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Case Report

Anterior maxillary rehabilitation with a digitally engineered PEEK obturator in an aramany Class VI defect: Case report

Parmeet Kaur[1]*, Anupama NM[1], J Nandev KR[1], Bharat Raj[1], Manjula[1]

[1]Dept. of Prosthodontics, Vokkaligara Sangha Dental College & Hospital, Bangalore, Karnataka, India

Abstract

Maxillary defects following surgical resections or infections severely impair mastication, deglutition, speech, and esthetics, making prosthetic rehabilitation with obturators a vital treatment option. Aramany Class VI defects, characterized by bilateral posterior maxillary teeth present with anterior teeth missing, present unique biomechanical challenges due to the lack of anterior support and unesthetic appearance. Conventional cobalt–chromium frameworks, though widely used, have disadvantages such as weight, metallic taste, and esthetic limitations. This case report presents the rehabilitation of an Aramany Class VI defect in a 32-year-old female with a digitally designed and CAD/CAM-milled polyetheretherketone (PEEK) obturator. Intraoral scanning and computer-aided design were used to fabricate a lightweight, biocompatible, and esthetically pleasing PEEK framework with an attached hollow bulb obturator. The prosthesis demonstrated excellent fit, retention, and patient satisfaction, significantly improving function and esthetics. This report underscores the potential of PEEK combined with digital workflows as an innovative alternative to conventional metallic frameworks in the management of complex maxillary defects.

Keywords: Aramany Class VI defect, Obturator prosthesis, Polyetheretherketone (PEEK), CAD/CAM, Maxillofacial rehabilitation, Digital dentistry

Received: 29-09-2025; **Accepted:** 29-11-2025; **Available Online:** 08-12-2025

1. Introduction

Maxillary defects resulting from surgical resection, trauma, or infections such as mucormycosis are among the most challenging conditions in maxillofacial rehabilitation, as they compromise mastication, swallowing, speech, and facial esthetics, thereby reducing the overall quality of life of affected individuals.[1] Prosthetic rehabilitation with obturator prostheses continues to be the most reliable and widely practiced treatment modality, as it restores essential oral functions without additional surgical morbidity.[2]

For systematic planning of obturator design, Aramany in 1978 proposed a classification of partially edentulous maxillectomy defects into six categories based on the location of the defect and the distribution of remaining teeth.[3] Among these, Aramany Class VI defects are relatively rare and present with anterior maxillary resections where only the posterior teeth remain. This configuration creates unique biomechanical challenges.[4]

To overcome these limitations, several modifications in obturator design have been documented. Magnet-retained two-piece prostheses have been advocated to improve retention and ease of insertion in extensive defects, particularly when anterior undercuts are accessible.[5] Swing-lock attachments have been used to distribute stresses more evenly by engaging multiple teeth and soft tissue areas.[6] Hollow bulb obturators have also been incorporated to minimize the weight of the prosthesis and improve patient comfort in large bilateral defects.[7] Despite these innovations, the long-term prognosis of Class VI cases with conventional frameworks remains guarded, primarily due to torquing forces on posterior abutments and the lack of stable anterior support.[8]

Traditionally, cobalt–chromium cast frameworks have been the standard material of choice for definitive obturators because of their high strength, rigidity, and durability. However, drawbacks such as increased weight, metallic aftertaste, thermal conductivity, and esthetic compromise due to visible clasps have limited patient acceptance.[2] With the advent of digital dentistry and newer biomaterials, these limitations are being addressed more effectively.

*Corresponding author: Parmeet Kaur
Email: kaurparmeet20@gmail.com

https://doi.org/10.18231/j.jpfa.13609.1764665070

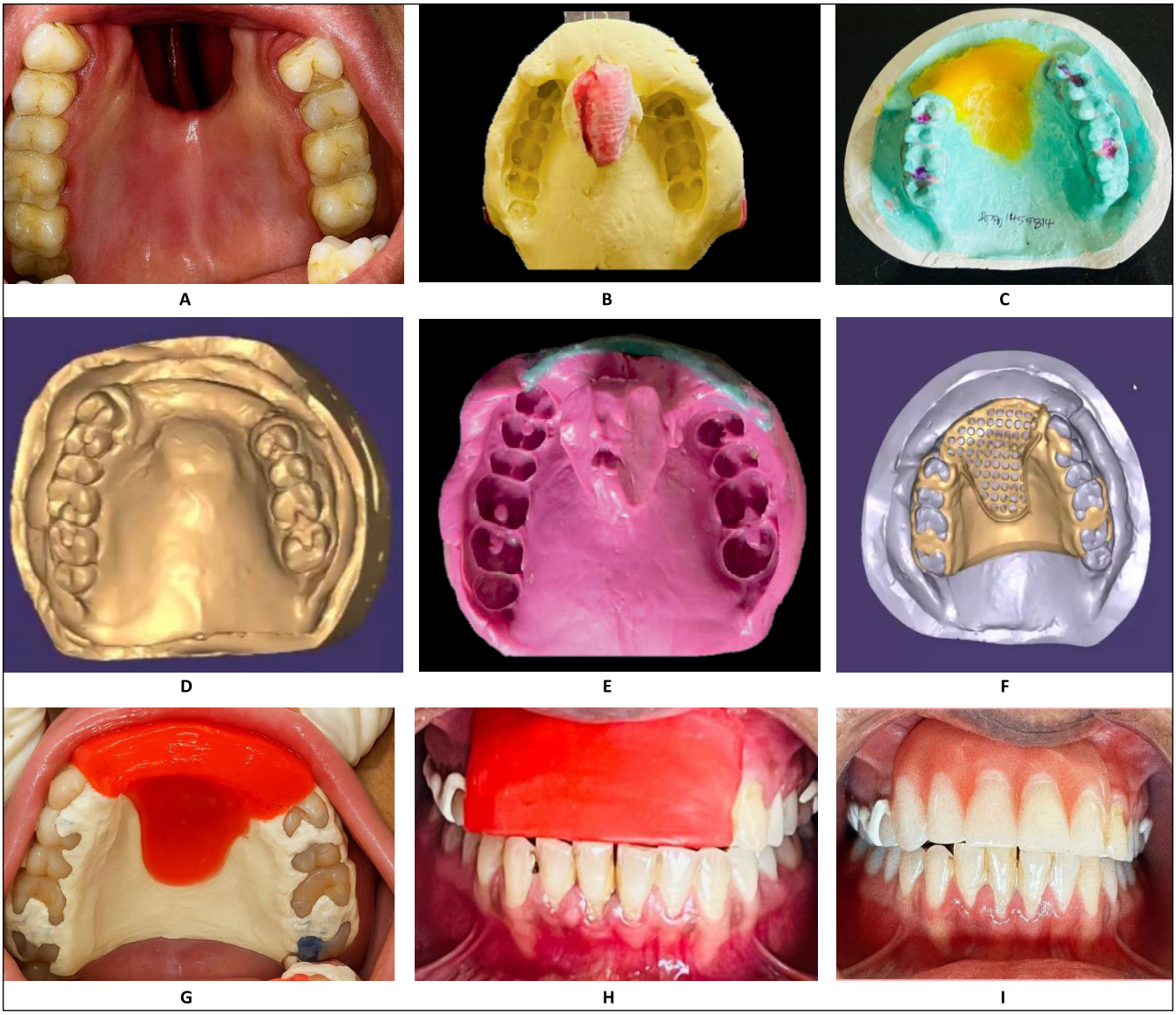

Figure 1: Clinical steps in fabrication of digitally engineered PEEK obturator in an aramany Class VI defect

Polyetheretherketone (PEEK), a high-performance thermoplastic polymer, has gained popularity in prosthodontics owing to its favorable characteristics like biocompatibility, low specific weight, high flexural strength, chemical inertness, and resistance to fatigue fracture.[9] Its tooth-colored appearance enhances esthetics by reducing the visibility of clasp assemblies. Moreover, when processed through CAD/CAM technology, PEEK frameworks can be designed with remarkable precision, minimizing manual errors, reducing chairside adjustments, and offering reproducibility in complex cases.[10] Literature supporting the use of PEEK in removable prosthodontics and implant dentistry is increasing; however, reports on its application in Aramany Class VI obturator rehabilitation remain scarce, thereby highlighting the novelty and clinical significance of this approach.

This article presents the clinical management of an Aramany Class VI maxillary defect rehabilitated with a digitally designed and milled PEEK obturator, emphasizing the advantages of combining digital workflow with advanced biomaterials to achieve predictable functional and esthetic outcomes.

2. Case Report

A 32-year-old female reported to the Department of Prosthodontics with the chief complaint of a fractured maxillary prosthesis and requested a replacement. She had previously been rehabilitated with a cast partial obturator, which had fractured during use. In addition to the breakage, she complained that the prosthesis was excessively heavy, caused an unpleasant metallic taste, and had an unesthetic appearance due to visible metal components.

2.1. History and clinical examination

The patient's medical history revealed a severe infection that developed during an obstetric surgery, attributed to complications involving a nasogastric tube. This infection necessitated surgical resection of the premaxilla, resulting in the loss of the anterior maxillary segment. Intraoral examination

revealed an acquired Aramany Class VI defect, **(Figure 1A)** characterized by an anterior maxillary defect with intact bilateral posterior teeth. The remaining posterior dentition provided favorable abutments, but the absence of the anterior segment had compromised esthetics, speech, and function.

2.2. Diagnostic procedures and preliminary impression

In order to record the defect accurately while ensuring patient safety, the nasal turbinate region was carefully blocked with gauze tied to dental floss to prevent ingress of impression material. A preliminary impression of the maxillary arch was made using irreversible hydrocolloid, capturing the defect and remaining teeth. **(Figure 1B)** The impression was poured in dental stone to obtain the primary cast. **(Figure 1C)**

This cast was subsequently extra orally digitized using a scanner, **(Figure 1D)** and the data were imported into Exocad software for digital design of the removable partial denture (RPD) framework. The virtual design allowed for precise visualization of component placement, rest seat positions, and guiding planes, laying the foundation for a digitally driven prosthetic workflow.

2.3. Mouth preparation and definitive impression

A custom tray was fabricated on the primary cast. Mouth preparations were then carried out on the abutment teeth, including refinement of existing rest seats, guiding planes, and minor connector spaces according to the digitally planned design. Care was taken to preserve sound tooth structure, with refinements focused primarily on previously prepared areas to ensure optimal seating of the framework.

Border molding was performed selectively in the anterior region to capture functional depth of the labial and palatal sulci, given the absence of posterior tissues for border extension. A medium-body elastomeric impression material was then used to record the definitive impression, ensuring accurate reproduction of both the dentition and defect anatomy. **(Figure 1E)** This impression was scanned to generate the definitive digital model for framework fabrication.

2.4. Framework design and fabrication

Using the digital model, the final framework was meticulously designed in Exocad, incorporating precise rest seats, guiding planes, and retentive clasp assemblies. **(Figure 1F)** The design was then exported to a 5-axis milling machine and milled from a pre-polymerized medical-grade polyetheretherketone (PEEK) blank. Retentive perforations were incorporated within the framework to facilitate mechanical interlocking with acrylic resin during acrylization. To enhance chemical adhesion, the PEEK surface was treated with piranha solution, creating a microscopically roughened surface for improved bonding.

2.5. Framework trial and maxillomandibular relations

The milled PEEK framework was tried intraorally and exhibited excellent adaptation, stability, and retention with minimal adjustments required. **(Figure 1G)** Its lightweight nature was immediately appreciated by the patient in comparison with her previous cast metal prosthesis. Occlusal rims were constructed in the anterior edentulous span, and maxillomandibular relationships were recorded. **(Figure 1H)**

3. Teeth Arrangement, Processing and Finishing

Artificial teeth were arranged in wax for the anterior segment, and the setup was tried in the patient's mouth to verify esthetics, phonetics, and occlusion. Following patient approval, the prosthesis was processed in heat-cured acrylic resin. A hollow bulb obturator design was incorporated to minimize prosthesis weight while maintaining adequate strength. After polymerization, finishing and polishing were carried out meticulously to achieve a smooth, biocompatible surface.

3.1. Prosthesis insertion and outcome

The final prosthesis was inserted, and occlusion was refined. **(Figure 1I)** The framework demonstrated excellent fit and stability, while the hollow bulb component effectively sealed the defect without undue bulk. The esthetic clasp assemblies provided discreet retention, eliminating the unesthetic appearance previously experienced with metal clasps.

The patient reported immediate improvement in mastication, speech articulation, and comfort. She also noted the absence of metallic aftertaste and expressed high satisfaction with the natural appearance and lightweight feel of the prosthesis.

4. Discussion

The rehabilitation of maxillary defects continues to pose unique challenges due to the complex interplay of function, esthetics, and patient comfort. Among the six categories described by Aramany, Class VI defects are relatively uncommon and are characterized by the loss of the anterior maxillary segment with retention of bilateral posterior teeth.[1] This configuration offers favorable posterior abutments; however, the absence of the premaxilla results in significant esthetic and phonetic deficits. In addition, retention and stability are often compromised, since anterior guidance and labial support are lost.[2]

Historically, cast cobalt–chromium frameworks have been the material of choice for definitive obturators in Class VI defects, owing to their rigidity and durability.[3] However, patients often report drawbacks such as excessive weight, metallic aftertaste, and esthetic concerns due to visible clasp assemblies.[4] In the present case, the patient's dissatisfaction with her previous metal obturator was primarily related to its heaviness and compromised appearance, which aligns with similar reports in the literature.[5]

Various methods have been employed to improve the function and retention of prostheses in Class VI cases. Magnet-retained two-piece obturators have been advocated for extensive anterior resections to enhance stability and

facilitate insertion, particularly in deep defects.[6] Murat et al reported the use of swing-lock designs to distribute stresses evenly and enhance retention. Similarly, hollow bulb obturator designs have been employed to reduce the weight of prostheses, thereby increasing patient comfort and functional adaptability.[7] While these innovations have contributed to improved outcomes, the fundamental drawbacks of metal frameworks remain.

With the advent of digital technology and newer biomaterials, prosthodontics has transitioned towards more patient-centered solutions. Polyetheretherketone (PEEK) is a high-performance thermoplastic polymer that has gained considerable attention due to its unique combination of properties, including low weight, high flexural strength, fatigue resistance, and biocompatibility.[9] In addition, its tooth-colored appearance reduces the visibility of clasp assemblies, thereby addressing esthetic concerns often associated with metallic frameworks. Stawarczyk et al demonstrated that PEEK exhibits mechanical properties adequate for removable prosthodontics, while Schwitalla and Müller highlighted its favorable clinical applicability in implant and maxillofacial prosthetics.[10,11]

In the present case, the use of CAD/CAM-milled PEEK framework proved advantageous over conventional metal frameworks. The digital workflow allowed precise capture of defect morphology, accurate design of RPD components in Exocad, and controlled milling from standardized PEEK blanks. This ensured a high degree of accuracy, minimal chairside adjustments, and superior patient comfort. Moreover, the framework's retentive perforations and surface treatment with piranha solution enhanced the mechanical and chemical bonding of acrylic resin, ensuring long-term stability.

When compared to previously reported methods for Class VI rehabilitation, the digitally designed PEEK obturator in this case provided a unique combination of lightweight comfort, superior esthetics, and precise adaptation. The patient's functional improvement in mastication, phonetics, and esthetics was consistent with the benefits described in recent literature on digital obturator fabrication.While long-term clinical data on PEEK obturators remain limited, the present case adds to the growing body of evidence supporting their clinical utility.

4.1. Clinical significance

This case demonstrates that PEEK, when combined with a digital workflow, offers a viable and innovative alternative to conventional metal frameworks for the rehabilitation of Aramany Class VI defects. It addresses patient concerns of weight and esthetics while ensuring predictable functional outcomes. Further clinical studies with larger sample sizes and long-term follow-up are required to validate its durability and patient-centered benefits.

Conflict of Interest

None.

Patient Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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Cite this article: Kaur P, Anupama NM, Nandev KRJ, Raj B, Manjula. Anterior maxillary rehabilitation with a digitally engineered PEEK obturator in an aramany Class VI defect: Case report. *J Pierre Fauchard Acad.* 2025;39(4):125–128.