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Diastema Closure with Dental Veneers Using Digital Workflow: A Case Report

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Abstract:- Diastema, or the presence of a gap between teeth, is a common dental issue that can affect both aesthetics and function. Traditional methods of diastema closure include orthodontic treatments and direct bonding, but these approaches can be time-consuming and invasive. This case report explores the use of dental veneers fabricated through a digital workflow to close a diastema effectively and efficiently.

A 25-year-old patient presented with a prominent diastema between the maxillary central incisors. After a comprehensive evaluation, a treatment plan involving porcelain veneers was proposed. The digital workflow began with an intraoral scan to create a precise 3D model of the patient's dentition. Using computer-aided design (CAD) software, the veneers were meticulously designed to ensure optimal fit and aesthetics. The designs were then sent to a milling machine, which fabricated the veneers from high-quality porcelain.

The preparation of the teeth was minimal, preserving as much natural tooth structure as possible. The veneers were bonded using a resin cement, providing a seamless integration with the natural teeth. Post-procedure, the patient reported high satisfaction with both the aesthetic and functional outcomes. The digital workflow not only reduced the overall treatment time but also increased precision and predictability.

This case highlights the advantages of using digital technology in dental treatments, particularly for cosmetic enhancements such as diastema closure. The integration of digital impressions, CAD software, and precision milling can lead to superior outcomes with less invasiveness and higher patient satisfaction. Further studies are recommended to explore the long-term durability and patient-reported outcomes of digitally fabricated veneers for diastema closure.

Keywords:- *Diastema Closure ,Dental Veneers, Digital Workflow, Aesthetic Dentistry, Smile Design.*

I. INTRODUCTION

The quest for a perfect smile is a universal desire that transcends ages and cultures. Among the most common aesthetic concerns are diastemas, the gaps between teeth, which can cause discomfort for many people. Traditionally, closing diastemas required lengthy and sometimes uncomfortable orthodontic treatments. However, the advent of dental veneers and the integration of digital workflow have transformed this practice, offering quick, precise, and aesthetically satisfying solutions.

Dental veneers, thin lenses of aesthetic ceramic, have become one of the most popular solutions for correcting dental imperfections, including diastemas. Their ability to provide a natural and harmonious result makes them a preferred option for both dentists and patients. It is not only the material technology that has evolved but also the clinical protocol for designing and bonding these veneers.

The digital workflow has revolutionized the field of aesthetic dentistry. With advanced technologies such as intraoral scanning, computer-aided design (CAD), and computer-aided manufacturing (CAM), the process of fabricating and bonding dental veneers has become more precise, faster, and less invasive. This integrated approach allows for the customization of therapeutic options based on each patient's specific expectations, ensuring optimal results.

In this article, we will delve into how the use of dental veneers combined with digital workflow represents a true revolution in diastema closure. We will examine the advantages of this modern approach, the key steps in the clinical process, and the therapeutic results obtained, demonstrating why this method is redefining the standards of contemporary aesthetic dentistry.

II. CASE PRESENTATION

Miss N.M., a 25-year-old in general good health, presented for a consultation at our dental medicine service at Farhat Hached University Hospital in Sousse. The patient has a diastema between the maxillary central incisors and moderate damage to these same teeth with defective composite restorations. She wishes to improve the aesthetics of her smile without resorting to orthodontic treatments.

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Fig 1: Initial Situation at the First Consultation

A. Clinical Examination

➢ *During this Initial Consultation, We Conducted a Thorough Clinical Examination that Revealed the Following:*

- Exobuccal Findings: * The patient has a symmetrical face with balanced facial thirds. She has a thick upper lip with a well-defined philtrum.
- Endobuccal Findings: * Oral hygiene was adequate, but plaque control and hygiene motivation were advised. The patient exhibits a thin periodontal morphotype.
- Maxilla:

✓ Teeth 11 and 21 have defective vestibulo-occluso-lingual composite restorations.
✓ There is vestibular versioning of the central incisors.

- Mandible:

✓ The patient has no dental caries or periodontal disease.
✓ In occlusion, the patient exhibits an anterior open bite and Angle Class I occlusion.

Functionally, we suspect a slight tongue thrust. A radiographic examination was also performed, revealing no abnormalities.

After the initial consultation, we understand that the patient wishes to harmonize her smile while being very conservative about her teeth.

B. Aesthetic Analysis

Preoperative smile analysis is essential in aesthetic treatment, allowing us to define, based on predefined aesthetic criteria, the areas that need correction during the clinical procedure. Both dental and gingival criteria are crucial for achieving a harmonious smile. Magne and Belser have established an aesthetic checklist that includes fundamental objective criteria and subjective criteria. (1).

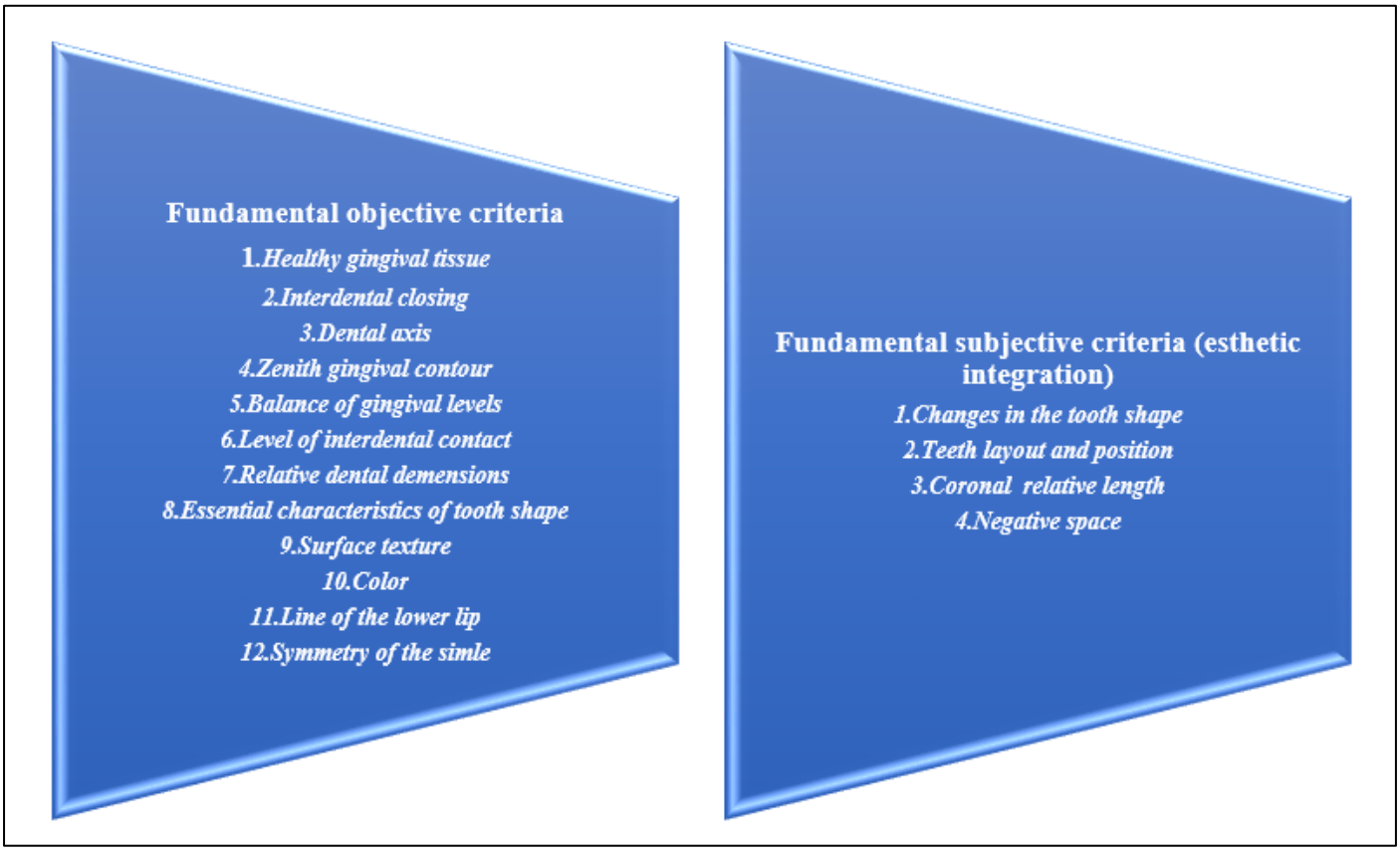

Fig 2: Esthetic Check-List

After synthesizing the aesthetic criteria for both gingival and dental aspects, we will correlate these criteria with those of our patient. To better illustrate the situation, we have schematized all the criteria we aim to improve on a photograph. These criteria will be analyzed first from the gingival perspective and then from the dental perspective.

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- *__Gingival Perspective__: Our patient has healthy gums, but the gingival margins are not aligned. Specifically, the gingival margin of the lateral incisors is higher than that of the central incisors. The laterals are positioned higher but asymmetrically.
- __*Dental Perspective__: The analysis of the central incisors reveals a worn incisal edge and vestibular versioning.
- __*Aesthetic Analysis with DSD:__ We use simulation software to plan the final result in terms of the shape, size, and alignment of the veneers.

Fig 3A: Aesthetic Analysis with DSD

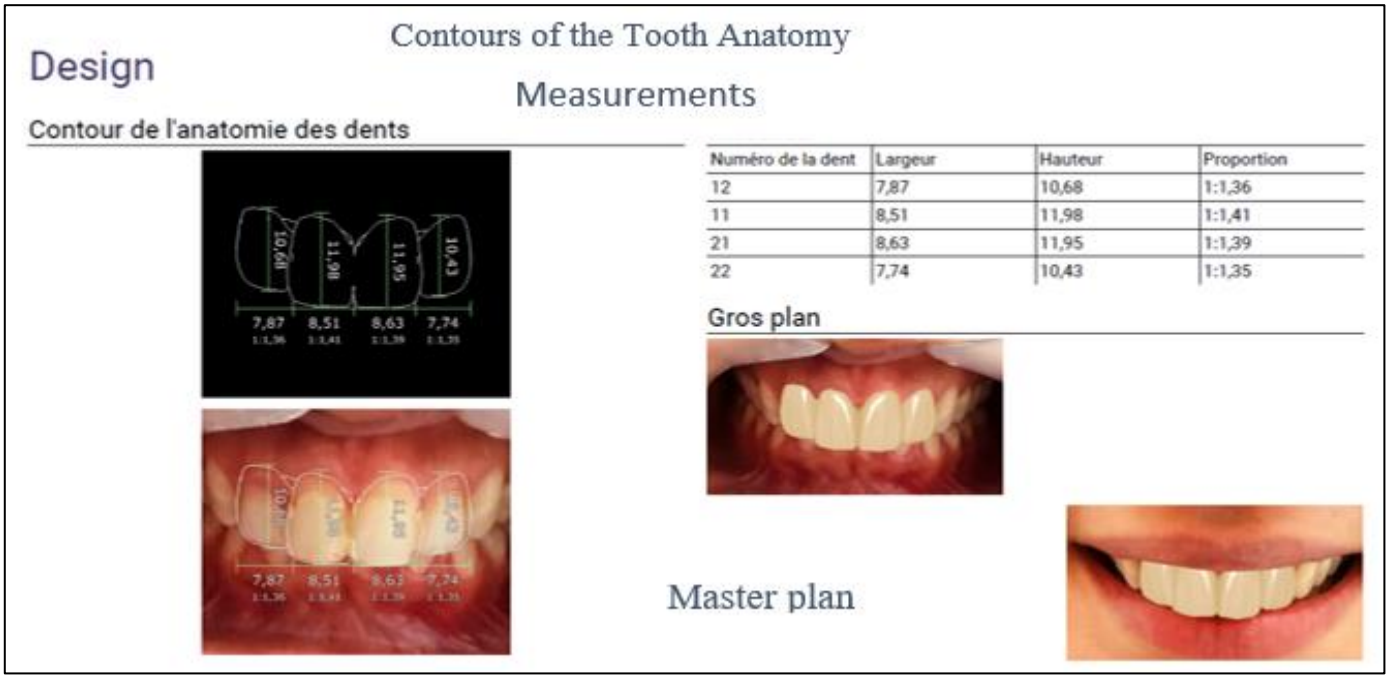

Fig 3B: Design and Measurements

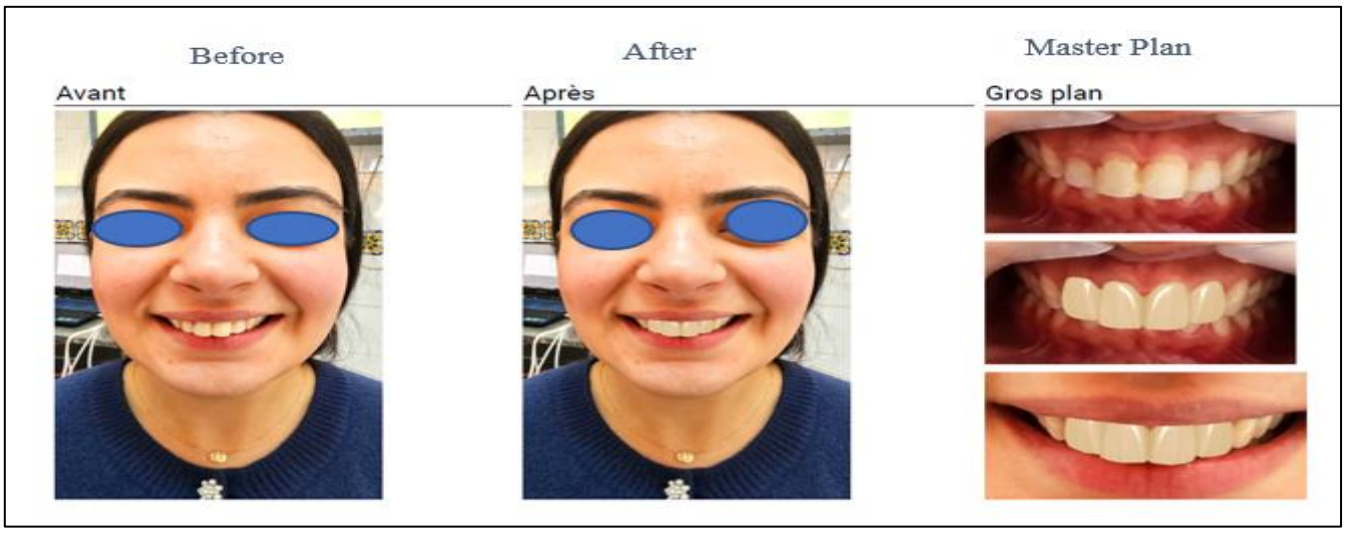

Fig 3C: Result Simulation after Veneer Treatment

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- Bas du formulaire

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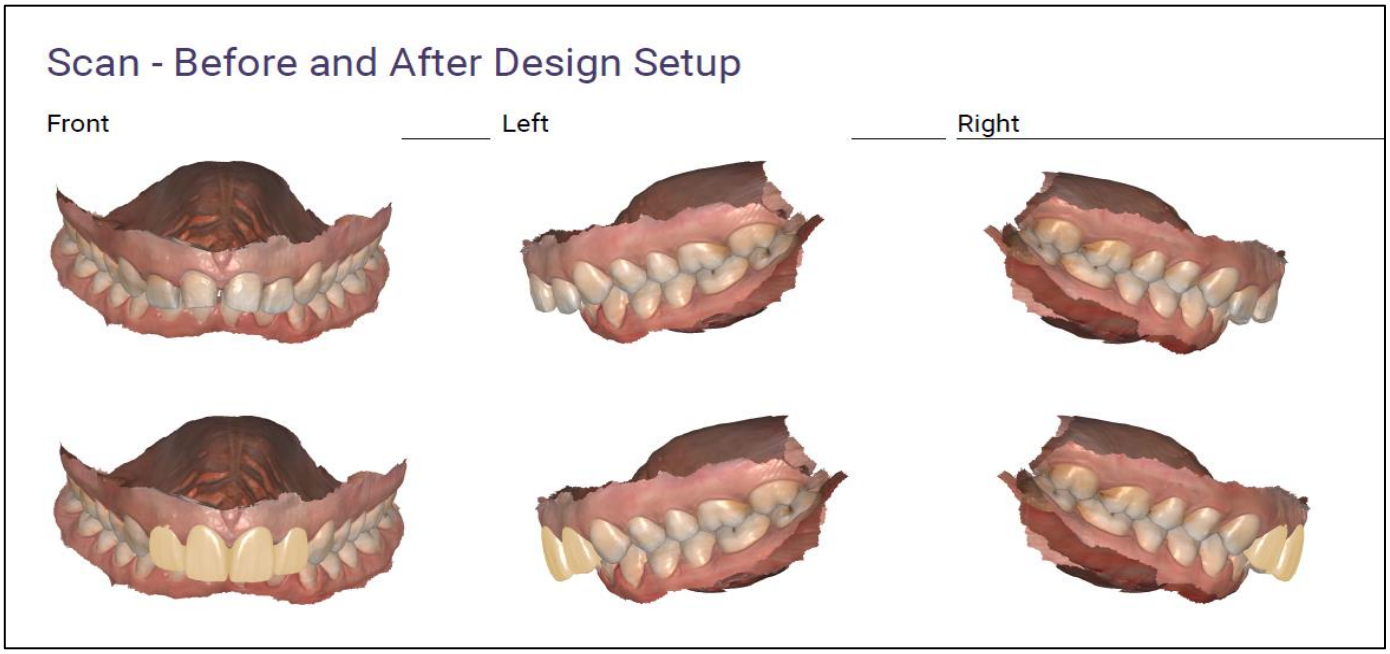

Fig 3D: Scan (before and after design set-up)

- **Digital Mock-Up:** A digital preview of the veneers to obtain the patient's approval. This allows the patient to see what her smile will look like after the treatment.

Fig 4: 3D Prosthetic Project Impression

C. Proposed Therapeutic Options

After a thorough aesthetic analysis, several therapeutic solutions were proposed to the patient. We presented them from the least invasive to the most invasive:

- **Option 1:** We suggested orthodontic treatment and possibly speech therapy to correct the tendency towards tongue thrusting. However, the patient had previously undergone orthodontic treatment as a child and did not wish to repeat it or seek a second opinion.
- **Option 2:** We proposed redoing the composite restorations. Anterior composite layering is a conservative approach that can restore such substance loss. Several factors support this decision:

✓ Young patient: 25 years old.
✓ Potential for long-term follow-up and ease of reintervention.
✓ Achieving an aesthetic result at a reasonable cost.

However, this non-invasive and quick solution was rejected by the patient due to the maintenance it required.

- **Option 3:** We suggested placing veneers on the four central and lateral incisors to achieve a more harmonious distribution of space. Veneers fit within a gradual therapeutic approach. They are relatively quick, minimally invasive, and reliable over time (according to a study by Fradeani et al., which shows a low failure rate of 5.7% over 12 years). Reintervention will be easy and always possible.
- **Option 4:** Ceramic crowns were considered, but this option is too invasive compared to veneers in the context of conservative dentistry. Therefore, it was not chosen.

The benefit-risk ratio, as well as the advantages and disadvantages of each option, were presented to the patient. She was able to make an informed decision on the therapeutic option best suited to her clinical situation and financial capabilities.

➢ *Chosen Therapeutic Decision:***

The realization of e-max veneers on the four maxillary incisors. Here is the resulting treatment plan:

- *Pre-Prosthetic Phase:*

✓ **Periodontal Health**: Two scaling sessions are scheduled to educate the patient on plaque control and oral hygiene practices.

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✓ **Gingival Correction**: The gingival margins are misaligned, so a slight gingivectomy is performed on the two lateral incisors. After probing, we carried out a simple gingivectomy to reshape the gum. This allows for the placement of a flowable composite "point" to maintain the gum position and prevent recurrence. The gingival margins are now in an optimal position. The following two figures illustrate the gingival and dental corrections performed.

Fig 5: The Use of a Clear Splint as a Guide for Gingivectomy.

Once these preliminary adjustments have been completed, we can proceed to the clinical and prosthetic stages of veneer placement. We will outline the various steps involved in the preparation and assembly of the veneer.

- *Prosthetic Phase:*

✓ **Mock-Up**

The mock-up stage involves creating a prototype to transfer the prosthetic plan into the patient's mouth and confirm the final result. Silicone keys are used for this purpose. After shaping, the key is tried in the mouth and adjusted as needed. Bis-Acryl resin is applied to the key and positioned in the mouth. Once the resin sets, excess material is removed, and the mock-up is evaluated by both the practitioner and the patient to ensure it meets aesthetic and functional criteria.

Fig 6: Mock-up in the Mouth

Once the mock-up is approved, veneer preparation begins. The mock-up not only provides an aesthetic preview but also guides the preparation process. It helps in accurately shaping the surface by using depth-limiting burs to control preparation depth, reducing the risk of dentin exposure that could impact veneer bonding.

- **Dental Preparation**: To prepare through the mock-up, we use a diamond bur with a vestibular stop (penetration depth: 0.4mm) to control the depth. Horizontal grooves are made to a depth of 0.4mm, maintaining the double convexity of the tooth.

Fig 7: Horizontal Grooving through the Mock-Up

Fig 8: Buccal and Proximal Surfaces Prepared

Fig 9: Preparation at the Incisal Edges

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Fig 10: The Finished and Polished Preparations


Fig 11: Global Impression with Intraoral Scanner


Fig 12: "Temporary Veneers in Place (Temporization)"

In the process of diastema closure using dental veneers, precise impression taking is crucial to ensure a perfect fit of the final restorations. Digital impressions are increasingly preferred due to their accuracy and efficiency. Following the impression, temporization plays a vital role in maintaining esthetics and function while the definitive veneers are fabricated. Temporary restorations not only protect the prepared teeth but also provide a preview of the final result, allowing for adjustments before the permanent veneers are placed.

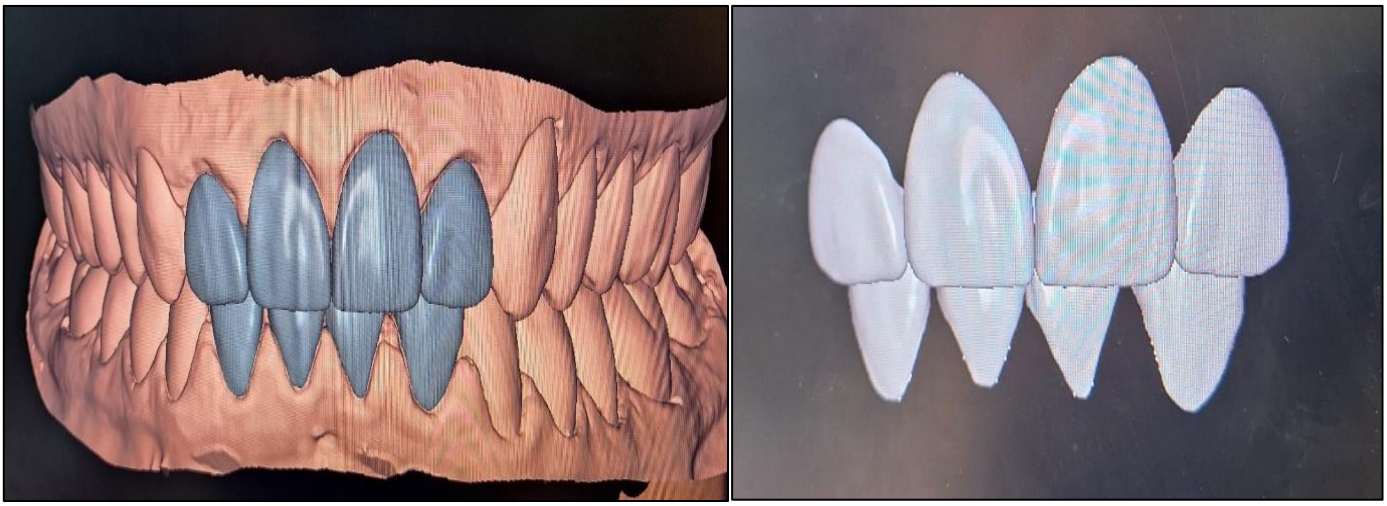
Fig 13: Digital Design of Final Veneers

- **Try-In and Adjustments** We remove the provisional veneer using a low-speed round bur to avoid damaging the preparations. The tooth surfaces are cleaned thoroughly. The veneers are then tried in, and we check the marginal fit, proximal contacts, shape, and transition lines. Once all parameters are validated, we seek the patient's feedback.


Fig 14: Final E-Max Veneers on Model

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- ***Bonding the Veneers**:*

The bonding of veneers is the final clinical step. Attaching a veneer to a tooth involves three materials: the tooth, the adhesive, and the ceramic veneer. There are two key interfaces: adhesive/enamel and adhesive/ceramic. We will examine the surface treatments applied to optimize the bonding process and ensure the durability of the veneer.

- ***Prosthetic Surface Treatment*

Fig 15: **Etching with 9.5% Hydrofluoric Acid for 30 Seconds + Rinse + Gentle Drying**

Fig 16 : Silanisation

➢ *** **Dental Surface Treatment*


Fig 17: Placement of the Rubber Dam and Ligatures


Fig 18: Etching the Enamel with 37% Phosphoric Acid for 30 Seconds + Rinsing + Drying


Fig 19: Application of Adhesive for 10 Seconds + Air Spray

➢ ***Adhesive Bonding:***


Fig 20: Coating the Inner Surface of the Veneer with Photo-Polymerizable Bonding Resin

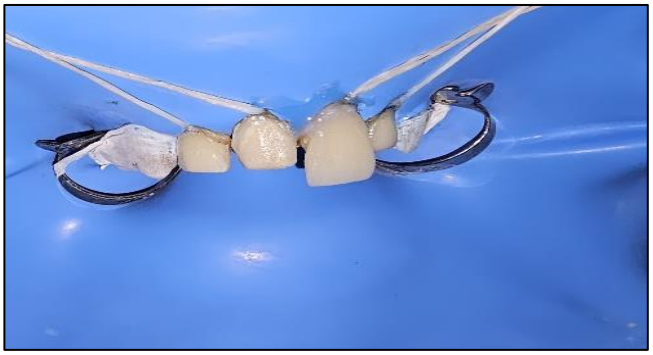
Fig 21: Veneer Positioning + Flash Photopolymerization

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Fig 22: Application of Glycerin on the Dento-Prosthetic Seal

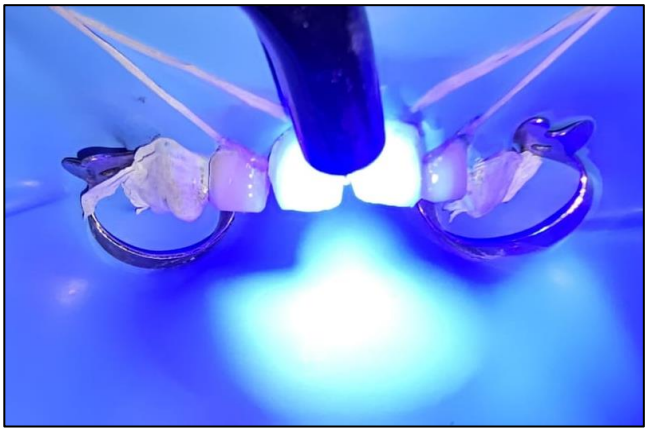
Fig 23: Photopolymerization (20s)


Fig 24: Result after Bonding

➢ ***Post-Operative Follow-Up***

- **Regular Check-ups:** Follow-up appointments to ensure that the veneers are well-tolerated and that the patient is satisfied with the results.
- **Maintenance:** Guidelines for maintaining the veneers, including recommendations on oral hygiene and dietary habits to prolong their lifespan.
- **Final Result**

After the treatment, Ms. N.M. exhibits a harmonious smile with no diastemas or signs of deterioration. The E.max ceramic veneers have successfully restored the aesthetics and functionality of her maxillary and mandibular incisors, providing a natural and durable outcome.

In summary, dental veneers combined with digital workflow represent a significant advancement in the aesthetic treatment of diastemas, offering exceptional aesthetic and functional results that meet the high expectations of both patients and aesthetic dentistry professionals.

III. DISCUSSION

- Diastema refers to natural spacing between teeth, often seen between upper incisors. These gaps can vary in size and impact on a smile. Causes include genetic factors, lifestyle habits such as thumb sucking, and periodontal diseases that lead to gum recession and bone loss (2) (3). Diastemas can affect smile symmetry, self-confidence, and dental function, potentially causing plaque accumulation and increasing the risk of cavities and gum disease (4).

➢ *Traditional Treatments for Diastemas Include:*

- Orthodontics: Uses braces or discreet options like Invisalign to realign teeth. This method is effective but can be lengthy (5).
- Crowns and Bridges: Cover or replace missing teeth but may involve reducing natural teeth and are less suitable for young patients (6).
- Dental Composites: Apply resin to fill gaps, offering a quicker but less durable solution (7).
- Modern alternatives, like dental veneers combined with digital workflows, provide promising solutions. Veneers are thin shells applied to the front of teeth, available in composite or ceramic materials. Ceramic veneers are durable and natural-looking, offering immediate and long-lasting results (5) (6) (7).

A. *Dental Veneers: A Modern Solution***

➢ **Description of Dental Veneers**

A dental veneer is an extremely thin shell, most commonly made from aesthetic ceramic, applied to the surface of a tooth to alter its appearance. Developed in the 1980s, dental veneers gained significant popularity in the 2000s due to advances in both technique and materials. Dental veneers are designed to enhance the aesthetic appearance of teeth, creating a more harmonious smile. They can change the color (shade) and/or shape of the tooth, conceal minor defects on damaged teeth, and close diastemas, all while being minimally invasive to the dental tissues.(8)(9)

➢ **Advantages of Dental Veneers for Diastema Closure**

Dental veneers offer several notable benefits for closing diastemas:

- **Enhanced Aesthetics:They effectively correct gaps between teeth, improving the overall appearance of the smile.
- **Minimized Invasiveness and Therapeutic Gradient :Compared to methods like dental crowns, veneers generally require less reduction of the natural tooth structure.

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- **Durability : Modern materials used in veneer fabrication, such as lithium disilicate ceramics, offer enhanced durability and resistance to discoloration.
- **Rapid Clinical Protocol:** The clinical process for veneers is typically quick and requires less recovery time compared to other treatments like orthodontics.
- **Natural Aesthetic Results:** Once applied, veneers realistically mimic the appearance of natural teeth, ensuring a naturally beautiful and harmonious result. (10)(11)

➢ **Comparison Between Veneers and Other Diastema Treatments**

Compared to traditional methods such as orthodontics or crowns:

- **Orthodontics:** While orthodontics can be effective for closing diastemas by shifting natural teeth, it can take a considerable amount of time (often several years) and requires ongoing commitment.
- **Crowns:** Crowns require significant reduction of natural tooth structure and are generally used for severely damaged teeth or significant diastemas.
- **Dental Composites:** Composite resins can be used to fill gaps between teeth, but they may require frequent touch-ups and are not as aesthetically durable as veneers.

In comparison, dental veneers offer an attractive alternative due to their ability to provide superior and long-lasting aesthetic results with less discomfort for the patient, as well as a faster and more predictable process.

B. Digital Workflow in Aesthetic Dentistry

Definition and Explanation of Digital Workflow:

Digital workflow in aesthetic dentistry integrates advanced digital technologies throughout the treatment process, enhancing accuracy, predictability, and efficiency from planning to execution (12).

Key Technologies in Digital Workflow

➢ *Key Technologies Include:*

- **Intraoral Scanning:Captures precise digital dental models without traditional impressions.
- **Computer-Aided Design (CAD): Designs dental restorations based on anatomical and aesthetic specifications.
- **Computer-Aided Manufacturing (CAM): Produces custom restorations using milling or 3D printing from CAD models.
- **3D Printing: Creates accurate dental models and surgical guides with increased flexibility (13).

➢ ***Advantages Over Traditional Methods***

Digital workflow provides:

- **Increased Accuracy:** Reduces human error and ensures predictable outcomes.
- **Faster Treatment:** Streamlines procedures with automation, reducing delays.
- **Optimal Customization:** Offers restorations tailored to individual needs.
- **Enhanced Patient Comfort:** Minimizes discomfort and anxiety associated with traditional methods.

By incorporating digital workflow, dentists can enhance practice efficiency and deliver high-quality, personalized care, meeting patient expectations for both aesthetics and comfort.

➢ ***Challenges and Future Perspectives***

Current Limitations of Veneers and Digital Workflow

Dental veneers combined with digital workflow, while beneficial, face limitations. Challenges include the need for minimal tooth preparation and the potential for periodic touch-ups due to limited resistance to extreme forces. Despite digital advancements, errors in design or fabrication can still occur, requiring vigilance from dental professionals (14).

➢ ***Potential Challenges***

Adopting veneers and digital workflow may be hindered by costs, particularly in areas with limited dental care access or inadequate insurance. Ongoing dentist training is essential for optimal results, and the geographical and economic accessibility of digital equipment may limit use in smaller or rural practices.

➢ ***Future Innovations and Trends in Aesthetic Dentistry***

The field is evolving with more durable materials for veneers and advanced scanning techniques, reducing treatment times and increasing precision. Innovations like artificial intelligence and augmented reality promise to enhance planning and personalization. Improved accessibility to digital technologies is expected to broaden access to aesthetic dental care, enhancing patient quality of life worldwide (15).

In conclusion, while challenges remain, the future prospects for dental veneers and digital workflow are promising, with continued potential to transform the practice of aesthetic dentistry and enhance patient outcomes on a global scale.

IV. CONCLUSION

This article highlights the significant advancements in modern aesthetic dentistry through the use of dental veneers and digital workflow, particularly in closing diastemas.

Diastemas, the gaps between teeth, can be effectively addressed with dental veneers. These thin, custom-made shells enhance both the aesthetics and function of teeth. The digital workflow, incorporating technologies like intraoral scanning, CAD, and CAM, has transformed the veneer application process, providing increased precision, optimal customization, and greater comfort for patients.

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The key benefits of dental veneers and digital workflow are their ability to deliver natural, durable aesthetic results with minimal invasiveness. These innovations not only meet high aesthetic expectations but also improve patients' overall well-being and self-confidence.

Looking ahead, we foresee continuous advancements in materials and techniques, offering increasingly precise and personalized solutions. The integration of artificial intelligence, predictive simulations, and biomaterial innovations is set to redefine aesthetic dentistry standards, making care more accessible, efficient, and rewarding for both patients and dental professionals.

In summary, dental veneers and digital workflow not only revolutionize diastema closure but also promise a future where a perfect smile is achievable for all, backed by advanced science and technology.

REFERENCES

[1]. Magne et Belser,*Bonded porcelain restorations in the anterior dentition. A biomimetic approach*, 2002.
[2]. Temisanren OT, Opeodu OI. Acceptability of midline diastema among dental technician students at the university college hospital, Ibadan. Niger J Med. 2019;28(4):354-9.
[3]. Huang WJ, Creath CJ. The midline diastema : a review of its etiology and treatment. Pediatr Dent. 1995;17:171-9.
[4]. Richardson ER, Malhotra Sk SK, Henry M, Little RG, Coleman HT. Biracial study of the maxillary midline diastema. Angle Orthod. 1973;43(4):438-43.
[5]. Shashua D, Årtun J. Relapse after orthodontic correction of maxillary median diastema : a follow-up evaluation of consecutive cases. Angle Orthod. 1999;69(3):257-63.
[6]. Baum AT. The midline diastema. J Oral Med. 1966;21(1):30-9.
[7]. Joneja P, Pal V, Tiwari M, Hazari P. Factors to be considered in treatment of midline diastema. Int J Curr Pharm Res. 2013;5(2):1-3.
[8]. Mauro F. Rehabilitation Esthetiques en prothese fixee: Analyse esthetique. 352 p. (Quintessence International; vol. 1). 2006
[9]. Erdemir U, Yildiz E. Esthetic and functional management of diastema : a multidisciplinary approach. Cham: Springer; 2015. 228 p.
[10]. Kamble A, Shah P, Velani PR, Jadhav G. Laser-assisted multidisciplinary approach for closure and prevention of relapse of midline diastema. Indian J Dent Res. 2017;28(4):461.
[11]. Culp L, Mc Lawen E, Swann L. Smile analysis - Converting digital designs to the final smile : Part 2. Journal of Cosmetic Dentistry. 2013;29(2):98-107.
[12]. Syda PM. Apports des outils numériques à l'analyse esthétique et à la réhabilitation du sourire [Internet]. Académie de Nancy – Metz université de Lorraine Faculté d'odontologie;2018. Disponible sur: http://docnum.univlorraine. fr/public/BUPHA_TD_2018_SYDA_PAUL_MARIE .pdf
[13]. Breton O, Leclercq P. Apport du numérique en orthodontie. EMC – Orthopédie Dentofaciale. 2021;33 (4) :1-8.
[14]. Devin R. La dentogénique - une conception actuelle de l'esthétique dentaire. Rev Fr Odontostomatol. 1961;53:7-63.
[15]. Gaillard C, Riera C. Le smile design : un outil pour la planification des traitements esthétiques et fonctionnels. Le fil dentaire. 2016;121: 40- 46.