Journal of Craniomaxillofacial Research

Vol. 13, Issue. 3 Summer 2026

Posterior Maxillary Segmental Osteotomy–A Paradigm Shift From Orthognathic Surgery to Preprosthetic Surgery: A Case Series

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ARTICLE INFO

Article Type:
A Case Series

Received: 3 March 2026
Revised: 9 April 2026
Accepted: 26 May 2026

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ABSTRACT

Severe supraeruption of maxillary molars following loss of opposing mandibular teeth can critically reduce interarch space and compromise implant-prosthetic rehabilitation. When extrusion is extensive, orthodontic intrusion or prosthetic reduction may be impractical. Posterior maxillary segmental osteotomy (PMSO), classically indicated in orthognathic surgery, can be repurposed as a preprosthetic intervention to restore vertical dimension and occlusal harmony. Two patients presenting with missing mandibular posterior teeth and marked supraeruption of opposing maxillary molars exhibited interarch space of <5 mm. After clinical and radiographic evaluation, PMSO was planned to reposition the extruded maxillary posterior segment. Osteotomy lines were executed under local anesthesia, and the segment was repositioned using a prefabricated surgical stent for guidance and stabilization. Simultaneous placement of endosseous implants was performed in the mandibular posterior region. Patients were followed radiographically and clinically to assess bony union, implant osseointegration, pulpal vitality, and segment stability. Both cases demonstrated satisfactory repositioning of the maxillary segment with immediate restoration of interarch space adequate for prosthetic rehabilitation. Follow-up imaging confirmed successful bony union and implant osseointegration. No postoperative complications, including segmental necrosis, relapse, or pulpal injury, were observed. Definitive prosthetic rehabilitation was completed after three months with stable occlusal relationships and improved function. PMSO can serve as a predictable preprosthetic surgical option for immediate correction of severe dentoalveolar extrusion when conventional orthodontic or prosthetic methods are not feasible. This approach facilitates restoration of interarch space and enables successful implant-supported rehabilitation with favorable functional outcomes.

Keywords: Posterior maxillary osteotomy; Dentoalveolar extrusion; Interarch space.

Please cite this Article as:
Rathan A C L, Jhunjhunwala M, Narayanan V, Subramanian A, Seetaram M. Posterior Maxillary Segmental Osteotomy–A Paradigm Shift From Orthognathic Surgery to Preprosthetic Surgery: A Case Series. J Craniomaxillofac Res 2026; 13(3): 398-403. DOI: 10.18502/jcr.v13i3.23116

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Introduction

Interarch space, also known as vertical dimension of occlusion (VDO), is one of the essential factors for dental prosthetics. Scientific studies have highlighted its importance across various aspects of prosthetic rehabilitation. Common reasons for decrease in interarch space include missing teeth, leading to dentoalveolar extrusion and supraeruption of opposing teeth, tooth wear (from grinding or erosion), deep bite and improper prosthetic restorations [1]. In these cases, maintaining sufficient space for prosthesis can be an important criteria in establishing treatment plan. Dental extrusion involves the tooth alone moving occlusally, while alveolar (dentoalveolar) extrusion involves both the tooth and surrounding alveolar bone shifting upward together. When the dentoalveolar extrusion is not too severe, it is possible to gain space by performing endodontic treatment and a coronoplasty of supra-erupted maxillary teeth or periodontal crown lengthening with endodontic treatment of the maxillary teeth.

To correct occlusion, orthodontic treatment using conventional orthodontic methods or mini-implants as a skeletal anchorage can be used. When the extrusion is too severe, extraction of teeth is often proposed. Alternatively, interarch space can be achieved surgically by a segmental maxillary osteotomy procedure [2,3]. Posterior maxillary segmental osteotomy (PMSO) is a common osteotomy procedure, routinely done as a part of orthognathic surgery, to address vertical skeletal discrepancies. It was introduced by Schuchardt (1955) as a 2-stage surgery to correct the open bite deformity and was then modified by Kufner (1970) into a 1-stage procedure [4,5]. This procedure can be done to significantly restore previously decreased vertical dimension [6]. Our case aims to highlight the role of PMSO as a preprosthetic procedure in improving posterior vertical height for implant rehabilitation.

Case Report

Two patients in the age range of 30-50 years reported to our Department of Oral and Maxillofacial Surgery with a complaint of missing teeth in the right lower back tooth region for the past 1 month. Both patients were female. On further history taking, both patients reported difficulty in chewing due to missing teeth in relation to the lower right posterior region. Both the patients' medical history was non-contributory, and no contraindications for treatment were noted. On general examination, both patients were conscious and oriented with no abnormalities noted extraorally. On intraoral examination, mouth opening was adequate with stable occlusion. The patients exhibited asymmetrical 'V' shaped maxillary and mandibular arch form with a mild curve of Spee. The first patient had edentulous space in relation to 45, 27; root stumps in relation to 46, 47 and prosthesis in relation to 35, 17. The second patient has edentulous space in relation to 46, 47 and 37 and fixed prosthesis in relation to 16, 34, 35, 36, 43 and 44. Severe supraerupted segment of the right upper first and second molar was noted due to missing opposing teeth and root stumps. The maxillary teeth were abutting the mandibular gingival mucosa with reduced interocclusal space of 2 mm (Figures 1, 7).

On radiographic evaluation using orthopantamogram (OPG), available alveolar bone height and width and the localization of sinus floor were assessed. Consequently, cone beam computed tomography (CBCT) was taken to confirm the OPG findings as well as to assess the bone density (Figures 2, 8). As the available ridge height and interocclusal space were reduced, therefore, both patients were diagnosed with severe dentoalveolar extrusion and it was decided to increase the vertical height by performing a Posterior maxillary segmental osteotomy. The treatment plan selected included stabilizing the maxillary right segment in the desired position, obtaining required interocclusal space and placing implants in the right mandibular segment. It was planned that the mandibular posterior segment would be restored with an implant-retained fixed partial denture (FPD).

Work up/Mock surgery-Diagnostic stone casts were fabricated after making preliminary impressions using putty impression material of both arches and working models were mounted in a semi-adjustable articulator. The mock surgery was performed in which the osteotomy of the supraerupted maxillary segment was followed by superior impaction, and vertical dimension (VD) of 10mm was achieved, following which an occlusal/wafer splint was fabricated on the maxillary cast to be used during and after the surgical procedure to determine the definitive occlusal plane (Figures 3, 9). Surgical Procedure–Under left nasoendotracheal intubation, general anesthesia was induced and maintained. Local anesthesia was infiltrated in relation to the right vestibule, 27, 35, 45, 47 region. Standard patient preparation and draping were done. A vestibular incision was placed in relation to the 14 to 17 regions, 5mm from the attached gingiva. Free gingival crevice was reflected in relation to 13, 14, and 15 regions. Two hor-

izontal osteotomy cuts were placed, one 5 mm above the root apices and the other 5 mm above the first line. Interdental vertical osteotomy cuts were placed between 13 and 14 using 701 bur. Using a pterygoid chisel, pterygomaxillary dysjunction was done. The fragment was then down-fractured with digital pressure. The fractured segment was mobilized and repositioned using an occlusal guide stent; the segment was kept in position. Once the desired position was achieved, the segment was then secured with interdental wiring and fixed with titanium miniplates and screws (Figures 4, 10). For both patients, immediate placement of implants of desired size was carried out and primary stability was assessed using Resonance frequency analysis (RFA) (Table 1). Osseointegration of the implants and favorable bony union of the segmented maxilla were noted in a span of three months using radiographic investigations (Figures 5, 11), after which final prosthetic rehabilitation was carried out (Figures 6, 12).



Figure 1. Intraoral image.

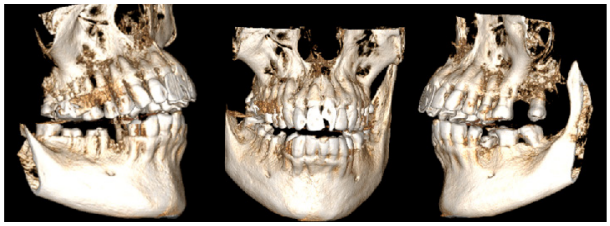


Figure 2. Pre-operative CBCT.

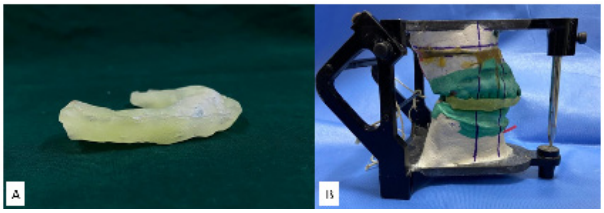


Figure 3. Working model: **A**– occlusal splint; **B**– mock surgery.

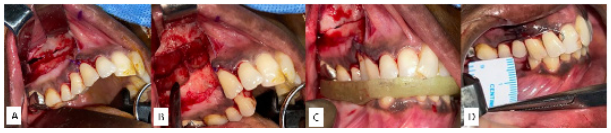


Figure 4. Intraoperative images: A–Osteotomy cuts placed; B–Down fracture segment; C–Repositioning of fractured segment using occlusal splint; D–Vertical dimension achieved.



Figure 5. Post operative OPG.

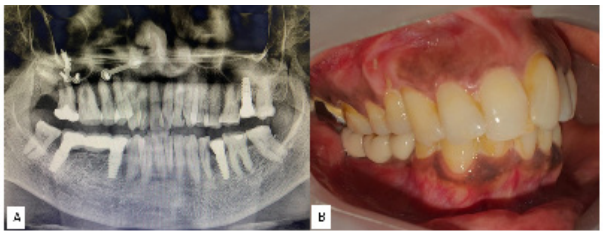


Figure 6. Final prosthesis: **A**- OPG; **B**- intraoral image.



Figure 7. Intraoral image.



Figure 8. Pre-operative CBCT.

DOI: 10.18502/jcr.v13i3.23116

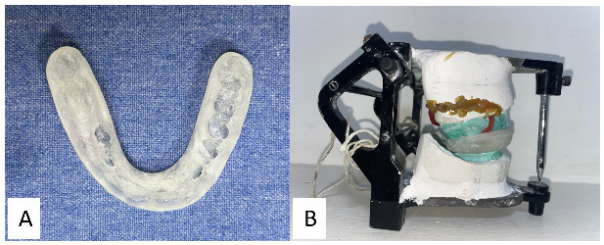


Figure 9. Working model: **A–** Occlusal splint; **B–** mock surgery.



Figure 10. Intraoperative images: **A–** Osteotomy cuts placed and down fracture segment; **B–** Repositioning of fractured segment using occlusal splint; **C–** Fixation done using titanium plates and screws.



Figure 11. Post operative OPG.

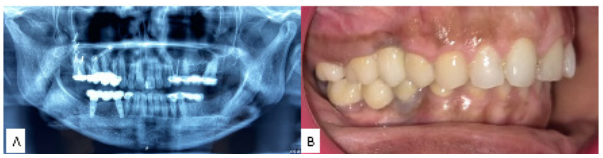


Figure 12. Final Prosthesis: **A-** OPG; **B-** Intraoral image.

Table 1. Resonance frequency analysis for primary stability of implants at different sites.

Patient 1		
Implant Site	*Buccolingual*	*Mesiolingual*
45	*80*	*78*
47	*70*	*65*
27	*68*	*70*
35	*70*	*72*
Patient 2		
Implant Site	*Buccolingual*	*Mesiolingual*
45	*72*	*70*
47	*70*	*68*

Discussion

Multiple factors contribute to the development of dentoalveolar extrusion. The most common and well-documented is the absence of occlusal antagonists, especially for prolonged duration, which may result in progressive vertical migration of teeth. Other contributing factors include age-related eruptive changes, individual variability in periodontal ligament activity, and inherent vertical eruption patterns [7-9]. These pathophysiological changes create a vertical occlusal disharmony, often observed in the form of a unilateral or bilateral posterior maxillary excess, which is difficult to correct through orthodontic or prosthetic means alone [10]. The treatment approach for dentoalveolar extrusion varies depending on the severity of vertical overeruption and associated alveolar bone involvement. In cases of mild extrusion (≤ 2 mm), conservative management is often sufficient and may include selective occlusal adjustment (enameloplasty), minor orthodontic intrusion, or prosthetic compensation. When the extrusion is moderate (2–4 mm), more active intervention is usually required. Orthodontic intrusion with skeletal anchorage, such as TADs or mini-plates, can be employed. In some instances, crown height reduction combined with endodontic treatment may be indicated to restore interarch space [11]. For severe extrusion (> 4 mm), where there is significant vertical elongation of both the teeth and alveolar process, a posterior segmental maxillary osteotomy is indicated to reposition the overerupted dentoalveolar segment superiorly [12]. This surgical approach effectively restores interarch space and occlusal harmony, particularly in patients preparing for implant-supported or fixed prosthetic reconstruction [13-15]. The posterior maxillary osteotomy was disapproved earlier due to the difficulty of achieving the desired degree of intrusion at the time of surgery and for the lack of postoperative stability. That was mainly due to insufficient mobilization of the segment at the time of surgery leading to incomplete osteotomy [16,17]. However, there is increased evidence to support the clinical impression that long-term stabili-

ty of the skeletal and dental elements can be achieved [5]. NaBadalung used a combination of a maxillary surgical splint, cast splint, titanium plate screws and a provisional mandibular removable partial denture to stabilize the occlusion [18]. To achieve the desired occlusion, it is necessary to use an acrylic splint as a surgical guide. The interim denture and/or the placement of an orthodontic arch wire prevent the risk of movement in transverse and vertical dimensions [19]. In this case report, the patients were devoid of intermaxillary space due to severe dentoalveolar extrusion. So, proper occlusal rehabilitation only by prosthetic treatment was not possible. Orthodontic intrusion by skeletal anchorage with miniplates is a safe and minimally invasive procedure to gain significant intrusion of the affected molars, resulting in a leveling of the occlusal plane and alveolar bone [20]. The range of intrusion of molars and the duration of orthodontic treatment limit its use when compared with segmental osteotomy, in which we obtain the desired level of occlusion immediately. Implant placement of the mandibular molar can be done at the same time with maxillary molar segmental osteotomy, or can be done after the operation, but the proper timing has not been established clearly yet. Itkin et al. [21] presented a case of simultaneous endosteal implant placement in the maxilla after PMSO. Due to the stability, blood supply and bone healing properties of the posterior maxillary osteotomized segments as well as the osteoconductive ability of the hydroxyapatite-coated implant, it is possible for both procedures to be performed simultaneously.

In our case, surgical procedure and implant placement of the mandibular molar was simultaneously performed. A satisfactory outcome was obtained by correcting the implant location through maxillary molar segmental osteotomy and improving decreased arch space and improper molar width following tooth extraction. Complications of surgical treatment include hemorrhage, infection, necrosis of bone fragments, relapse, vitality loss of adjacent teeth, and neurosensory deficits [22]. Preserving the integrity of the palatal mucosa and maintaining the local vascularity is one of the important factors in PMSO to prevent the most severe complication of the procedure, aseptic necrosis. In this case report, neither pulpal necrosis on the adjacent tooth of the region where segmental osteotomy was conducted nor the accompanying symptoms occurred. During the hospitalization and follow-up periods, we did not find any irregularity of the palatal mucosa and avascular necrosis of the operated site, and the occlusion was stabilized without the open bite.

Conclusion

The posterior maxillary segmental osteotomy (PMSO) procedure is an excellent option as a preprosthetic procedure in improving posterior vertical height for implant rehabilitation. It provides satisfactory functional and esthetic results in many patients with skeletal abnormalities who would otherwise present significant problems in prosthetic reconstruction.

Conflict of Interest

There is no conflict of interest to declare.

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