counteract mesial tipping force from push spring; providing elongation force for mandibular dentition to counteract intrusive force from uprighting spring anterior end on the dentition [11]. Additionally, the long-arm buccal tube increased mechanical efficiency ($M = F * d$) by extending the force arm (d) through increased traction hook length [12].

4.4. Long-Arm Buccal Tube and Miniscrew Application

For adult patients, especially those with complex dentition conditions, treatment expectations should be appropriately reduced without excessive pursuit of ideal normal occlusion [13]. In this case, the patient had significant mandibular crowding, and extraction of tooth 46 provided alignment space. However, due to asymmetric extraction, the mandibular midline shifted rightward post-treatment. This

deviation was predictable and fully discussed with the patient pre-treatment, so the patient was satisfied with the treatment results.

5. Conclusion

This case report demonstrates that uniarch treatment using long-arm buccal tube, uprighting spring, and miniscrew implant can effectively manage horizontally impacted mandibular third molars. The approach successfully achieved tooth uprighting and mesialization while preserving natural dentition and maintaining periodontal health. Key success factors include proper patient selection, precise biomechanical planning, adequate anchorage control, and realistic treatment expectations. This treatment modality offers a viable alternative to extraction and implant therapy for suitable cases, particularly when patients have specific preferences regarding.

6. Contribution

X. S, Y. C and F. W contributed to the drafting of the manuscript; X. S, Y. C, Q. J, Y. X and Q. F contributed to the dental examination and dental treatment of the patient; X. S, Y. C and Q. J contributed to the conception and design of study. All authors approved the version submitted for publication. All authors read and approved the final manuscript.

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Conflicts of Interest

The authors declare that they have no competing interest.

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