World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(CASE REPORT)

Diagnostic wax up of teeth with a maxillary central diastema resulting from mesiodens extraction: A case report

Sri Redjeki Indiani [1], Sianiwati Goenharto [1, *], Fina Aprilia Sabilana [2], Mia Laksmi Lita Rosa [1], Anisa Nur Halimah [1], Widiya Ulfa [1], Narta Nikita Sari [1] and Winda Kusumawardani [1]

[1] *Department of Health, Faculty of Vocational Studies, Universitas Airlangga, Surabaya, Indonesia.*
[2] *Undergraduate, Department of Health Faculty of Vocational Studies, Universitas Airlangga, Surabaya, Indonesia.*

World Journal of Advanced Research and Reviews, 2025, 25(03), 109-118

Publication history: Received on 17 January 2025; revised on 24 February 2025; accepted on 27 February 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.25.3.0636

Abstract

A mesiodens is a supernumerary tooth located in the midline between the maxillary central incisors. Extraction of mesiodens often results in a central diastema, characterized by a gap between the m axillary central incisors. Given the significant tooth alterations involved in complex prosthodontic treatment, a diagnostic wax-up is highly recommended to plan and visualize the final restorative outcome. In this case, we received the final cast from the dentist, where teeth 11 and 21 had already been prepared. Closure of the diastema was achieved by creating a diagnostic wax in the form of a cantilever bridge, with the lateral incisors designed as two units. The wax-up was carefully crafted, taking into consideration the midline alignment with the mandibular teeth, the maxillary labial frenulum the tooth width, and the anatomy of similar teeth. Effective communication between the dentist, patient, and dental technician was essential during the diagnostic wax-up process to achieve a well-planned dental restioration, ultimately enhancing both patient and dentist satisfaction.

Keywords: Diagnostic Wax Up; Central Diastema; Mesiodens

1. Introduction

Supernumerary teeth are a dental anomaly characterized by an excess number of teeth beyond the normal dentition, resulting from disturbances in growth and development. Mesiodens, the most common type of supernumerary tooth, occurs in approximately 0.15% to 1.9% of the population and can lead to various oral complications, including malocclusion, food impaction, and compromised aesthetics (1). The development of mesiodens is often attributed to the splitting of the dental lamina during odontogenesis, where one segment forms a normal tooth while the other develops into a mesiodens (2). Mesiodens can present in different morphologies, such as conical or peg-shaped forms, and may be positioned normally or inverted (3). A study conducted at Saraswati Dental and Oral Hospital between 2016 and 2019 reported a prevalence of supernumerary teeth in 35 cases (4.375%), with mesiodens accounting for 1.5% of these cases. Of the 35 cases, the condition was slightly more prevalent in males (51.43%) than in females (48.57%) (4).

The management of patients with mesiodens often involves the extraction of the supernumerary tooth without subsequent orthodontic treatment. However, the removal of mesiodens may result in the formation of a diastema between the maxillary central incisors (5). A diastema is defined as an interdental space exceeding 0.5 mm between the proximal surfaces of adjacent teeth. This condition can cause aesthetic concerns for many individuals, particularly when the diastema is located in the anterior region. A gap specifically occurring between the maxillary central incisors is referred to as a central diastema (6,7).

* Corresponding author: Sianiwati Goenharto

Copyright © 2025 Author(s) retain the copyright of this article. This article is published under the terms of the Creative Commons Attribution Liscense 4.0.

To enhance aesthetics, diastema closure is achieved through the placement of restorations. One of the most effective and minimally invasive restorative techniques is the use of a cantilever bridge restoration (8). This technique is particularly advantageous as it improves the aesthetic function of the maxillary anterior teeth, providing a more natural and harmonious appearance (9). In this case, an all-ceramic cantilever bridge will be fabricated using multi-layered zirconia, a material renowned for its superior aesthetic properties and excellent mechanical strength.

Complex prosthodontic treatments often involve significant dental alterations, making the use of a diagnostic wax-up a crucial step in the treatment planning process. A diagnostic wax-up is a procedure in which restorations are designed and modeled in wax on a diagnostic cast to optimize clinical and laboratory workflows, ensuring both functional and aesthetic outcomes (10). In cases involving a wide central diastema in the anterior maxilla resulting from mesiodens extraction, a diagnostic wax-up serves as an essential communication tool among the dentist, dental technician, and patient. It provides a three-dimensional representation of the provisional treatment plan, allowing for visualization and modifications as needed. This process is conducted indirectly in a dental laboratory. Additionally, the diagnostic wax-up aids in evaluating the restorative space requirements, ensuring alignment with the dental arch and accommodating restorative treatment needs (10). The procedure involves reshaping the teeth on the diagnostic model using wax to simulate the planned restorations. The wax-up can then be tried intraorally on the patient to confirm satisfaction and provide a basis for fabricating the definitive restoration (11).

The objective of this writing is to outline the systematic procedure for performing a diagnostic wax-up on maxillary central teeth with a diastema resulting from the extraction of a mesiodens.

2. Case Report

2.1. Case description

A case model had been provided by the dentist, consisting of upper and lower jaw casts with a prominent diastema in the anterior region between teeth #11 and #21. The models were fabricated from type III dental stone and demonstrating normal occlusion. The dentist had done tooth preparation at tooth #11 and #12 for further restorative planning. The case involved performing a diagnostic wax-up on the anterior maxillary teeth to close the wide diastema caused by the extraction of a mesiodens. The wax-up included the fabrication of two units for the lateral incisors to achieve closure of the central diastema. The proposed design for the anterior maxillary region is as follows:

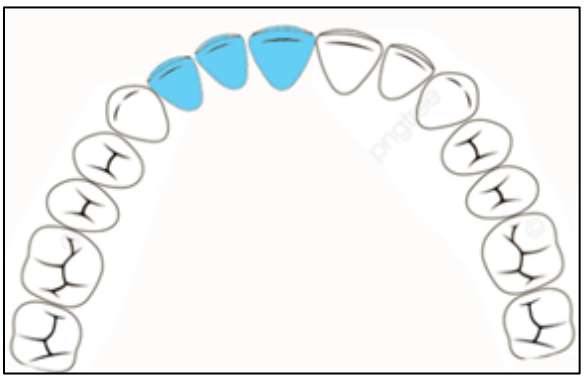
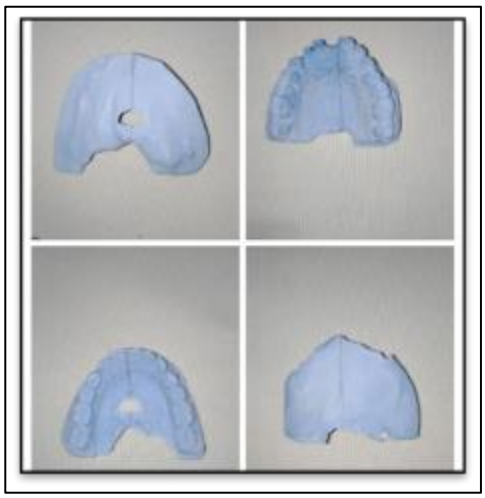
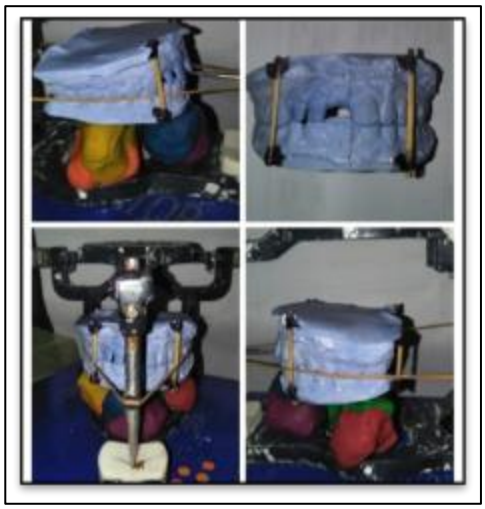


Figure 1 Design plan wax up on the upper anterior teeth. To close the central diastema, the plan includes creating a wax up of 2 lateral incisors and 1 central incisor

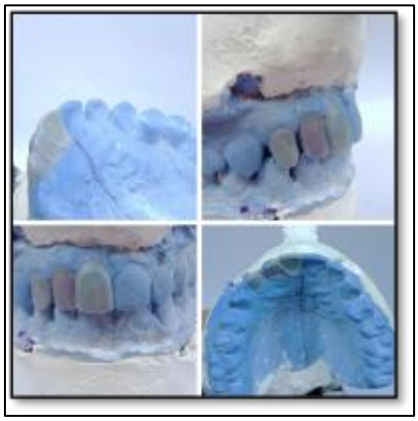
2.2. Procedure for making a wax-up

The initial step in performing diagnostic wax-up for anterior teeth with a diastema was to thoroughly reviewing the dentist's work order. This ensures a clear understanding of the treatment objectives and helps minimize errors during the fabrication proces.

Table 1 Diagnostic wax up procedure for anterior teeth restoration in central diastema cases.

No.	Figures	Notes
1	 	The master model provided by the dentist, comprising the upper and lower arches, was received and thoroughly examined. The working model was then assessed to ensure it was well-formed, free of defects, and ready for use in the restorative process.
2		The next step was to establish the midline on the working model. The midline of both the upper and lower jaw models should be aligned straight or parallel to the upper jaw, serving as a reference guide during the mounting process on the articulator
3		The mounting stage was done on a semiadjustable articulator. The upper and lower jaw models were occluded and secured using a wooden stick and adhesive wax. They were then positioned on the articulator, ensuring the horizontal pin was aligned with the contact point of the left and right lower central incisors. The vertical pin must be in contact with the articulator table to ensure proper alignment.

4		The working model was mounted on the articulator using type II dental stone.
5		Performing diagnostic wax-up began with the fabrication of a coping on the tooth, which had been prepared by the dentist. The coping was applied in a thin layer using a rotating motion on the die, starting from the base and progressing to the incisal edge. The layer was gradually thickened over the entire surface until it reaches the cervival margin.
6		The pontic is created in the diastema area, ensuring that its height, curvature, and arch are harmonious with the adjacent teeth. Point angle was formed on the pontic, which will later be shaped into a central incisor. The point angle should be adjusted to match the height of the adjacent teeth.
7		The framework creation begins with shaping the line angle on the pontic to match the curvature of the adjacent teeth. The process should ensure that the dental arch was aligned with the arch of the tooth to be restored, specifically tooth #11. The framework for tooth #11 should seamlessly connect to the coping of tooth #12, ensuring that the shape and size of tooth #11 were consistent with those of tooth #21.

8		The framework that has been created was filled by adapting the anatomical characteristics of tooth #21. Critical aspects were carefully considered, and grooves were formed to match the corresponding tooth on both the labial and lingual surfaces. When fillling the arch, proper alignment with the jaw arch must also be ensured.
9		Point angle and line angle was made on the first unit of tooth #12. In this case, two units of tooth #12 will be fabricated. The height, convexity, and contact points must be carefully considered.
10		The framework for the first unit of tooth #12 was filled, and it is adjusted to match tooth #22. The cervival portion of the first unit of tooth #12 should be longer to accommodate the tooth preparation.

11		The creation of the point angle and line angle framework for the second unit of tooth #12 was performed. The height , convexity and contact points must be carefully considered.
12		The framework was filled to match the convexity, height, and contact points, with grooves shaped to correspond to the adjacent tooth. This tooth was made smaller than the first unit to follow the tooth preparation shape and the curve of Spee.
13		The diagnostic wax-up was ready to be discussed with the dentist.
14		The first two units of central incisors appeared thin at the mesiolabial and mesiolingual areas. Upon measurement, the mesiolabial thickness was only 0.3 mm, and the mesiolingual thickness was only 0.5 mm. In the second two units of the central incisors, the incisal portion was still too thin, with a thickness of only 1 mm.

3. Discussion

The diagnostic wax-up was performed so that the dentist and the dental technician can visualize the final result of the planned restoration. This also facilitates discussion with the patient regarding their preferences for the final oucome of the treatment. A well-executed wax-up can be used to control tooth preparation and the fabrication of both provisional and definitive restorations (12). The result of the wax-up process is a 3D model of the tooth created in wax, representing the desired countours of the tooth to be restored (10).

The material that can be used for a diagnostic wax-up is inlay wax. This type can be used to create inlay patterns, which can be applied directly in the mouth or on a model. Inlay wax is used to create patterns for casting beacuse it can be easily manipulated and precisely shaped, with excellent characteristics in terms of smoothness, dimensional stability, color stability, flow, bornout stability, and flexibility (13).

The initial step before creating the diagnostic wax-up is to establish the midline on the working model received from the dentist. This is done to ensure proper alignment when mounting the models on the articulator, and it serves as a guide during the mounting process. The midline should be aligned straight between the upper and lower arches in centric occlusion, however, in this case of central diastema, the midline between the upper and lower arches was not straight, as the midline of the lower arch was slightly shifted to the right. Therefore, the midline of the lower arch was adjusted to follow the midline of the upper arch. The purpose of creating the midline, in addition to serving as a reference during mounting on the articulator, is to determine the symmetry between the teeth and the patient's face to ensure optimal aesthetics (14).

Preparation for mounting on the articulator was carried out by positioning the horizontal pin at the contact points between left and right mandibular central incisors. Additionally, all aspects of the mounting process must be carefully considered to ensure proper occlusion and articulation of the model, preventing any discrepancies in height that could affect the diagnostic wax-up process. The articulator was mounted using type II dental stone.

Before performing the wax-up, measurements of the width from the mesial aspect of the central incisor to the mesial aspect of the canine were taken using calipers. The measured width was 19 mm, whereas the space for the teeth to be restored was 25 mm wide. Fabricating a fixed dental prosthesis in a space that is insufficient within the dental arch would result in pontics that appear disproportionately small, compromising aesthetics. Therefore, a cantilever bridge restoration was planned to optimize the available space by slightly modifying the size and shape of the abutment teeth while utilizing the minimal adjacent space without compromising aesthetics (15).

If the restoration was limited to the central and lateral incisors, a wide diastema of approximately 6 mm will remain between the lateral incisor and the canine. Leaving this diastema unaddressed would compromise the aesthetics of the patient's dentition and fail to achieve the primary objective of the restoration, as it would create a diastema on the opposite side. Additionally, creating only the central and lateral incisors to fill the restoration space would result in excessively wide teeth, which would appear unaesthetic. To address this problem, the remaining space of approximately 6 mm would be utilized to fabricate a second lateral incisor restoration. In this case, two lateral incisors were created, with their dimensions adjusted to fit the available space. If the lateral incisors are made to match the width of their contralateral counterparts, the resulting pontics would be too small. Undersized pontics can impair masticatory function, compromise aesthetics, and lead to food impaction, making oral hygiene maintenance more challenging. Adjusting the pontic dimensions appropriately ensures that the restoration meets both the patient's aesthetic and functional needs effectively (16).

The first step in performing a diagnostic wax-up was creating a coping on the prepared tooth, followed by constructing a pontic in the central diastema area. The framework for tooth #11 was slightly shifted distally to adjust the tooth's width to match its contralateral counterpart, as the central diastema space was insufficient for forming tooth #11 otherwise. During the framework filling process, the incisal edge height at the mesial and distal should be harmonious and shaped to align with the neighboring teeth.

In the labial region, attention must be given to shaping the distoincisal angle to be slightly rounded and the mesioincisal angle to be more angular. Additionally, shallow grooves should be formed in the mesiolabial and distolabial regions. For the contact zones at the mesial and distal aspects, proper contact should be ensured with adjacent teeth, namely tooth #12 and tooth #21. In the palatal/lingual area, the palatal ridge and palatal fossa were shaped to mimic the anatomy of neighboring incisors. The mesial and distal marginal ridges on the palatal surface should be appropriately aligned and formed as elongated prominences to enhance the tooth's functionality and aesthetics.

In the wax-up process for the first unit of tooth #12, after creating the coping, the next step was forming the point angles to shape the cusps of the tooth, ensuring they aligned with the height and curvature of the adjacent teeth. This step was followed by forming the line angles to establish the framework for the lateral incisor, facilitating adjustments to the tooth's curvature, contact points, arch, and alignment with its contralateral counterpart. The framework for the first unit of tooth #12 was slightly shifted distally to ensure the tooth was not overly small. During the framework filling process, the incisal edge height at the mesial and distal must be harmonious and shaped to align with neighboring teeth.

The wax-up process for the second unit of tooth #12 began with creating the line angles to shape the tooth cusps, ensuring they aligned with the height of the adjacent teeth. It was followed by forming the line angles to construct the anatomical framework of the tooth, facilitating adjustments to the tooth's curvature, contact points, and arch. In this case, a slight rotation of tooth #13 caused a minor diastema, so the framework was designed with careful attention to creating proper contact points with the canine to close the diastema effectively. During the framework filling process, the incisal edge height, curvature, and arch should be harmonized with the neighboring teeth and the contralateral counterpart.

For the labial region, the mesioincisal angle was shaped to be slightly rounded, while the distoincisal angle was made significantly rounded. The cervical line was shaped lower than that of the first unit of tooth #12 to align with the adjacent teeth and achieve harmony, as well as to follow the curve of Spee. In the palatal/lingual region, the palatal ridge was formed to create a palatal fossa that matches the anatomy of the neighboring incisors. The mesial and distal marginal ridges on the palatal side were carefully shaped to align properly and form elongated prominences, ensuring both aesthetics and functionality.

After the complete formation of all the restoration crowns, each crown was bonded together or connected to form a cantilever bridge. A cantilever bridge is a conventional fixed dental prosthesis featuring a rigid pontic that is connected to a retainer on only one end (17). The diagnostic wax-up for this case revealed some areas requiring evaluation. On the first lateral incisor unit, the mesiolabial and mesiolingual regions were found to be thin, with a thickness of only 0.3 mm in the mesiolabial area and 0.5 mm in the mesiolingual area. Similarly, the second lateral incisor unit also exhibited a thin region at the incisal edge, which measured only 1 mm in thickness. This issue arose due to insufficient preparation of the abutment tooth in these areas.

Inadequate tooth preparation poses a risk of restoration failure because the insufficient thickness of the tooth structure may compromise the integrity of the restoration. Improper preparation can also hinder the fabrication of the final restoration by causing over-contouring, which negatively impacts aesthetics (18). Ideal preparation considerations for an all-ceramic cantilever bridge restoration using multilayer zirconia material include axial reduction of 1.0–1.5 mm and incisal reduction of 1.5–2.0 mm. The finishing line should be chamfered or rounded with an internal bevel and an angulation of approximately 10 to 30 degrees (13).

Multilayer zirconia was selected as the material for the final restoration due to its superior aesthetic qualities, making it highly suitable for use in anterior restorations. Additionally, the strength of multilayer zirconia is comparable to that of conventional PFM (Porcelain Fused to Metal) restorations. For patients with heightened sensitivity to metal, the use of all-ceramic zirconia for anterior or posterior crowns eliminates this concern while maintaining excellent functionality and aesthetics.

4. Conclusion

The diagnostic wax-up procedure for a wide diastema in the anterior region due to the extraction of a mesiodens includes receiving the working model from the dentist, duplicating the model, mounting it on the articulator, and creating the diagnostic wax-up on teeth 11, 12, and 13 (the second lateral incisor). Several factors need to be considered during the diagnostic wax-up, including the physiological anatomy such as the interproximal areas, embrasures, contact points, tooth contours, and inclinations. Effective communication between the dentist, patient, and dental technician is essential during the diagnostic wax-up process to ensure proper restorative planning, ultimately enhancing patient and dentist satisfaction.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Russell KA, Folwarczna MA. Mesiodens--diagnosis and management of a common supernumerary tooth . The Journal of Canadian Dental Association [Internet]. 2003 [cited 2025 Jan 7];69(6):362–6. Available from: https://pubmed.ncbi.nlm.nih.gov/12787472/

[2] Lubis HF. Management of upper supernumerary teeth during mixed dentition: a case report. Journal of Syiah Kuala Dentistry Society [Internet]. 2016 [cited 2025 Jan 7];1(2):103–9. Available from: https://jurnal.usk.ac.id/JDS/article/view/5317/4496

[3] Meighani G, Pakdaman A. Diagnosis and Management of Supernumerary (Mesiodens): A Review of the Literature. J Dent (Tehran) [Internet]. 2010 [cited 2025 Jan 7];7(1):41. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3184724/

[4] Ardyta MTB. Prevalence of supernumerary teeth reviewed from panoramic radiography at Saraswati Dental and Oral Hospital from 2016 - 2019. [Denpasar]: Universitas Mahasaraswati; 2021.

[5] Sembiring LS, Marcia M. Extraction of a Mesiodens in the Maxillary Anterior Region: a Case Report. Sound of Dentistry. 2019;4(2):47–56.

[6] Joneja P, Pal V, Tiwari M, Hazari P. Factors to be Considered in the Treatment of Midline Diastema. Int J Curr Pharm Res [Internet]. 2013 [cited 2025 Jan 7];5(2):1–3. Available from: https://www.academia.edu/65447059/Factors_to_Be_Considered_in_the_Treatment_of_Midline_Diastema

[7] Sutjiati R. Management of Central Diastema Closure Following Mesiodens Tooth Extraction. Stomatognatic (Jurnal Kedokteran Gigi Unej) [Internet]. 2011 [cited 2025 Jan 7];8(1):56–61. Available from: https://repository.unej.ac.id/bitstream/handle/123456789/17335/gdlhub-%20%2853%29xx_1.pdf?sequence=1

[8] Permatasari R, Usman M. Closure of diastema using a nanofiller composite. Indonesian Journal of Dentistry [Internet]. 2008 [cited 2025 Jan 7];15(3):239–46. Available from: https://lib.ui.ac.id/file?file=digital/2016-8/20428979-AJ-Rina%20Permatasari.pdf

[9] umartati Y, Dipoyono HM, Sugiatno E. Pembuatan Cantilever Bridge Anterior Rahang Atas sebagai Koreksi Estetik. Majalah Kedokteran Gigi Indonesia [Internet]. 2012 Dec 31 [cited 2025 Jan 7];19(2):167–70. Available from: https://jurnal.ugm.ac.id/mkgi/article/view/15543

[10] Simon H, Magne P. Clinically based diagnostic wax-up for optimal esthetics: the diagnostic mock-up . J Calif Dent Assoc [Internet]. 2008 [cited 2025 Jan 7];36(5):355–62. Available from: https://pubmed.ncbi.nlm.nih.gov/18557126/

[11] Jain A, Fanibunda U, Sonkurla S, Shete O, G. Aruna. Diagnostic wax up - a valuable tool in aesthetic treatment planning. Dento-med journal [Internet]. 2014 [cited 2025 Jan 7];1(1):27–32. Available from: https://www.scribd.com/document/393503576/ContentServer-asp-8

[12] Abduo J. Geometrical effects of conventional and digital prosthodontic planning wax-ups on lateral occlusal contact number, contact area, and steepness. J Oral Sci [Internet]. 2017 [cited 2025 Jan 6];59(3):431–8. Available from: https://pubmed.ncbi.nlm.nih.gov/28904320/

[13] Shillingburg HT, Sather DA, Wilson EL, Cain JR, Mitchell DL, Blanco LJ, et al. Fundamentals of Fixed Prosthodontics [Internet]. 4th ed. Quintessence Publishing ; 2012 [cited 2025 Jan 7]. Available from: https://www.quintessence-publishing.com/gbr/en/product/fundamentals-of-fixed-prosthodontics

[14] Farahani A, Jafari K, Hemmati A, Naghizadeh A, Nemati R, Farahani M. Assessment of the Relationship Between Facial and Dental Midlines with Anatomical Landmarks of the Face and Oral Cavity. Turk J Orthod [Internet]. 2019 [cited 2025 Jan 7];32(4):200. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7018495/

[15] Sangeetha S. Prosthodontic Space Management in Anterior Tooth Region Esthetically-A Case Study. Journal of Pharmaceutical Science and Research. 2016;8(3):173–5.

[16] Gahan MJ, Nixon PJ, Robinson S, Chan MFWY. The ovate pontic for fixed bridgework. Dent Update [Internet]. 2012 [cited 2025 Jan 7];39(6):407–15. Available from: https://pubmed.ncbi.nlm.nih.gov/22928453/

[17] Madhok S, Madhok S. Evolutionary Changes in Bridge Designs. Journal of Dental and Medical Sciences [Internet]. 2014 [cited 2025 Jan 7];13(6):50–6. Available from: www.iosrjournals.org

[18] Apsari A, Kusumawardani CDN. The Importance of Abutment Teeth Preparation Guide for Telescopic Double Crown Restorations with Friction Element. Dental Jurnal Kedokteran Gigi. 2017;11(1):69–74.