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-7 | Issue-1 | Jan-Feb-2025 | DOI: https://doi.org/10.36349/easjdom.2025.v07i01.002

Case Report

Zirconia Post and Core Restorations: A Case Study Highlighting Exocad Laboratory Workflow and Material Review

Yosr Kraeim[1], Wejden Ben Amor, DMD[2*], Yosra Gassara, DMD[3], Sarra Nasri, DMD[4], Ameni Adli, DMD[5], Moncef Ommezine, DMD[5], Zohra Nouira, DMD[5], Jilani Saafi, DMD[5], Belhassen Harzallah, DMD[5]

[1]Student, University of Monastir, Tunisia
[2]Department of Fixed Prosthodontics, Faculty of Dental Medicine, University of Monastir, Tunisia
[3]Assistant Professor, Graduate Prosthodontics, Department of Fixed Prosthodontics, Faculty of Dental Medicine, University of Monastir, Tunisia
[4]Assistant Professor, Graduate Prosthodontics, Department of Fixed Prosthodontics, Faculty of Dental Medicine, University of Monastir, Tunisia
[5]Professor, Graduate Prosthodontics, Department of Fixed Prosthodontics, Faculty of Dental Medicine, University of Monastir, Tunisia

Article History
Received: 04.12.2024
Accepted: 10.01.2025
Published: 17.01.2025

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

Quick Response Code

Abstract: Post and core buildups are important for damaged or endodontically stabilized teeth. Zirconia is a common material for these restorations due to its exceptional mechanical properties, biocompatibility, and aesthetic appeal. This study presents a case of a 47-year-old female patient, where the tooth was reconstructed and improved its appearance using zirconia bars and implants and was fabricated using Exocad software exactly as it was done in that process. Although zirconia offers impressive advantages, including durability and natural appearance, it presents challenges such as high cost and possible cracking risks. Studies establish how effective zirconia is at emphasizing the restoration of integrity while acknowledging its limitations.

Keywords: Post and core dental buildups, zirconia, aesthetics, biocompatibility, mechanical strength.

INTRODUCTION

In the field of dentistry, the restoration of damaged or endodontically treated teeth poses a significant clinical challenge [1]. Post and core buildups emerge as a pivotal technique in rebuilding and supporting teeth that have undergone extensive trauma or root canal therapy [2, 3]. These buildups restore the tooth's structural integrity and serve as a foundation for the final crown restoration, ultimately contributing to the patient's oral health, function, and aesthetic satisfaction [4,5]. As such, understanding the importance of post and core restorations in dental practice becomes paramount, highlighting the need for meticulous consideration in material selection to ensure optimal outcomes [6]. The success of post and core buildups depends on the proper material selection. The materials selected have to combine mechanical strength, biocompatibility, and aesthetic needs, be capable of meeting the functional requirements in the oral environment, ensure stability over longer periods, and stimulate patient satisfaction [7]. Zirconia In this case, it is one of the most popular materials used thanks to its phenomenal mechanical strength, biocompatibility, and aesthetic properties. Nevertheless, the process of decision-making requires profound knowledge of zirconia's advantages and disadvantages as well as clinical outcomes to deliver the best outcomes in dental practice [8].

This article aims to showcase the effectiveness of zirconia as a material for post and core buildups, highlighting its mechanical properties, aesthetic appeal, and biocompatibility while discussing its limitations and giving alternative material possibilities.

CASE PRESENTATION

The patient, a 47-year-old female, presented with advanced caries that necessitated the extraction of tooth 25 and the depulpation of tooth 24. The patient is still in generally good health despite having suffered a severe crown loss.

***Corresponding Author:** Dr Wejden Ben Amor
Department of Fixed Prosthodontics, Research Laboratory of Occlusodontics and Ceramic Prostheses LR16ES15 Faculty of Dental Medicine, University of Monastir, TN 5000, Monastir, Tunisia

To prioritize the restoration of dental aesthetics and chewing function, the dentist chose to fabricate a post and core using zirconia materials.

Zirconia was selected for its exceptional strength, biocompatibility, and aesthetic properties, making it an ideal choice to restore the tooth's structural integrity and enhance its natural appearance.

The procedure started after scanning the maxillary and mandibular jaws. Exocad was opened to input patient and dentist details, ensuring easy access when needed (Fig. 1). Next, tooth 24, along with its antagonist, tooth 34, were selected for the procedure (Fig. 2).

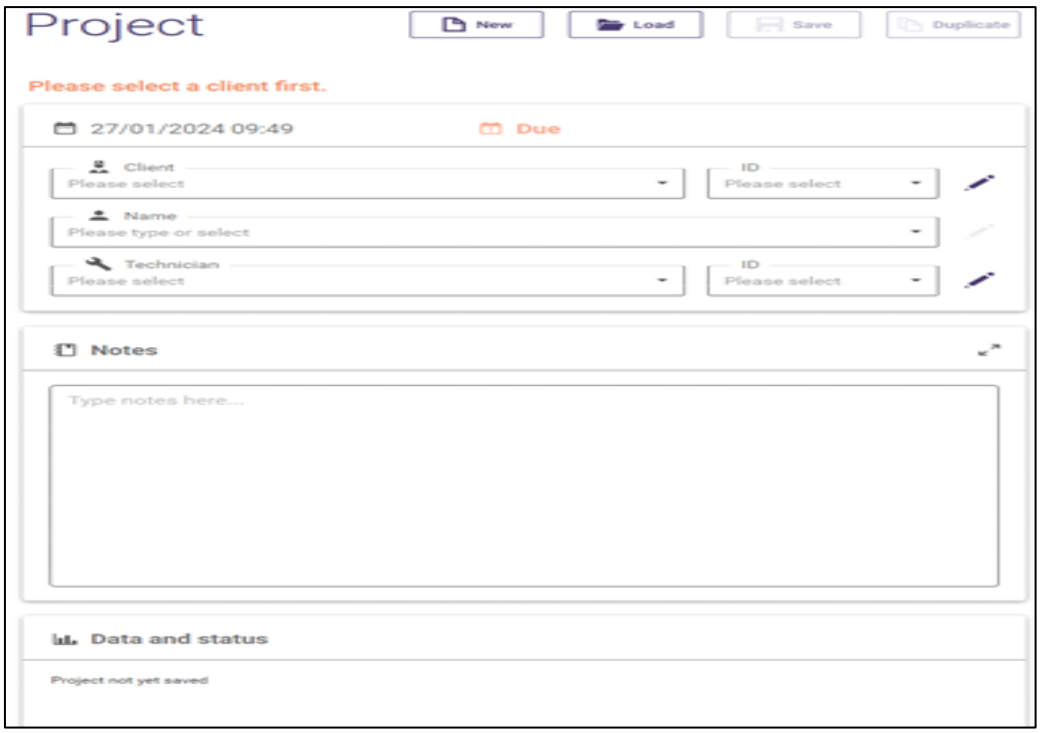

Figure 1:Exocad Case Management Dashboard

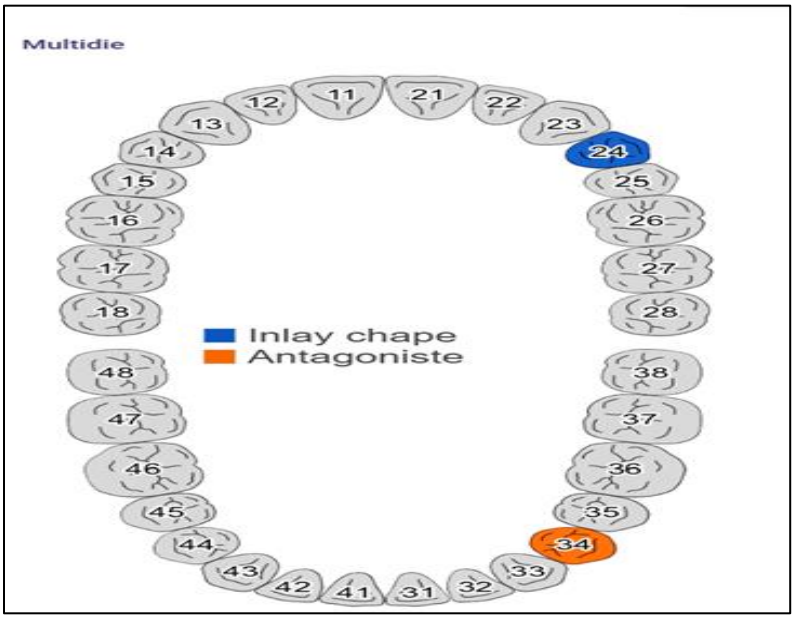

Figure 2: Selection of Teeth and Antagonists

Zirconia was selected as the future post and core material. Additional parameters could be selected as well, such as the block shade and cement gap (Fig. 3).

Then the scan data were imported into the software, starting with the maxillary jaw moving to the mandibular.

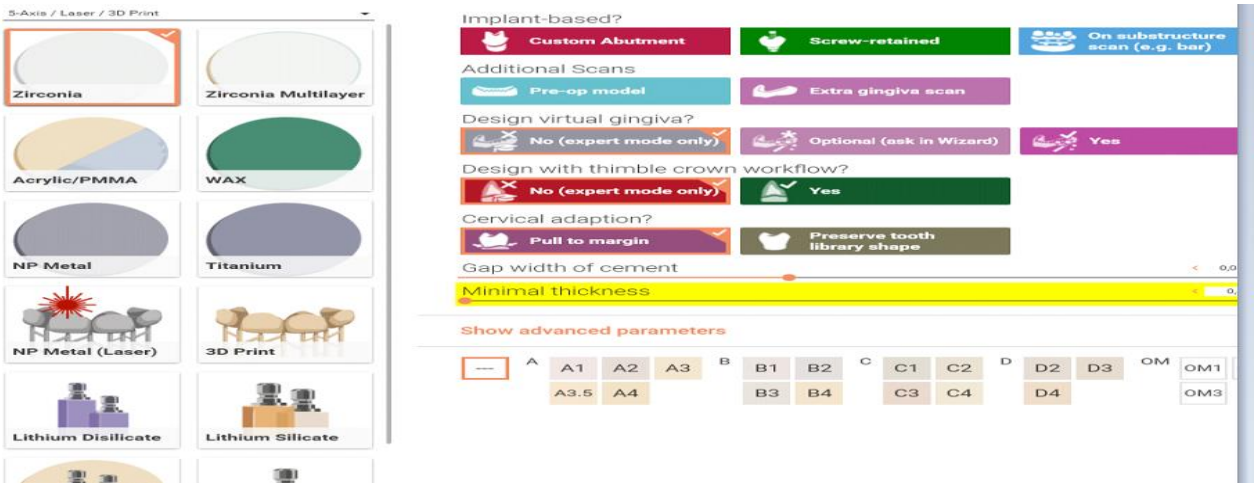

Figure 3: Choosing the materials

The next step was to adjust the digital data orientation to achieve optimal vision of the occlusal surfaces. (Fig. 4). Then, the marginal line was identified for a perfect fit (Fig. 5).

Figure 4: Orientation adjustment

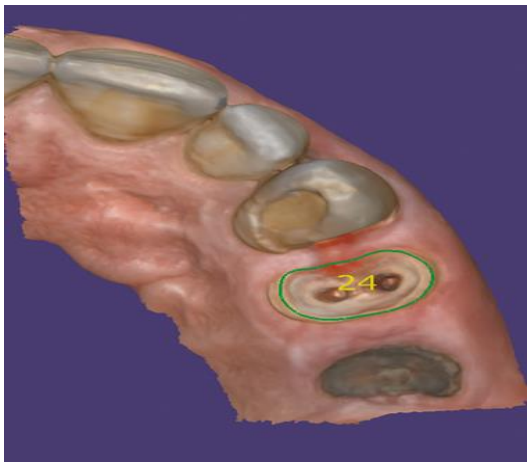

Figure 5: Limit detection

The insertion axis was selected to minimize undercuts (Fig. 6). Added to that, the cement space was adjusted to 0.05 mm for optimal fit and retention (Fig. 7).

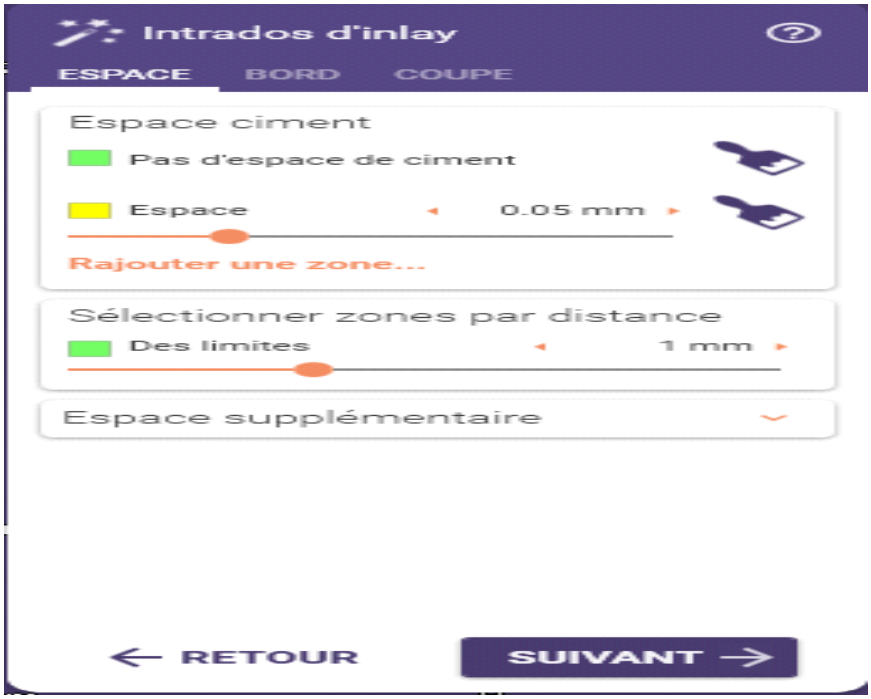

Figure 6: Settings of cement space

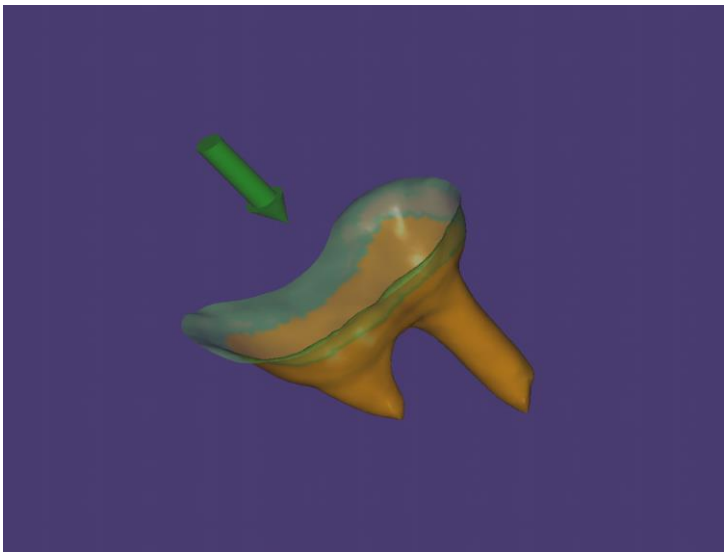

Figure 7: Axis insertion

Modeling began with pre-designed post-and-core customized within the software (Fig. 8). The design was refined to meet specifications and aesthetics before transitioning to the fabrication software for production (Fig. 9).

Zirconia was chosen as the material. Then, the disc dimensions and shade were introduced into the software (Fig. 10). A 1.2500 scale was adopted to compensate for zirconia shrinkage during the sintering process and ensure a precise level of dimensions.

An inlay/onlay was selected as the restoration type because there was not a specific option for post and core dental restoration (Fig. 11).

Figure 8: Modeling of the post and core

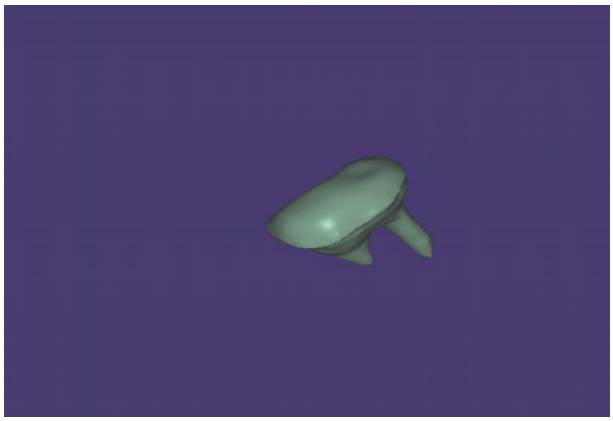

Figure 9: The final post and core 3D design

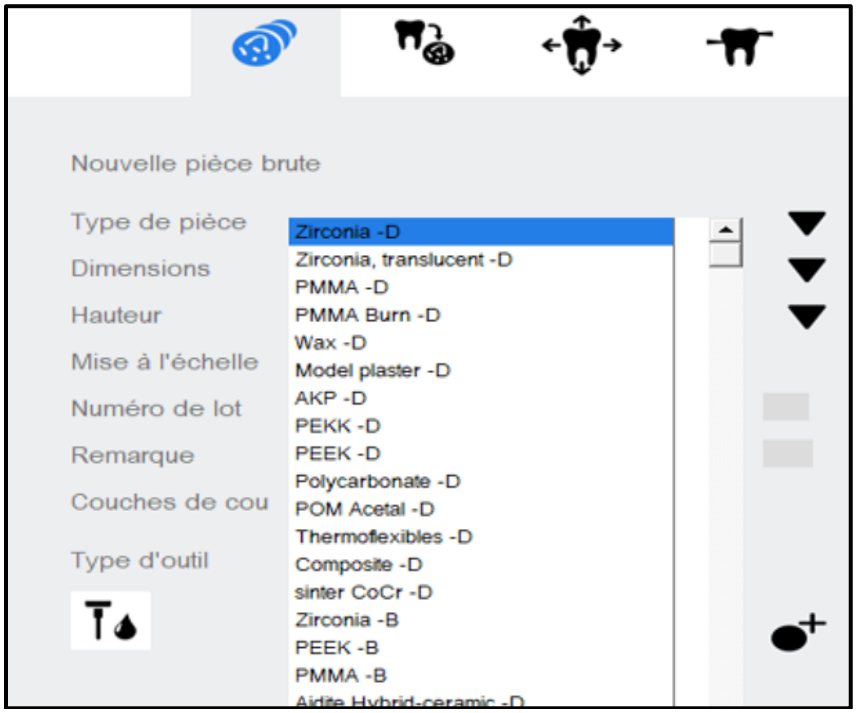

Figure 10: Selection of the material

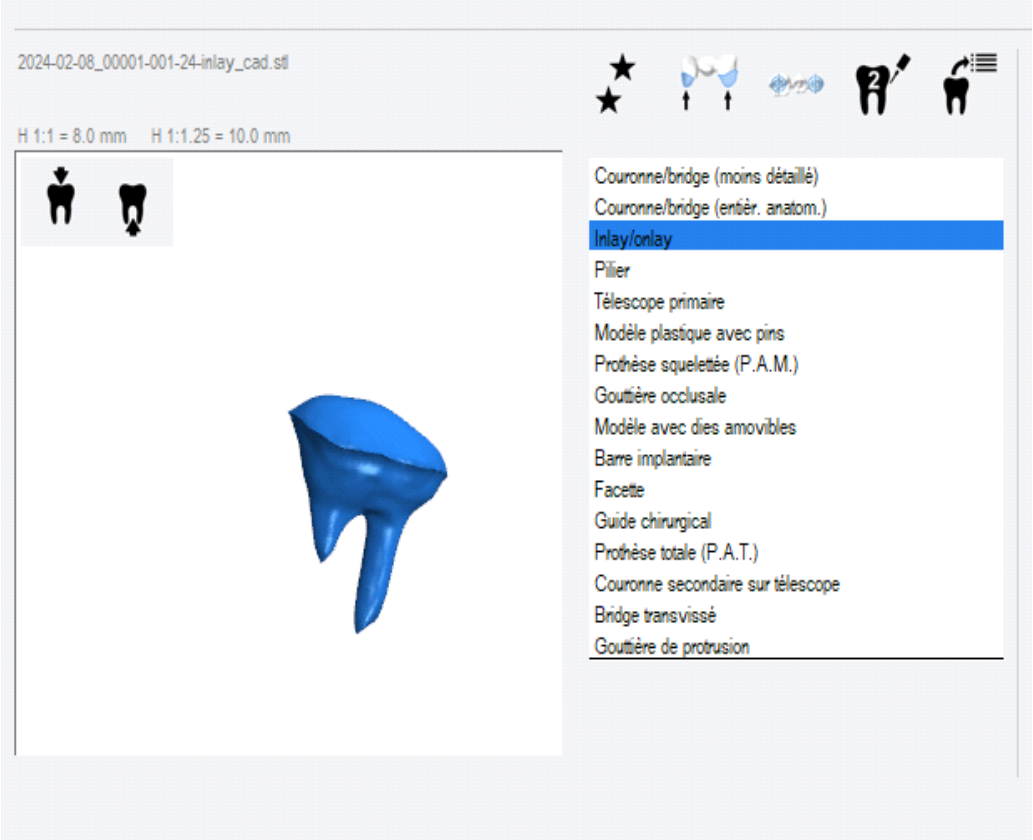

Figure 11: Selection of the restoration

With the parameters set, the design of post and core restorations was placed into the virtual disc (Fig. 12). Then, supporting pegs were attached to the design; they serve as guides, ensuring a secure anchorage within the disc and a smooth milling process (Fig. 13).

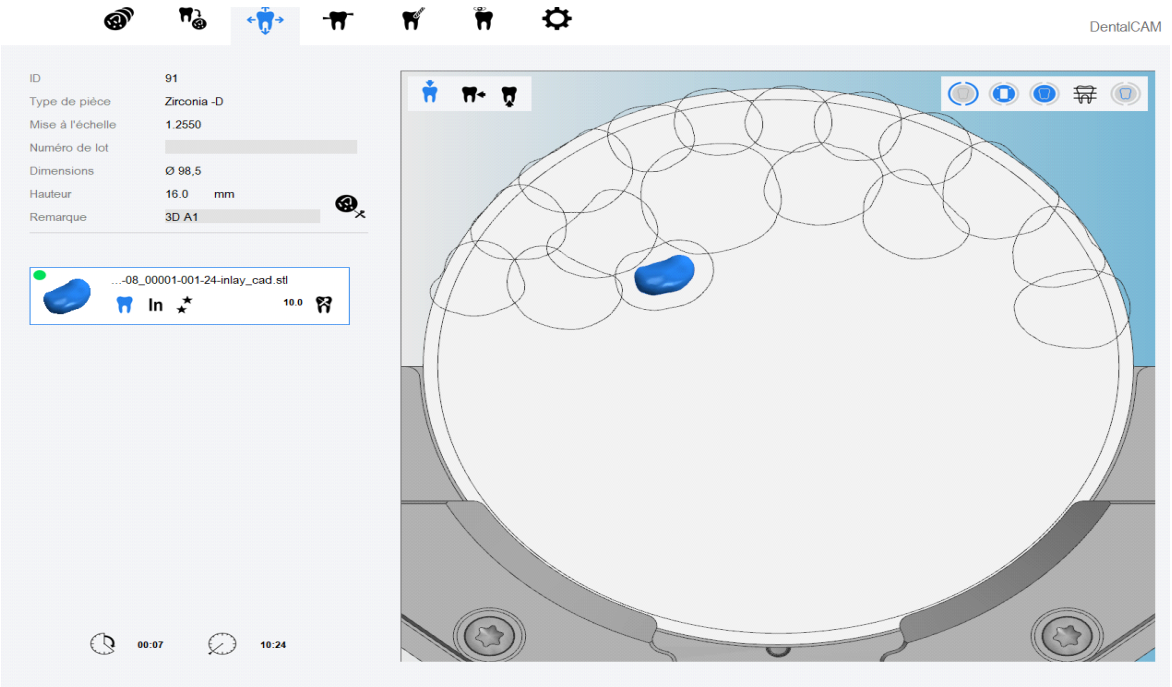

Figure 12: Placing the design into the virtual disc

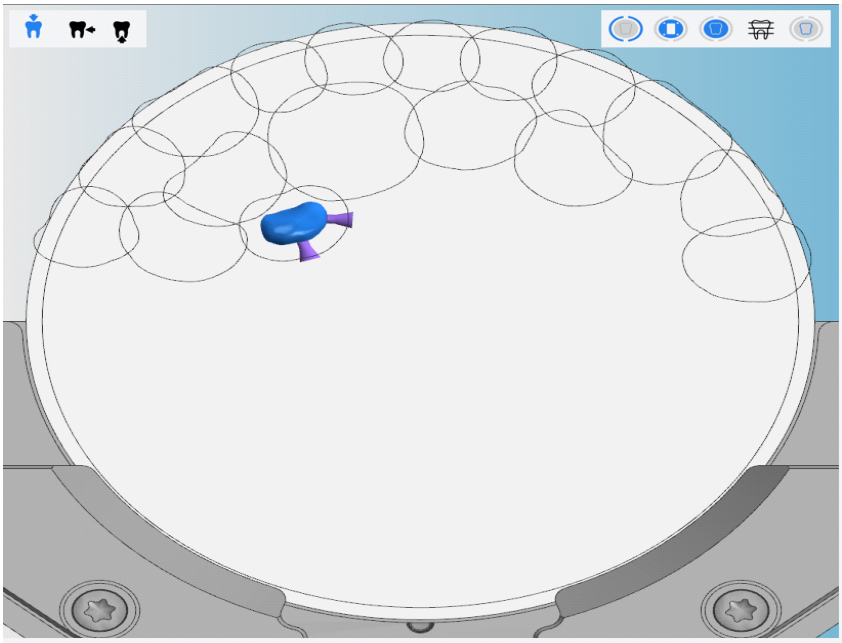

Figure 13: Adding the supporting pegs to the design

The file was transmitted to the milling machine for the fabrication of the post and core. After miling, the zirconia restoration received a sintering process at a high temperature to strengthen the post and core buildup.

Then the pegs were removed from the post-pathways, and the surfaces of the buildup were finished and polished to improve aesthetics and ensure that it met excellent standards of fit to be able to leave all patients satisfied with their new restoration (Fig. 14).

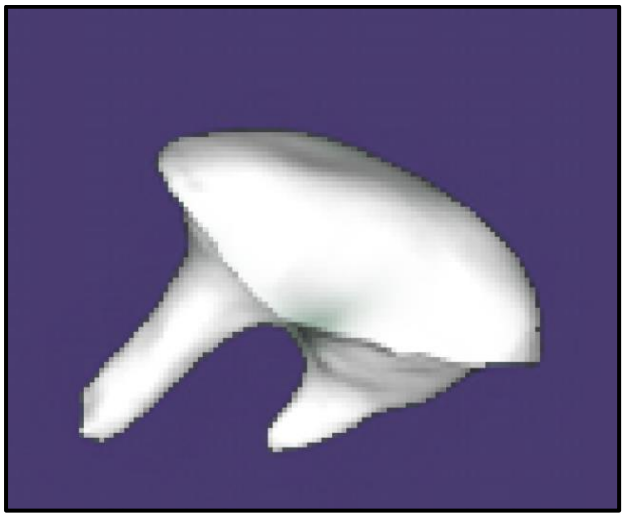

Figure 14: Zirconia post and core

DISCUSSION

The primary constituent of zirconia post and core systems is called ZrO2, which stands for zirconium dioxide in chemical terms [9]. These materials often incorporate stabilizers such as yttria (Y2O3) to enhance mechanical properties and ensure phase stability [10].

Due to its very outstanding mechanical properties and high biocompatibility, zirconia belongs to the leading materials for dental restorations, particularly post- and core-buildups.

Several studies have reported that zirconia has excellent mechanical properties, with flexural strength of 900 to 1,200 MPa, fracture toughness of 7–10 MPa·m1/2, and very high resistance to bending. These properties are relevant for post and core buildups that involve large masticatory forces, especially in posterior teeth, where stability for the long term is needed. Additionally, the high resistance to wear of zirconia guarantees the survival of the restoration, so this material can be used in places with increased stress [11].

Aesthetically, research reveals that, as a post- and core-restorative material, zirconia fulfills all

aesthetic demands. It allows the material to blend particularly well with adjacent teeth, matching their natural translucency and shades of tooth [3, 4]. In fact, it's especially critical with an anterior post and core buildups where visibility is greater and the restoration should blend perfectly [12]. Zirconia posts and cores are made to enhance the aesthetic outcomes of the final restoration, providing a more natural appearance compared to metal-based alternatives [13].

Zirconia is additionally biocompatible, as evidenced by clinical research studies, adding another layer to its advantages. Zirconia is also a great choice to use when patients have metal allergies or sensitivities [6, 14]. Added to that, zirconia materials are highly resistant to corrosion in the oral environment, ensuring the long-term stability and performance of the restorations [15].

Some important constraints about zirconia post and core restorations have been shown in studies as follows, although with numerous benefits. The fracture toughness is one of the primary limitations; despite its high mechanical strength properties, zirconia could be exposed to fractures, especially in compact and unsupported regions, leading to a loss of longevity for restorations [16]. Additionally, zirconia compounds are generally more expensive than traditional options, making them less common for patients who cannot afford a very high-end treatment solution [17]. Moreover, the high elastic moduli of zirconia, compared to dentin, can contribute excessive force transmissions to the tooth structure and possibly cause damage during loading [16].

Furthermore, while this material is commonly used in this type of buildup, there are new options available for post- and core dental restorations, such as PEEK (polyetheretherketone) or fiber-reinforced composites [17].

CONCLUSION

Zirconia post and core buildups are important to maintain the integrity and function of future crown restorations thanks to their high mechanical properties, biocompatibility, and aesthetic appeal. However, it also has disadvantages that should be considered depending on the clinical case to ensure the best possible results.

REFERENCES

1. Baroudi, S.A.G, AlHumaid, J., Merdad, K., Alkhodair, K. & Al-Khaldi, A. (2017). Clinical Performance of Post Systems for Endodontically Treated Teeth: A Systematic Review and Meta-Analysis. *J Endod*. *43*(7), 1044-1050. doi: 10.1016/j.joen.2017.05.014. PMID: 28522776.
2. Al-Omiri, M. K., Mahmoud, A. A., Rayyan, M. R., & Abu-Hammad, O. (2010). Fracture resistance of teeth restored with post-retained restorations: an overview. *Journal of endodontics*, *36*(9), 1439-1449. doi: 10.1016/j.joen.2010.06.005.
3. Al-Qarni, F. D. (2022). Customized post and cores fabricated with CAD/CAM technology: a literature review. *International journal of general medicine*, 4771-4779. doi: 10.2147/IJGM.S365296. PMID: 35571288; PMCID: PMC9091696.
4. Abou-Rass M. (1992). Post and core restoration of endodontically treated teeth. *Curr Opin Dent*. 2, 99-107. PMID: 1520948.
5. Ahmed, R., & Dubal, R. (2020). The restoration of structurally compromised endodontically treated teeth: principles and indications of post and core restorations. *Dental Update*, *47*(8), 670-676.
6. Fernandes, A. S., Shetty, S., & Coutinho, I. (2003). Factors determining post selection: a literature review. *The Journal of prosthetic dentistry*, *90*(6), 556-562.
7. Peroz, I., Blankenstein, F., Lange, K. P., & Naumann, M. (2005). Restoring endodontically treated teeth with posts and cores--a review. *Quintessence international*, *36*(9).
8. Kim, H.K., Lim, H.P. & Park, S.W. (2020). Advances and challenges in zirconia-based materials for dental applications. *J Korean Ceram Soc. 57*(4), 397-412. doi: 10.1007/s43207-020-00048-3. PMID: 32407348.
9. Gremillard, L., Virkar, A.V. & Clarke, D.R. (2023). Zirconia as a ceramic biomaterial in dentistry. BMC Oral Health.
10. Hannink, R.H.J., Kelly, P.M. & Muddle, B.C. (2023). The tetragonal-monoclinic transformation in zirconia: Lessons learned and future trends. J Am Ceram Soc.
11. Zhang, Y., & Lawn, B. R. (2018). Novel zirconia materials in dentistry. *Journal of dental research*, *97*(2), 140-147. doi: 10.1177/0022034517737483. PMID: 29035694; PMCID: PMC5784474.
12. Bozkurt, D. A., Buyukerkmen, E. B., & Terlemez, A. (2023). Comparison of the pull-out bond strength of endodontically treated anterior teeth with monolithic zirconia endocrown and post-and-core crown restorations. *Journal of Oral Science*, *65*(1), 1-5. doi: 10.2334/josnusd.22-0288. PMID: 36385051.
13. Anusavice KJ. Phillips' Science of Dental Materials. Elsevier; 2003.
14. Spitznagel FA, Boldt J, Gierthmuehlen PC. CAD/CAM ceramic restorative materials for natural teeth. J Dent Res. 2023.
15. Alam, M. A., Samad, U. A., Anis, A., Sherif, E. S. M., Abdo, H. S., & Al-Zahrani, S. M. (2023). The effect of zirconia nanoparticles on thermal, mechanical, and corrosion behavior of nanocomposite epoxy coatings on steel substrates. *Materials*, *16*(13), 4813. doi: 10.3390/ma16134813.
16. TULBAH, H. I. (2019). ZIRCONIA CERAMIC POST-AND-CORE SYSTEMS. AN UPDATED LITERATURE REVIEW OF SOME CLINICAL-

RELATED ISSUES. *International Journal of Medical Dentistry*, *23*(4).

17. Kasem, A. T., Shams, M., & Tribst, J. P. M. (2022). The use of polyetheretherketone (PEEK) as an alternative post and core material: Five-year follow-up report. *Dentistry Journal*, *10*(12), 237. doi: 10.3390/dj10120237. PMID: 36547053; PMCID: PMC9776542.

Cite This Article: Yosr Kraeim, Wejden Ben Amor, Yosra Gassara, Sarra Nasri, Ameni Adli, Moncef Ommezine, Zohra Nouira, Jilani Saafi, Belhassen Harzallah (2025). Zirconia Post and Core Restorations: A Case Study Highlighting Exocad Laboratory Workflow and Material Review. *EAS J Dent Oral Med, 7*(1), 7-15.