Review article International Journal of Dental Materials 2024;6(2) ISSN:2582-2209

Veneers in Prosthodontics: A Comprehensive Review on Evolution, Techniques, and Advancements

N. Simhachalam Reddy[1], Divya Bekkem[2,*]

[1]Professor, Department of Prosthodontics, G Pullareddy Dental College and Hospital, Kurnool, Andhra Pradesh, India.
[2]Postgraduate Student, Department of Prosthodontics, G Pullareddy Dental College and Hospital, Kurnool, Andhra Pradesh, India.

Article History

Received *30th April 2024*

Accepted *27th July 2024*

Published *31st July 2024*

*Correspondence

Divya Bekkem

Postgraduate Student,
G Pullareddy Dental College and Hospital,
Kurnool, Andhra Pradesh, India.
E-mail: *divyaramireddy720@gmail.com*
DOI: *http://dx.doi.org/10.37983/IJDM.2024.6204*

Abstract

Esthetics in dentistry has become a primary motivation for patients seeking to enhance their smiles, driven by advancements in science and technology. Veneers offer a conservative technique to improve the appearance of teeth, allowing for modifications in shape, size, and colour. Originating from Dr. Charles Pincus's invention in 1928, veneers have significantly evolved, with milestones like Dr. Michael Buonocore's acid etching technique and modern porcelain bonding methods. The design and makeover of a smile encompass facial, dental, and gingival components, ensuring a harmonious and aesthetically pleasing result. Veneers are indicated for various dental issues, including discolouration, enamel cracks, and diastemas, but have contraindications like high caries rate and severe malposition. Recent advances have introduced new materials and techniques, such as lithium disilicate, e.max veneers, and prefabricated composite veneers, enhancing durability and aesthetic outcomes. This review underscores the importance of precise tooth preparation, impression-making, and bonding procedures in achieving successful veneer applications. With continuous innovations, veneers remain a pivotal element in esthetic dentistry, offering patients minimally invasive solutions for a radiant smile.

Keywords: Esthetics, Ceramics, Veeners.

1. Introduction

Esthetics is often the primary motivation for seeking dental treatment to enhance one's smile using advances in science and technology in esthetic dentistry [1]. Veneers have worked wonders for the victims of unaesthetic and discoloured teeth. Veneers provide the most conservative technique for improving appearance. These conservative treatments can modify the shape, size, and colour of the teeth to meet the patient's expectations [1,2].

Their conservative tooth preparation and non-invasive approach create remarkable smiles. Veneers are thin shells of porcelain that are internally etched and then bonded to the enamel of the teeth [2]. This ultra-thin resin–retained ceramics significantly reduces the periodontal and pulpal jeopardy often associated with crown procedures while offering an excellent aesthetic appearance [2].

2. History

The history of esthetic or cosmetic dentistry can be traced back to the Japanese custom of decorative tooth staining called 'Ohaguro', which was documented 4000 years ago [3]. Veneers were invented by California dentist Charles Pincus in 1928. In 1937, he developed acrylic veneers to be attached with denture adhesive, but only temporarily due to minimal adhesion [3]. In 1959, Dr. Michael Buonocore introduced the concept of the acid etching technique, which provided a simple method of increasing the adhesion to enamel surfaces [3]. Research in 1982 by Simonsen and Calamia revealed that porcelain could be etched with hydrofluoric acid to improve its retention [3]. In a study, Calamia described a technique for the fabrication and placement of etched bonded porcelain [3].

3. Smile design and makeover

The reconstruction of teeth for cosmetic and esthetic purposes is most noticeable when smiling. The design and makeover of a smile encompass three main components: facial, dental, and gingival [4-6].

3.1 Facial Component

Two important components of the face are the interpupillary line and the lips. A smile line refers to an imaginary line along the incisal edges of the maxillary anterior teeth, and it should mimic the curvature of the superior border of the lower lip while smiling [4-6]. The incisal line curvature is more pronounced in women than men [5]. A pleasing smile is achieved when the angles of the mouth are parallel to the inter-pupillary line and the occlusal plane, with the tips of the canines barely touching the lower lip. Smile symmetry refers to the relative symmetrical placement of the corners of the mouth in the vertical plane [4-6]. The facial midline or dental midline acts as the central point. Parallelism of lines must exist between the corners of the mouth or commissural line and the

occlusal plane [5,6]. Further facial components to consider are the patient's age, lip line, upper lip curvature, occlusal line and occlusal frontal plane [5,6].

3.2 Dental Component

The dental component includes the tooth component and the gingival component.

3.2.1 Tooth component:

The tooth component includes dental midline, incisal length, tooth dimensions, zenith point, axial inclinations, interdental contact area (ICA) and point (ICP), incisal embrasure, sex, personality and age, symmetry and balance [4-6]. The dental midline is an imaginary vertical line that separates the two central incisors, and it is considered important for achieving a symmetrical smile. Research on the Golden Proportion has shown that most beautiful smiles do not perfectly align with the golden proportion formula [4-6].

3.2.2 Gingival component [4-6]

The gingival component includes gingival health, gingival levels and harmony, interdental embrasure and smile line. The gingival component considers gingival morphology and gingival contour [4-6].

4. Diagnostic Considerations [7-10]

The diagnostic considerations include assessing the face, evaluating the smile, taking photographs, and using computer imaging.

5. Indications [8]

Veneers are indicated to address various dental problems, particularly for enhancing the appearance of anterior teeth. They are often used to address extreme discolouration caused by tetracycline staining, fluorosis, teeth darkened with age, and devitalized teeth. Additionally, veneers can be effective for covering enamel cracks and correcting diastema or multiple spacing between teeth. They are also utilized in the repair of sound metal-ceramic or all-ceramic crowns that have unsatisfactory colour, as well as for improving the appearance of peg laterals or rotated teeth.

6. Contra-indications [8-10]

Veneers have several contraindications that must be considered. These include teeth that are overly fluoridated, teeth that are still growing and may not etch efficiently, and tiny, slender crowns typically found on lower incisors. Teeth with insufficient enamel and young permanent teeth are also unsuitable for veneers. Further, patients with a high caries rate, severe parafunctional habits such as bruxism, severe tooth malposition, severe periodontal disease, and teeth with limited interocclusal distance are not ideal candidates. Additionally, anterior teeth with a deep vertical overlap and any other conditions that impair the proper placement of laminate veneers should be considered.

7. Classification

Veneers can be classified based on material, preparation technique, application, and permanence. Based on materials, they are divided into porcelain veneers, known for their durability and natural appearance, and composite veneers, which are less expensive and can be applied in a single visit but may not last as long. Preparation technique classifications include traditional veneers, which require some removal of tooth structure, and no-prep veneers, which require minimal to no removal of tooth structure, preserving more of the natural tooth. Based on applications, there are direct veneers, made of composite resin and applied directly to the teeth in the dentist's office, and indirect veneers, fabricated in a dental laboratory from porcelain or composite [10,11].

7.1 Direct Veneers [10,11]

Direct veneers, also known as composite veneers, are a type of dental veneer made from composite resin. They are applied directly to the teeth by the dentist in a single visit, making them a quick and cost-effective solution for improving the appearance of teeth. Direct veneers are ideal for minor cosmetic corrections, such as closing small gaps, repairing chips, or improving discoloration. While they are less durable than porcelain veneers and may not last as long, they can be easily repaired and require less removal of the natural tooth structure [10,11]. However, composite veneers are more prone to discolouration and deterioration.

7.2 Indirect Veneers

Indirect veneers are dental veneers fabricated outside the mouth, usually in a dental laboratory, and then bonded to the teeth. They are typically made from more durable materials such as porcelain or composite resin, providing a longer-lasting and more natural-looking solution compared to direct veneers.

7.2.1 Conventional powder-slurry ceramic (feldspathic porcelain)

This type of porcelain is layered on the refractory die by the lab technician. Feldspathic veneers are fabricated by layering glass-based (silicon dioxide) powder and liquid materials. Feldspathic porcelain can be etched with hydrofluoric acid, which provides better adhesion to the remaining enamel [11-13].

7.2.2 Heat-pressed ceramics

Heat-pressed ceramic veneers are made by the lost wax technique, are melted at high temperatures and pressed into a mold (e.g. IPS Empress 1 and 2, OPC). Glass ceramics could be an excellent choice for anterior restorations. They have improved physicomechanical qualities such as fracture and erosion resistance [11-14].

7.2.3 Machineable (CAD/CAM) ceramics (e.g. CEREC)

Computer-aided design/computer-assessed manufacturing (CAD/CAM) makes veneer construction easier. Partially sintered ceramic (zirconia), glass-bonded ceramic ('Vitablock'), or glass-ceramic ('IPS e.max' lithium disilicate) moulded into machinable blocks are used in recent breakthroughs in dental CAD-CAM technology [11-13].

8. Tooth preparation

8.1 Preparation of incisal edge

The incisal edge can be prepared in three ways: window or inter-enamel preparation, by giving an incisal bevel of 0.5–1 mm, or by overlapping the incisal edge 2-4 mm. Castelnuovo *et al.* [9] reported that the elimination of the

palatal chamfer for Ceramic veneers with incisal butt joints resulted in stronger restorations and simplified tooth preparation.

8.1.1 Window or inter-enamel preparation

Window or inter-enamel preparation is indicated for cases requiring minimal tooth preparation, particularly for teeth suffering from stains or discoloration without the need for crown length correction. This conservative approach preserves the majority of the natural tooth structure while effectively addressing aesthetic concerns.

The technique involves the preparation of the labial or facial tooth surface, and the incisal portion is just prepared from the facial surface. No preparation at all is done at the incisal edge and palatal surface. However, a decreased retention and weakened incisal portion of ceramic laminate veneers is the major drawback with this.

8.1.2 Incisal bevel 0.5–1 mm

Various studies revealed that the incisal bevel of 0.5–1 mm will result in nearly a butt joint and the palatal reduction of incisal edge will make a chamfer finishing line [11,12]. This technique offers several advantages, including increased strength of the veneer in this area and an easy preparation process. It is particularly indicated for cases involving multiple ceramic laminate veneers.

8.1.3 Edge-lapped or the overlapped incisal edge preparation

The wrap around or incisal overlap preparation places the porcelain under compression thus gives better result as it withstands compression more than tension.

8.2 Labial surface reduction

Since the labial surface is the most aesthetically significant part of ceramic laminate veneers, precise preparation depth is crucial and can be attained through various methods [11,12].

8.2.1 Free-hand Technique

This method relies solely on tactile sensation and does not use depth orientation grooves. It is not recommended for beginner dentists due to the risk of overcutting or achieving uneven reduction levels on the labial tooth surface.

8.2.2 Use of depth cuts/grooves

The use of depth cutters or grooves and dimples has been recommended to control tooth preparation, as the use of standardized objects allows accurate judgment of depth.

8.2.3 Use of silicone putty index [11-13]

The key to success in tooth preparation is the placement of the cutting instrument in two to three different planes along the convex labial surface. The recommended depth for a minimally invasive approach is 0.5 mm. Minimally invasive preparation for Porcelain laminate veneers is highly conservative treatment and is indicated for small corrections of the incisal edge, dental fractures, conoid teeth, and diastemas [7,11,13]. Labial reduction requires 0.1 mm reduction at the cervical third, 0.2–0.5 mm reduction in the middle third, and 0.7–1.0 mm reduction in the incisal third [11,13].

8.3 Preparation of interproximal surface

Preparation may include any of the designs, including virtually no preparation, preparation that stops just short of the interproximal contact, and a slight opening of the interproximal contact. Breaking the contact (sometimes called the “slice preparation”) may be necessary to clear the contact in certain situations, such as changing the shape or position of teeth and in the case of multiple veneers [11,13].

8.4 Cervical margin

The finishing line may be at one of three locations: supra-gingival, gingival or sub-gingival. The desired position for the finish line of the veneer is just within the confines of the gingival sulcus [11,13]. The chamfer finish line is more accepted and will be more beneficial for ceramic technicians to determine where to build and construct the porcelain laminate veneers [11,13].

If the tooth preparation is more conservative and confined to enamel, the bond strength between recent resin cements and enamel would be better than with dentin. The preparation for ceramic veneers should be made meticulously to maintain the preparation completely in enamel [7, 11, 13].

9. Impression making

Elastomeric impression materials are ideal for making the impression to capture the precise shape and contours of the prepared teeth [10].

10. Provisional Restorative materials [14]

Preformed polymethyl methacrylate shells and Composite resin [14] are widely used materials for the fabrication of provisional restorations.

10.1 Try-in of veneers

Place the veneers on colour-contrast surfaces such as dark paper napkins. The veneers are fragile and should be handled carefully, preferably with the finger. Inspect the veneer for any cracks and imperfections on the model to have an appropriate fit. Then, remove the provisional with a hemostat, a composite is used for luting of provisional, and pumice the surface to obtain a smoother surface [11]. Moisten the teeth and the internal surface of the porcelain veneers with water, then place the veneers on the teeth to evaluate their fit and colour. Make any necessary adjustments using a fine diamond bur and verify the fit. Some slight staining modifications can be made chairside, as further firing of the porcelain is not possible. There are several staining kits available, mainly consisting of lightly filled resins that include various colours.

10.2 Bonding procedure

The ceramic veneer technique involves bonding a thin porcelain laminate to the tooth surface, including enamel and/or dentin, using adhesive techniques. These techniques encompass chemical attachment, such as light-activated composite cements and coupling agents, and micromechanical attachment, such as acid etching, as well as combined attachments. Luting cements used in this process can be classified into two subgroups: cements associated with conventional or self-etching adhesives, and self-adhesive cements, which do not require any prior conditioning of the tooth structure [15-17].

10.3 Tooth surface preparation to receive veneer [15-17]

Clean the dental surfaces with a rubber cup mounted on a counter angle [15-17]. Etch the dental substrates with orthophosphoric acid for 20 seconds, followed by rinsing thoroughly for one minute, and dry moderately. Apply adhesion promoter to all prepared tooth surfaces. The shear bond strength was the lowest on dentin. Therefore, bonding of the porcelain laminate veneer restoration to only dentine should be avoided [18].

11. Recent advances

11.1 e.max veneers

Lithium disilicate ($2SiO_2 \cdot Li_2O$), first introduced in 1988, has evolved from a heat-pressed core material known as IPS Empress 2 (Ivoclar Vivadent, Liechtenstein) to IPS e.max CAD, which was developed in 2006. In its partially crystallized form, e.max CAD contains 40% lithium metasilicate crystals, whereas, in its fully crystallized form, it is primarily composed of 70% fine-grain lithium disilicate crystals [19-21].

11.2 Lumineers

Lumineers consist of a thin shell-like porcelain material, custom-made for patients, and applied to the tooth surface with the help of a permanent bonding agent [19,20].

11.3 Da Vinci veneers

Da Vinci veneers were introduced by Dr. Joel. D. Gould in 2008 at the Da Vinci laboratory in California [19,20]. They are ultrathin shells of tooth-coloured ceramics whose thickness ranges between 0.2 and 0.3 mm [19,20]. They resist staining and mimic the natural appearance of the tooth. These veneers require little or no anaesthesia and a minimum tooth.

11.4 Durathin veneers

Durathin veneers are as thin as a fingernail, measuring 0.3 mm, while traditional veneers have a thickness of approximately 0.5 mm [19,20].

11.5 MAC veneers

The Micro Dental laboratory in Dublin introduced MAC (Micro Advanced Cosmetic division) veneers in 2005. Made from pressed ceramics, these veneers are sturdier and thicker (0.8-1 mm) than conventional porcelain veneers. They are designed to fit precisely and securely onto the tooth surface [19,20].

11.6 Pre-fabricated composite veneers

The concept of prefabricated composite veneers was formally introduced in the late 1970s with the Mastique Veneer System by Caulk Dentsply. However, it achieved limited success because the large glass filler technology available at the time did not offer sufficient aesthetics or durability [19,20].

11.7 Edelweiss veneers

Introduced in 2018, the Edelweiss Veneer was the first of the "new generation" of prefabricated veneers [19,20]. These veneers can be bonded to the tooth structure like a direct composite restoration, without the need for sandblasting, acid etching, post-etching cleaning, or silane application.

11.8 Componeers

Componeer (Coltene, Altstätten, Switzerland) are thin composite resin shells, measuring 0.3 mm cervically and 0.6–1.0 mm at the incisal edge, that are prefabricated [19-20,22]. These veneers are made from a prepolymerized hybrid composite resin called Synergy D6 (Coltene). They can be cemented using the same hybrid composite resin from which they are made, potentially creating a monoblock unit for the restoration [20,22].

12. Conclusion

The evolution of veneers has significantly transformed esthetic dentistry, offering conservative solutions for enhancing dental aesthetics. Veneers, particularly porcelain laminates, provide a minimally invasive approach to improving the appearance of teeth, allowing for modifications in shape, size, and colour while preserving natural tooth structure. The historical advancements in bonding techniques and materials, such as the introduction of acid etching and the development of various types of veneers, have greatly enhanced their effectiveness and durability. The integration of facial, dental, and gingival components in smile design ensures a comprehensive and harmonious outcome. With ongoing innovations, including the advent of new materials like lithium disilicate and prefabricated options like Edelweiss veneers, the future of veneer applications looks promising, offering even more refined and durable solutions for patients seeking esthetic dental treatments.

Conflicts of interest: Authors declared no conflicts of interest.

Financial support: None

References

1. Guzman-Perez G, Jurado CA, Azpiazu-Flores F, Afrashtehfar KI, Tsujimoto A. Minimally invasive laminate veneer therapy for maxillary central incisors. Medicina. 2023;59(3):603. https://doi.org/10.3390/medicina59030603
2. Sailo JL, Bathla N, Thakur P, Nagpal A, Gupta R, Duvedi K. Porcelain veneers vs composite resin veneers: a review. J Adv Med Med Res. 2020;32(24):316-26. https://doi.org/10.9734/jammr/2020/v32i2430784
3. Rashid R, Ayoub WU. Veneers: Modern approach of dentistry-a review. International Journal of Advance Research, Ideas and Innovations in Technology. 2017;3(5):107-11.
4. Alikhasi M, Yousefi P, Afrashtehfar KI. Smile Design: Mechanical Considerations. Dent Clin North Am. 2022;66(3):477-487. https://doi.org/10.1016/j.cden.2022.02.008
5. Alhazzani E A, Al-dakheel M D, Aldossary M S, Smile design and porcelain laminate veneers: Clinical aspects and considerations. Int J Oral Health Dent. 2017;3(4):206-209
6. Alikhasi M, Yousefi P, Afrashtehfar KI. Smile design: Mechanical considerations. Dent Clin. 2022;66(3):477-87. https://doi.org/10.1016/j.cden.2022.02.008
7. Noorsaeed AS, Matrood MA, Almutairi MS, Alqarni AN, Alothman KJ, Alshareef AH, Almutairi SM, Alhejazi MA, Alshehri KA. Overview on Dental Veneer Placement. J Pharm Res Int. 2021;33(64A):494-501. https://doi.org/10.9734/jpri/2021/v33i64A35812
8. Sowmya S, Sunitha S, Dhakshaini MR, Raghavendraswamy KN. Esthetics with veneers: a review. Int J Den Health Concerns. 2015;1(1):1-5. https://doi.org/10.15713/ins.ijdhc.11

9. Alothman Y, Bamasoud MS. The Success of Dental Veneers According To Preparation Design and Material Type. Open Access Maced J Med Sci. 2018 Dec 14;6(12):2402-2408. https://doi.org/10.3889/oamjms.2018.353
10. Mitthra S, Anuradha B, Pia JC, Subbiya A. Veneers– Diagnostic and Clinical Considerations: A Review. Ind J Public Health Res Develop. 2019;10(12): 2143-2148. https://doi.org/10.37506/v10/i12/2019/ijphrd/192316
11. Salah A Yousief., et al. Types of Veneers in Dental World. EC Dental Science 19.2 (2020): 01-06.
12. da Cunha LF, Reis R, Santana L, Romanini JC, Carvalho RM, Furuse AY. Ceramic veneers with minimum preparation. Eur J Dent. 2013;7(4):492-496. https://doi.org/10.4103/1305-7456.120645
13. Jwalithaclare M, Arunachalam S, Sneha G, Mondal S. Veneers: A Perfect Solution to Imperfect Teeth. Uni J Dent Sci. 2024;10(1):82-87. https://doi.org/10.21276/ujds.2024.10.1.17
14. Atria PJ, Lagos I, Sampaio CS. In vitro evaluation of surface roughness, color stability, and color masking of provisional restoration materials for veneers and crowns. Int J Comput Dent. 2020;23(4):343-350.
15. Pini NP, Aguiar FH, Lima DA, Lovadino JR, Terada RS, Pascotto RC. Advances in dental veneers: materials, applications, and techniques. Clin Cosmet Investig Dent. 2012;4:9-16. https://doi.org/10.2147/CCIDE.S7837
16. Ultrafinos L, del Arte Actualizado UE. Ultra-Thin Veneers: A Current State-of-the-Art. Int. J. Odontostomat. 2021;15(4):898-903. https://doi.org/10.4067/S0718-381X2021000400898
17. Peumans M, Van Meerbeek B, Lambrechts P, Vanherle G. Porcelain veneers: a review of the literature. J Dent. 2000;28(3):163-77. https://doi.org/10.1016/S0300-5712(99)00066-4
18. Öztürk E, Bolay Ş, Hickel R, Ilie N. Shear bond strength of porcelain laminate veneers to enamel, dentine and enamel-dentine complex bonded with different adhesive luting systems. J Dent. 2013;41(2):97-105. https://doi.org/10.1016/j.jdent.2012.04.005
19. Elanthendral S. Recent advances in the material aspects of veneers. Euro J Mol Clin Med. 2020;7(03):2079-2085.
20. Gaonkar AV, Gopeshetti P, Pujar M, Sahana U, Chowdary A. Advances in dental veneers: a review. Ind J Appl Res. 2023;13(4):36-38. https://doi.org/10.36106/ijar/9512517
21. Hasan NH, Malallah A, Hazim M. Marginal chipping factor in machinable zirconia and lithium disilicate ceramic veneer restorations. Int J Dent Mater. 2024;6(1):1-5. https://doi.org/10.37983/IJDM.2024.6101
22. Irmaleny I, Hidayat OT, Handayani RA. Componeer as an aesthetic treatment option for anterior teeth: a case report. BMC Oral Health. 2024;24(1):367. https://doi.org/10.1186/s12903-024-04081-4

How to cite this article: Reddy NS, Bekkem D. Veneers in Prosthodontics: A Comprehensive Review on Evolution, Techniques, and Advancements. Int J Dent Mater. 2024;6(2):45-49. DOI:*http://dx.doi.org/10.37983/IJDM.2024.6204*