EAS Journal of Dentistry and Oral Medicine
Abbreviated Key Title: EAS J Dent Oral Med
ISSN: 2663-1849 (Print) & ISSN: 2663-7324 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-8 | Issue-6 | Nov-Dec-2026 | DOI: https://doi.org/10.36349/easjdom.2026.v08i06.001

Case Report

Reconstructing Endodontically Treated Incisor with CAD-CAM Milled Peek Post and Core: A 4-Year Follow Up Case Report

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Article History
Received: 22.08.2026
Accepted: 16.10.2026
Published: 07.11.2026

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: Endodontically treated teeth with extensive coronal destruction require a post and core to retain the definitive restoration, and the elastic modulus of the post material influences the risk of root fracture. Polyetheretherketone (PEEK), a metal-free thermoplastic polymer with a modulus close to that of dentin, combined with CAD/CAM technology, offers a promising alternative for custom-made post and cores. This case report describes the clinical procedure for fabricating a customized one-piece PEEK post and core using CAD/CAM technology and highlights its bonding and esthetic challenges. A 14-year-old male patient presented after dental trauma with a horizontal coronal fracture of the maxillary right central incisor, associated with a Class II skeletal pattern, a 6 mm overjet and overbite, and interdental diastemas. Since composite restoration would have been non-retentive, a corono-radicular reconstruction was planned after endodontic treatment, followed by a PMMA provisional prosthesis supported by the tooth until a definitive fixed prosthesis at age 20. An indirect technique was used: gutta-percha was partially removed, the canal was shaped, and a silicone impression was scanned to design and mill the post and core from a PEEK blank. The restoration was bonded in the same session with a self-etching universal adhesive and an MDP-containing resin cement, and the provisional crown was sealed. PEEK showed favorable biomechanical behavior, with an elastic modulus (5 GPa) lower than that of dentin, but its inert surface compromises adhesion and its opacity limits anterior esthetics, which may be compensated by a translucent ceramic final restoration. Milled PEEK posts represent a solid clinical option, although improved bonding protocols, optical properties, and long-term clinical trials remain necessary.

Keywords: PEEK, CAD/CAM, Post and core, Endodontically treated teeth, Corono-radicular reconstruction, Bonding, Esthetics.

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INTRODUCTION

The field of dentistry has evolved significantly since its inception. Instead of preservation, tooth extraction was the most popular treatment method for many disorders in the past. The advancements in endodontics and restorative dentistry linked to contemporary restorative procedures have caused a paradigm shift in which doctors now anticipate conservative treatment options. In cases of substantial coronal tooth damage, where further retention is required, a post should be inserted to the root in order to retain the core and the restoration.

The literature suggests that the ideal material for manufacturing posts and cores should have an elastic modulus that accomodates the root's normal flexural dynamics. Post and core materials having dentin-like biomechanical properties may also help reduce the risk of root fractures or debonding. These materials include high-performance polymers like polyetheretherketone (PEEK) [1].

Polyetheretherketone (PEEK) is a linear, aromatic, semi-crystalline thermoplastic, high performance polymer recently used in dentistry as a framework material for metal-free fixed dental prostheses. Previous research has demonstrated that

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PEEK is a potential biocompatible material with high shock absorption capacity, mechanical strength, and thermal and chemical resistance. In theory, post and core systems made from these materials could reduce the number of root fractures. Additional laboratory and clinical investigations are required to test this notion. In addition to the appropriate biomaterial, the digital workflow using CAD/CAM helps to improve the fabrication of custom-made post and core. It enables the anatomic structure to be digitally developed and then milled, resulting in an excellent fit for this custom-made post and core and a thinner cement coating.

Although PEEK is becoming widespread in clinical practice, only a few studies are available focusing on the use of this material for digitally custom-made post and core [2].

The goal of this case study was to describe the clinical procedure for creating customized one-piece PEEK post and core using a CAD/CAM technology and to highlight his bonding and esthetic challenge [1].

CASE REPORT

A 14-year-old male patient referred to fixed prosthodontics department at the Hospital of Farhat Hached Sousse, Tunisia after being subject of a dental trauma. He had a horizontal coronal fracture of upper right central incisor (The 11) (Figure 1).



Figure 1: Initial situation: Extensive coronal destruction of the 11

After a comprehensive clinical and radiological examination, we identified:

- Class 2 skeletal, significant overjet and overbite (6mm), and interdental diastemas.
- The persistence of the cervical third of the crown of the 11, indicating that the coronal restoration with composite resin will be non-retentive.

A provisional perennial prosthetic solution should be chosen until the patient benefits from a definitive fixed prosthesis at the age of 20 (maturation of periodontal tissues).

=> The prosthetic decision was a PMMA provisional prosthesis supported by the 11.

Therefore, a corono-radicular reconstruction will be necessary as a pre-prosthetic treatment, following the completion of a rigorous and satisfactory endodontic treatment.

CAD/CAM post-and-core was planned to be made using a low elastic modulus high-density polymer: The Polyetheretherketone (PEEK).

The indirect technique for fabricating custom-made post and core was employed (Figure 2).

After eliminating any undermined enamel and weakened tooth structure, the two-thirds of the gutta-percha was extracted from the canal using Gates Glidden drills. The canal was then tapered and shaped with Largo drills to remove undercuts and create space for the tapered post. To ensure a passive fit within the canal, a tapered plastic post was tested before injecting the impression material (Light+putty Silicone) [3].



Figure 2: The indirect technique of custom-made post impression

The impression was scanned with a 3D optical scanner, the post was then designed and milled from PEEK blank in the milling machine (Figure 3).

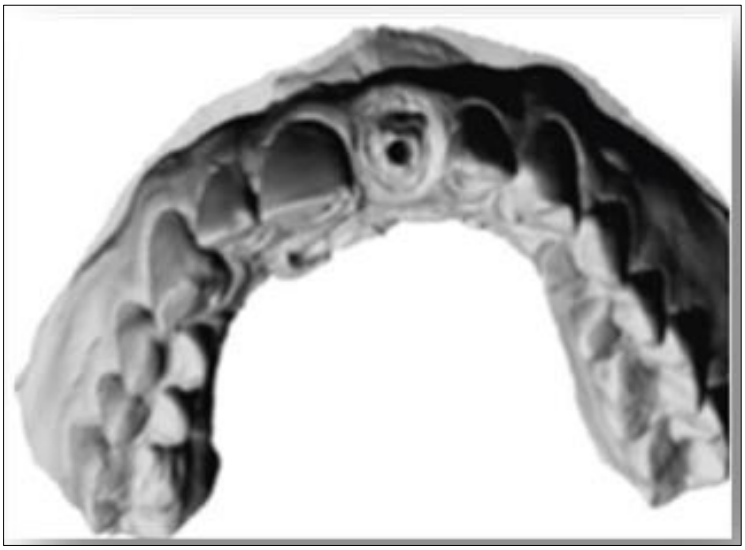


Figure 3: The impression scan

After fabrication of the piece in the laboratory, we received the inlay core and were able to bond it during the same session. The teeth were then isolated for cementation using a split dam technique and cotton rolls. A sterile operating field was established, and the bonding was performed using a self-etching universal adhesive combined with a cement with bonding potential containing MDP: Panavia (Figure 4).

And we concluded with the sealing of the provisional PMMA prosthesis in the same session. The excess cement was removed and the occlusion was checked (Figure 5).



Figure 4: Custom PEEK post-and-core in place



Figure 5: Provisional crown in place

DISCUSSION

1. PEEK: Properties and Fabrication Techniques

Recent dental literature has explored various materials for post and core systems. These materials need to have high fracture and fatigue resistance, a good fit with the root canal's morphology, and a Young's modulus similar to that of dentin (18.6 GPa) to mitigate the risk of catastrophic fractures in remaining tooth structures. Materials with a modulus closer to dentin distribute stress more favorably, whereas materials like cast metal and zirconia, which have higher moduli, can concentrate stress at the root, risking fractures [4].

Recent studies suggest PEEK (polyether ether ketone) ; a biocompatible material with better aesthetics than metal, high temperature resistance, chemical stability, polishability, wear resistance and low plaque affinity [5]. When compared to stiff framework materials like zirconium oxide and metal alloys, PEEK has a low modulus of elasticity of 5GPa, which provides a cushioning effect and reduces stresses imparted to the abutment teeth [2-6], consequently lower incidences of root fracture [7].

Recently, the adoption of CAD/CAM technology enable precise manufacturing of PEEK posts.

This allows also an industrially regulated milling process with standard and homogenous material blocks, and therefore the biomechanical behavior of such materials is enhanced (1) : Compared to dentin, PEEK post-and-cores milled in a CAD/CAM system have similar flexural strength (PEEK, 200 MPa; dentin, 212.9 MPa) but lower elastic modulus (PEEK, 5 GPa; dentin, 18.6 GPa), resulting in lower stress in the post-and-core components due to its flexibility [8]. However, when the PEEK post is overloaded, stress is concentrated on the surrounding cement and core. This might explain the greater prevalence of post-cement debonding shown in several investigations [9].

While CAD/CAM offers efficiency and accuracy, traditional heat-pressed methods have demonstrated higher accuracy for PEEK restorations [10].

Customized PEEK post-and-cores show promising mechanical performance, comparable to fiberglass posts, but exhibit higher rates of debonding, necessitating further research into surface conditioning.

2. Bonding Challenges

PEEK is recognized for its inert surface, which complicates adhesion, in many debonding cases, residual cement was found within the root canal [2].

Several strategies have been explored to improve PEEK adherence, including acid etching, plasma treatment, airborne particle abrasion, laser treatment, and adhesive systems. Few of the surface modification technologies that are now available for PEEK demonstrate the safety and operability necessary for routine clinical application [11].

The bond between PEEK post core and resin cement is one of the factors affecting the retention of the post and core system. This bond can be enhanced by two factors : surface treatment with airborne particle abrasion [110um Aluminium oxide powder under 200-300 KPa pressure at minimum distance of 3 mm] and the use of surface bonding agents. In our clinical case, the PEEK post was treated with airborne particle abrasion under light pressure and was luted with dual cure resin cement to form a homogenous system inside the canal [7].

A 2021 study conducted by Regina F. Villefort and collaborators, compared various surface treatments and found that treatments with sulfuric acid provided superior bond strengths (10–12 MPa) suitable for oral use, whereas sandblasting and silica coating underperformed (below 5 MPa). Optimal results were achieved with careful acid exposure (5 seconds), as prolonged exposure led to material degradation [12].

The bonding strength between PEEK and resin composites greatly improves when a surface pretreatment is applied alongside a bonding system. Therefore, future research on adhesion to PEEK should explore the use of gel-form sulfuric acid to facilitate handling in dental clinics [9]. Additionally, more emphasis should be placed on clinical trials to thoroughly evaluate long-term performance [12, 13].

3. Esthetic Challenges

PEEK is a metal-free material with a color ranging from light gray to opaque snow white. It provides aesthetic improvement for prosthetics when compared with metal and its alloys , whereas in comparison to zirconia it fails to achieve a satisfactory aesthetic outcome when serving as a post and core [11].

In a study published in 2021, POROJAN *et al*., examined the optical properties of PEEK, specifically translucency (TP), opalescence (OP), and color stability. Opalescence is the property of a material to transmit wavelengths in the red-orange range while reflecting those in the blue-green range. Translucency is the property of a material that allows some light radiation to pass through (Etienne and Anckenmann, 2016). These are two characteristic properties of enamel [14].

The results obtained are as follows: the translucency (TP) of PEEK ranges from 1.25 to 3.60, which is significantly lower than that of enamel (18.7), dentin (16.4), and zirconia (4.83 to 9.10). However, scientists found that glazing PEEK further increased its translucency compared to simple surface polishing (Porojan *et al*., 2021). The opalescence (OP) of PEEK is measured between 0.27 and 0.75. These values are also lower than those of the enamel/dentin complex (4.8) and zirconia (1.25 to 2.83) [14].

Finally, the results show a positive correlation between the Contrast Ratio (CR) and translucency. In contrast, for natural teeth, the CR varies inversely with translucency. This indicates that the optical properties of PEEK are significantly different from those of natural teeth [14].

Therefore, PEEK is not a biomaterial with excellent optical properties, as it remains quite opaque which may limit its use in the anterior teeth [15].

The use of leucite or lithium disilicate-reinforced ceramics as a material for the final coverage prosthesis provides the advantages of translucency and brightness to the restoration [16].

One of the interesting properties of PEEK is its color stability over time, which can be attributed to its low roughness and low surface energy.

CONCLUSION

In conclusion, the evolution of dental practices has shifted from tooth extraction to conservative treatments, particularly in the realm of endodontics and restorative dentistry. The incorporation of customized post-and-core systems, especially those made from polyetheretherketone (PEEK), marks a significant advancement. PEEK, with its favorable mechanical properties and biocompatibility, offers a promising alternative to traditional materials. Its lower elastic modulus aligns more closely with that of dentin, potentially reducing the risk of root fractures and improving stress distribution [12].

The use of CAD/CAM technology further enhances the precision and fit of these custom-made post-and-core systems, which is crucial for their effectiveness [17]. However, while PEEK demonstrates good mechanical performance, challenges remain in achieving optimal bonding strength due to its inert surface. Current research emphasizes the need for effective surface treatments, such as airborne-particle abrasion and acid etching, to enhance adhesion and mitigate debonding issues.

Aesthetic considerations also play a role in the choice of materials, as PEEK, despite its metal-free composition, lacks the translucency and opalescence of natural teeth and may not always provide satisfactory aesthetic outcomes, particularly in anterior applications. Future research should focus on improving the optical properties of PEEK and further exploring its long-term performance in clinical settings.

Overall, PEEK's properties, combined with advanced manufacturing techniques, position it as a valuable material in modern dentistry.

Milled PEEK posts represent a solid clinical choice, however they require advancement in CAD-CAM technology and enhancement in adhesion and esthetics [18]. Further commitment to clinical trials is essential to thoroughly evaluate their long-term performance.

BIBLIOGRAPHIE

1. The Use of Polyetheretherketone (PEEK) as an Alternative Post and Core Material: Five-Year Follow-Up Report [Internet]. [cité 9 oct 2024]. Disponible sur: https://www.mdpi.com/2304-6767/10/12/237.
2. Papathanasiou I, Kamposiora P, Papavasiliou G, Ferrari M. The use of PEEK in digital prosthodontics: A narrative review. BMC Oral Health. 2 août 2020;20(1):217.
3. Trebilcock CL, Evans DB. A two-stage impression technique for the indirect fabrication of multiple cast dowel and cores. The Journal of Prosthetic Dentistry. 1 oct 1991;66(4):422-5.
4. SciELO - Brazil - Application of polyetheretherketone (PEEK) posts: evaluation of fracture resistance and stress distribution in the root: *in vitro* and finite element analyses Application of polyetheretherketone (PEEK) posts: evaluation of fracture resistance and stress distribution in the root: *in vitro* and finite element analyses [Internet]. [cité 9 oct 2024]. Disponible sur: https://www.scielo.br/j/bor/a/NJVhZTM9p7NYh7psgpXWNdB/

5. Boualam A, Benfaida S, Assraoui KE, Andoh A. Contribution of Peek in Dental Prothesis. European Journal of Dental and Oral Health. 8 janv 2024;5(1):7-9.
6. Essa M. Al Omar N, Ibrahim A. Idris K, Athman A. Alaqi H, Yahya A. Juraybi A, Jain S. "PEEK" – ING into the Future! A Literature Review on Use of PEEK polymer in Prosthodontics. Saudi J Oral Dent Res. 9 janv 2021;6(1):29-33.
7. Galgali DrNR, Dange DrSP, Mahale DrKM, Khalikar DrSA. A novel approach of restoring endodontically treated tooth by using cad-cam milled peek post and core system: A case report. Int J Appl Dent Sci. 1 oct 2021;7(4):09-13.
8. Maloo LM, Toshniwal SH, Reche A, Paul P, Wanjari MB. A Sneak Peek Toward Polyaryletherketone (PAEK) Polymer: A Review. Cureus. 14(11):e31042.
9. Fracture Resistance and Failure Mode of Custom-made Post-and-cores of Polyetheretherketone and Nano-ceramic Composite | Operative Dentistry [Internet]. [cité 9 oct 2024]. Disponible sur: https://meridian.allenpress.com/operative-dentistry/article/45/5/506/427414/Fracture-Resistance-and-Failure-Mode-of-Custom
10. Polyetheretherketone (PEEK) Post and Core Restorations: A 3D Accuracy Analysis between Heat-Pressed and CAD-CAM Fabrication Methods - Lalama - 2022 - Journal of Prosthodontics - Wiley Online Library [Internet]. [cité 9 oct 2024]. Disponible sur: https://onlinelibrary.wiley.com/doi/full/10.1111/jopr.13452
11. Wang B, Huang M, Dang P, Xie J, Zhang X, Yan X. PEEK in Fixed Dental Prostheses: Application and Adhesion Improvement. Polymers (Basel). 8 juin 2022;14(12):2323.
12. Influence of Alternative and Conventional Surface Treatments on the Bonding Mechanism between PEEK and Veneering Resin for Dental Application [Internet]. [cité 9 oct 2024]. Disponible sur: https://www.mdpi.com/2079-6412/11/6/719
13. Lee JH, Lee GH. Fabrication of a custom polyetherketoneketone post-and-core with digital technology. Journal of Technologic Dentistry. 30 mars 2024;46(1):15-9.
14. Porojan L, Toma FR, Vasiliu RD, Topală FI, Porojan SD, Matichescu A. Optical Properties and Color Stability of Dental PEEK Related to Artificial Ageing and Staining. Polymers. janv 2021;13(23):4102.
15. Zoidis P. The Use of Modified Polyetheretherketone Post and Core for an Esthetic Lithium Disilicate Anterior Ceramic Restoration: A Clinical Report. The International Journal of Prosthodontics. 1 janv 2021;34:120-5.
16. Lalama M, Rocha MG, O'Neill E, Zoidis P. Polyetheretherketone (PEEK) Post and Core Restorations: A 3D Accuracy Analysis between Heat-Pressed and CAD-CAM Fabrication Methods. J Prosthodont. juill 2022;31(6):537-42.
17. Fracture strength of cad-cam milled polyetheretherketone (PEEK) post-cores vs conventional post-cores; an in vitro study [PeerJ] [Internet]. [cité 28 oct 2024]. Disponible sur: https://peerj.com/articles/18012/
18. PEEK and fiberglass intra-radicular posts: influence of resin cement and mechanical cycling on push-out bond strength | Clinical Oral Investigations [Internet]. [cité 9 oct 2024]. Disponible sur: https://link.springer.com/article/10.1007/s00784-022-04645-0.

Cite This Article: Ben Dalla, A., Boukhris, H., Mghirbi, N., Hajjaji, S., Hajjami, H., & Ben Youssef, S. (2026). Reconstructing Endodontically Treated Incisor with CAD-CAM Milled Peek Post and Core: A 4-Year Follow Up Case Report. *EAS J Dent Oral Med, 8*(6), 206-211. https://doi.org/10.36349/easjdom.2026.v08i06.001