



Review

Composite Resin Veneers: Current Techniques and Long-Term Clinical Success

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Abstract

With increasing aesthetic demands and the growing emphasis on minimally invasive approaches, composite resin veneers applied in the anterior region have gained significant importance in esthetic dentistry. This review examines current application techniques and the long-term clinical success of direct and prefabricated composite resin veneers. While direct composite veneers offer advantages such as single-session application, low cost, and reparability, they are highly operator-dependent. Therefore, various auxiliary materials such as transparent templates, the injection molding system, and prefabricated composite veneers have been developed to facilitate their use. Prefabricated composite veneers are polymerized under high pressure, heat, and light in laboratory conditions, providing superior surface properties and standardized restorations. However, they present limitations such as adaptation issues in the cervical and proximal areas and lack of layering capability. While ceramic veneers have better-documented long-term clinical success exceeding 10 years, long-term data for composite veneers are limited. Nevertheless, well-planned direct composite applications have shown high success rates in 3 to 5 years follow-ups. Additionally, the reparability of composite restorations provides biological and economic advantages. This review summarizes the latest developments in composite veneer applications and comprehensively evaluates the available long-term data.

Öz

Artan estetik beklentiler ve minimal invaziv yaklaşımların önem kazanmasıyla birlikte, anterior bölgede uygulanan kompozit rezin venederler estetik diş hekimliğinde önemli bir yer edinmiştir. Bu derlemede, direkt ve prefabrik kompozit rezin venederlerin güncel uygulama teknikleri ile uzun dönem klinik başarıları incelenmiştir. Direkt kompozit venederler tek seansta uygulanabilmeleri, düşük maliyetleri ve onarılabilir olmaları nedeniyle avantaj sağlarken, uygulayıcı bağımlılığı yüksek bir tekniktir. Bu nedenle uygulamayı kolaylaştırmak amacıyla şeffaf şablonlar, injection molding sistemi ve prefabrik kompozit venederler gibi çeşitli yardımcı materyaller geliştirilmiştir. Prefabrik kompozit venederler, laboratuvar ortamında yüksek basınç, ısı ve ışık altında polimerize edildikleri için yüzey özellikleri bakımından daha üstün ve standart formda restorasyonlar sunmaktadır. Ancak servikal ve aproksimal bölgelerde adaptasyon sorunları ile tabakalama yapılamaması gibi bazı sınırlılıkları da mevcuttur. Literatürde seramik venederlerin 10 yıl üzeri klinik başarıları daha iyi belgelenmişken, kompozit venederler için uzun dönem veriler daha sınırlıdır. Yine de iyi planlanmış direkt kompozit uygulamaların 3-5 yıllık takiplerde yüksek başarı oranlarına ulaşabildiği bildirilmektedir. Ayrıca kompozit restorasyonların onarılabilir olması, biyolojik ve ekonomik açıdan avantaj sağlamaktadır. Bu derleme, kompozit venederlerin klinik uygulamalarındaki güncel gelişmeleri özetlemekte ve uzun dönem başarılarına dair mevcut verileri kapsamlı şekilde değerlendirmektedir.



Introduction

With rising esthetic expectations and the influence of social media, esthetic dentistry has gained significant improvement. Especially in the anterior region, esthetic demands have made it necessary to meet patients' expectations not only from an esthetic and functional perspective but also from a psychosocial standpoint (1,2). As a result, minimally invasive dentistry—aiming for results with minimal tissue loss—has gained importance. This approach contributes to both preventive dentistry and esthetic harmony, especially in the anterior region (3,4).

In traditional dentistry, there are two main approaches: direct and indirect. Indirect techniques involve multi-appointment procedures using ceramic materials. Ceramic materials have been considered the gold standard in esthetic dentistry for many years. These materials exhibit superior properties in biocompatibility, color stability, translucency, and surface gloss. Ceramic restorations are frequently preferred in smile design cases, particularly when the color and form of multiple teeth need to be altered (5,6). However, despite their superior esthetic properties, ceramic materials also have certain limitations. They may require significant tooth reduction and have a brittle nature, necessitating careful case selection. Also, due to their high cost, they may not be suitable for all patients (6).

In such cases, composite resins offer a lower-cost alternative. Direct techniques can be performed in a single session, often with no or minimal preparation. This method is particularly favored for younger patients or esthetic issues involving a limited number of teeth. Today's advanced composite resins offer color harmony, gloss, reparability, and cost-effectiveness, making them a viable alternative to ceramics. In terms of esthetics, results comparable to those of ceramic materials can be achieved (7,8).

Today, restorations performed using the direct technique are no longer considered a temporary solution. The introduction of microhybrid and nanohybrid composites has improved long-term outcomes, making it possible to achieve both esthetic and minimally invasive goals (9).

Method

This study is a narrative review. A literature search was conducted in PubMed/MEDLINE, Scopus, and Web of Science for the period 2010–2025 using the keywords “composite veneer”, “direct resin composite veneer”, “prefabricated composite veneer”, “injection molding”, “porcelain laminate veneer”, and “CAD/CAM composite veneer”, along with their Boolean combinations. Inclusion criteria comprised clinical studies involving humans, systematic reviews, narrative reviews, and in-vitro studies that directly contributed to the topic, published in peer-reviewed journals in English or Turkish. Exclusion criteria were letters/commentaries, animal studies, and out-of-scope publications. Eligibility was assessed at the title–abstract and full-text levels, and core findings were synthesized under thematic headings. Foundational/classic references were included outside the date range where necessary to provide context. As this is a narrative review, no formal risk-of-bias assessment was performed; methodological quality was considered narratively (study design, sample, follow-up duration, and outcome measures).

We abstracted color stability, marginal adaptation, biological (gingival) adaptation, surface gloss/polish retention, marginal discoloration, anatomic form, retention/fracture, and need for repair/maintenance. Whenever possible, outcomes were mapped to modified USPHS/Ryge (Alpha/Bravo = success; Charlie/Delta = failure) or FDI criteria (1–3 acceptable; ≥ 4 failure) and extracted at reported time-points. Minor maintenance (e.g., polishing/refurbishment) was not considered failure; replacement indicated failure in the evaluated articles.

Evolution of Anterior Composite Resin Restorations

Esthetic dental restorations initially emerged with the development of porcelain veneers. However, advancements in composite resin materials have enabled a shift toward more conservative approaches. Anterior prosthetic restorations were first performed in the 1930s to enhance the appearance of film actors. However, the materials used during that time lacked adequate adhesive properties, limiting their long-term success (10). In the 1970s, with the development of adhesive agents, both composite and ceramic restorations could chemically bond to the tooth surface, laying the foundation for direct composite resin treatments (11). In the 1990s, composite resins saw substantial improvements in physical, chemical, and optical properties. With the introduction of microhybrid and nanohybrid composites, these materials became commonly used for anterior esthetic restorations (12). Using layering techniques, different optical and physical properties of enamel and dentin can be mimicked to create natural-looking results (13).

The clinical success of composite resin restorations depends not only on material properties but also on the clinician's anatomical knowledge and manual skills. In the anterior region, achieving a symmetrical and natural appearance requires high dexterity (4).

Due to the operator-dependent nature of composite applications, techniques and materials that simplify the procedure have been developed. One notable development is the semi-direct technique using prefabricated composite resin veneers (14).

These prefabricated veneers are produced from nanohybrid composites polymerized under heat, light, and pressure (15,16). Compared to conventional composites, they demonstrate higher degrees of polymerization, increased surface hardness, and greater color stability (17). Available in various sizes and shades, they facilitate selection and provide standardization. Products like Edelweiss (Edelweiss Dentistry, Austria) and Compoener (Coltène, Switzerland) are designed to be directly bonded to the tooth surface, enabling esthetic results in a single visit (15,16). A major advantage of these systems is that they reduce dependency on clinician skill, thanks to their preformed shape, contour, and surface finish. Therefore, they can be especially beneficial for less experienced practitioners seeking to achieve symmetrical results (18). Nevertheless, some disadvantages exist. Adaptation may be difficult in the cervical and proximal areas. Moreover, as per manufacturer instructions, in most cases only a single composite layer should be used, which limits layering options and complicates color transitions in esthetically demanding cases (19).

Besides prefabricated veneers, other tools have been developed to support direct techniques. U-Veneer (Ultradent, South Jordan, Utah, USA) and I-Veneer (IVENEER, Israel) are examples of preformed transparent templates in various sizes. U-Veneer is used with conventional composites, while I-Veneer can also be used with flowable resins. These allow for quick and symmetrical esthetic results. However, adaptation in the proximal and cervical areas still requires care (20).

Computer-aided design and manufacturing (CAD/CAM) systems have played a significant role in the evolution of anterior restorations in conjunction with composite resin blocks. Milled composite resin blocks stand out due to their high precision, surface quality, and marginal adaptation, even in ultrathin veneer applications (21). These blocks feature polymer-ceramic hybrid structures with a high ceramic filler content (approximately 75–86%), offering superior mechanical properties compared to conventional direct composite resins (22). Three-year randomized clinical trials have shown that ultrathin CAD/CAM composite resin veneers provide both functional and esthetic validity in cases of severe erosion; for instance, durable outcomes have been reported even in posterior ultrathin veneer applications (23). These findings support indirectly the use of CAD/CAM systems in anterior composite resin restorations through minimally invasive approaches. Furthermore, a prospective cohort study published in 2024 reported a 91% survival rate and an 87% success rate at 28 months for indirect restorations fabricated with Lava Ultimate or similar composite blocks and placed by dental students (24). These results indicate that CAD/CAM composite restorations are sustainable in both academic and clinical settings. CAD/CAM composites also offer chairside repairability when needed, lower brittleness, and high fracture resistance, while enabling case-specific customization through digital preview and shade management (21-24).

Another system, the injection molding technique, uses only flowable composite resin and involves two appointments. In the first session, impressions are taken, and restorations are planned on models in the lab. A transparent silicone index is fabricated and used in the second session to guide intraoral placement of heated microhybrid or flowable composite resins. This index was applied to the patient's mouth, and flowable composite was injected through the holes on the incisal surface of the index. This index can improve the esthetic result, enabling a more accurate morphology to be obtained. This reduces operator dependency significantly but requires accurate lab work. The injection molding technique with injectable composite resin can be indicated in a number of situations such as emergency repair of fractured teeth and restorations; modification and repair of prototypes and provisional restorations; composite restorations, especially class IV restorations and veneers; pediatric composite crowns; resurfacing of occlusal wear on posterior teeth; incisal edge length determination prior to esthetic crown lengthening; orthodontic space management; fabrication of an implant-supported composite provisional restoration; and repair of fractured or missing teeth (25).

As a result, new-generation composite resins, prefabricated veneers, and auxiliary tools have expanded the possibilities for faster, minimally invasive, and cost-effective esthetic treatments (26). These developments have positioned composite resins not just as temporary solutions but as a valid, economical alternative to ceramics when used with proper indications (2).

Long-Term Outcomes of Composite Resin Veneers

The clinical success of veneer restorations depends on the material used, application technique, clinician experience, and patient-related factors (27-29). While each material has its own strengths and limitations, ceramic veneers are known for superior long-term performance. Feldspathic and lithium disilicate porcelains can maintain esthetic and functional stability for over a decade, thanks to their strong enamel adhesion and biocompatibility. The long-term success of porcelain veneers depends mostly on the tooth preparation which should be preferably confined to enamel (6,27,28). In a 10-year clinical study by Peumans et al. (30), ceramic veneers showed success rates of 92% at 5 years and 64% at 10 years. Beier et al. (31) reported success rates over 82% even after 20 years. In a widely cited systematic review by Demarco et al. (2), the annual failure rates for anterior composite restorations, including veneers, were found to range between 0–4.1%, depending on case selection, patient factors, and operator experience.

If we summarize the long-term failure causes for both materials, we can say that the main failure, cause for ceramic veneers was fracture of the material (5), while for resin composite veneers, the main failure reasons were fracture, surface roughness, gloss loss, marginal discolorations, and chippings (6, 32).

Composite resin-based veneers, in contrast, have limited long-term data. However, clinical studies in the last decade report good 3- to 5-year performance in well-executed cases (2,9). Gresnigt et al. (32) showed survival rates of 81.2–93.8% over 3.5 years using two types of microhybrid composites.

Color stability and surface gloss are key factors for long-term esthetic success. Ceramics, being glass-like, resist staining. Composite resins, due to their organic matrix, are more prone to discoloration from dietary factors (7,13). To preserve the success of composite resin restorations, regular follow-ups and polishing are essential, as marginal adaptation, gloss, and color stability can deteriorate over time (13).

For prefabricated composite veneers, long-term clinical data are scarce. Most studies are limited to 1–2-year follow-ups, which suggest favorable short-term performance (18,19). Direct veneers may be preferred by experienced clinicians for greater flexibility, while prefabricated systems offer easier application for beginners (20). Clinical data on prefabricated composite resin veneer systems remain limited. An *in vivo* comparative study by Dua et al. (19) demonstrated that after a 12-month follow-up, there were no statistically significant differences between Composite resin veneers and direct composite resin veneers in terms of color stability, surface texture, marginal integrity, and gingival compatibility.

Nanohybrid and microhybrid composites, with smaller filler particles and higher filler content, allow better polishability and long-lasting gloss. However, staining may still occur in patients with poor hygiene or high consumption of tea, coffee, or tobacco (17,18).

Although manufacturers state that prefabricated veneers do not require polishing, studies show that surface gloss can decrease over time. Fine polishing is therefore recommended during placement and follow-up (18,19).

Polishing in composite resin restorations is not just for esthetics, it also helps to reduce biofilm formation, which supports long-term success. Regular maintenance and proper material selection are essential for longevity (13,17).

Another long-term complication that may arise in esthetic restorations is the need for replacement. Repairability aligns with the principles of minimally invasive dentistry and offers both biological and financial advantages (2-4). Fractures and marginal defects that occur in ceramic restorations are often difficult to repair, and in most cases, complete replacement of the restoration is required. (31).

Unlike ceramic restorations, which are difficult to repair, composite resin restorations are repairable. The total replacement of a resin composite veneer is very rare. These veneers can be easily repaired with a minimally invasive approach like re-polishing or refurbishment, thus providing longer durability and conservation of tooth structures (32- 34). Surface roughening using acid etching, sandblasting, or rotary instruments followed by adhesive bonding allows extension of restoration life (20). Similarly, prefabricated veneers can be repaired by polishing or resurfacing damaged areas with composite resin. However, marginal adaptation issues may still necessitate full replacement (18,19). In dental practice, the ability to repair restorations, one of the principles of minimally invasive dentistry, constitutes a more conservative approach from both economic and biological perspectives (2–4).

Prefabricated and direct composite resin veneers can be rapidly repaired in the clinic in cases of fracture or discoloration, which constitutes a major advantage over ceramic systems (35).

This review aimed to evaluate the current techniques and long-term clinical success of composite resin veneers. However, certain limitations in the existing literature also impact on the scope of this review. First, there is a lack of well-designed, adequately powered randomized clinical trials specifically focused on prefabricated and semi-direct composite resin veneers, and head-to-head comparisons with direct freehand composites and indirect CAD/CAM composite veneers remain scarce. Most of the available data is based on short-term follow-ups and case reports. Additionally, heterogeneity in brands, resin chemistry, filler systems, and finishing/polishing protocols makes direct comparisons difficult.

It was also not feasible to include every technique and material system in detail within this review. For example, while we summarized the role of CAD/CAM-manufactured composite blocks in anterior restorations, future work should clarify minimal thickness thresholds, marginal adaptation in ultrathin veneers, and aging behavior of resin–ceramic hybrids relative to lithium disilicate. Likewise, developments in biomaterials including high-filler nanohybrids, pre-polymerized blocks, fiber-reinforced or bioactive/ion-releasing matrices, and stain-resistant resin chemistries warrant clinical translation with standardized outcomes.

Future studies should therefore prioritize multicenter RCTs that standardize substrate (enamel-confined vs dentin-exposed), adhesive strategy (etch-and-rinse vs self-etch/universal), finishing systems, and maintenance intervals; report outcomes with modified USPHS/Ryge or FDI criteria and clear success/failure thresholds; and include time-to-event survival with ≥ 5 –10-year follow-up. In parallel, there is a clear need for long-term patient-reported outcomes which are esthetic satisfaction, oral-health-related quality of life, hypersensitivity, phonetics, and satisfaction with repair vs replacement to complement clinical endpoints. Pragmatic trials that evaluate digital workflows (Digital smile design guided planning, 3D-printed indices, injection molding vs template-assisted

layering, AI-assisted shade/morphology matching) for effects on operator dependency, chair time, reproducibility, and costs will better inform real-world decision-making. Finally, adopting a core outcome set and consistent reporting of brand/composition, shade, finishing system, and operator experience will enhance comparability, reproducibility, and the overall quality of evidence on composite resin veneers.

Conclusion

The esthetic rehabilitation of the anterior region today involves a multidisciplinary process that extends beyond material selection. Factors such as patient expectations, oral hygiene, diet, smoking habits, parafunctional behaviors, economic situation, and the clinician's technical competence all play critical roles.

Ceramic restorations are considered the gold standard in suitable cases due to their superior esthetic properties and proven long-term clinical success. However, their invasive nature and high cost can limit their applicability for some patients.

Composite resin restorations, on the other hand, offer advantages such as affordability, repairability, minimal invasiveness, and single-session application. Although direct composite resin restorations may be more technique-sensitive and clinician-dependent, recently developed techniques and auxiliary tools have significantly mitigated these limitations. A concise comparison of indications, advantages, disadvantages, and practical notes for the four principal veneer workflows were prepared (Table 1).

Table 1. Comparative overview of anterior veneer techniques.

Technique	Typical indications	Advantages	Disadvantages / Risks	Notes / Clinical pearls
Direct composite (freehand)	1–6 anterior teeth, diastema closure, minor shape/edge corrections, young pts	One-visit, minimally invasive/no-prep, lowest cost, fully repairable, shade/morphology highly customizable	Operator-dependent; learning curve; potential for gloss/colour stability loss; chair time may increase in multi-tooth cases	Use calibrated layering + finishing/polishing; schedule maintenance (polish/refurbish) to sustain gloss/ ΔE
Prefabricated (semi-direct) veneers	Symmetry/harmony in multiple teeth with time constraints; less experienced operators	One-visit; pre-shaped contour & surface finish; reduces technique sensitivity; predictable symmetry	Cervical/proximal adaptation can be challenging; limited layering & shade transition; finishing corrections may be needed	Try-in multiple sizes; refine margins gently; consider selective polishing despite manufacturer claims
CAD/CAM composite veneers (indirect)	Ultrathin restorations, erosion/wear; need for predictable fit & marginal quality	Excellent marginal adaptation & precision; pre-polymerized blocks, improved wear/colour stability vs chairside composites; repairable	Lab/scan/milling cost; adhesive steps technique-sensitive; thickness constraints; requires equipment or lab	Clarify minimal thickness; sandblast/prime intaglio per manufacturer; polish & glaze protocols standardize
Injection molding (index-guided composite)	Full-arch add-on, rapid morphology transfer, prototype-to-final translation	Highly reproducible contours; reduced operator variability; efficient for multiple teeth	Lab step (index) required; proximal/cervical cleanup; flowables may show higher wear/staining if not over-built & polished	Use high-viscosity composite where possible; meticulous isolation; post-cure & thorough finishing

Based on the current studies and systematic reviews discussed in this article, it is evident that both composite and ceramic restorations can achieve successful long-term outcomes when applied with appropriate indications and protocols. In clinical practice, the chosen treatment should not only meet esthetic and functional demands but also prioritize biological and economic considerations for the greatest overall benefit to the patient.

Declarations

Ethics Committee Permission Statement

Ethics committee approval was not required for this study, as no human or animal subjects were involved. The ethical principles of scientific research and publication were followed throughout the study.

Conflict of Interest Statement

The author declares no conflict of interest.

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Authors Contribution Statement

Hakan Bilen: The author contributed to conceptualisation, methodology, data analysis, writing, review, and editing of the manuscript.

Lezize Şebnem Türkün: The author contributed to conceptualisation, methodology, data analysis, writing, review, and editing of the manuscript.

The authors approved the final version of the manuscript.

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