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CLINICAL ARTICLE

# Is There Space for Resin Composite Restorations in a World of CAD-CAM and Digital Dentistry? Two-Year Follow-Up of Clinical Outcomes Using the Direct–Indirect Technique

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## ABSTRACT

**Objective:** This clinical report seeks to elucidate the versatility and mid-term outcomes of the direct–indirect technique. It presents a comprehensive step-by-step protocol for restoring anterior dentition across various clinical scenarios in accordance with the principles of the polychromatic layering technique.

**Clinical Considerations:** This clinical report was divided into two phases. First, an urgent procedure due to the debonding of an interim restoration in tooth #10 was followed by crafting a direct–indirect veneer. Then, in the six-month follow-up appointment, a complete esthetic improvement in the anterior dentition (teeth #8, #9) with two techniques and different materials for each tooth was observed: In tooth #8, a direct incisal edge augmentation was performed, while in tooth #9, a thin contact lens-type direct–indirect fragment was created to improve the form of the tooth. The restorations were followed up for a 24-month mean, with the following criteria: Color, wear, adaptation, marginal discoloration, and integrity.

**Conclusions:** The direct–indirect technique showed optimal clinical outcomes after a mid-term follow-up, making it an option to traditional direct veneering, ceramics, and CAD-CAM materials.

**Clinical Significance:** The direct–indirect technique amplifies the scope of resin composite restorations, providing optimal esthetic performance, broad indications, and mid-term longevity regardless of the selected restorative composite material or veneer type.

## 1 | Introduction

Despite the remarkable advances in digital and CAD-CAM dentistry in the last few years, direct composite restorations are still the most frequently performed medical intervention in the human body by health professionals worldwide [1]. Although digital technology has helped clinicians accelerate their procedures and create a preview for their patients to see the outcomes of their treatments, most digital approaches still require expensive equipment and professional training to operate their software [2]. Therefore, when restorations for a single or a few teeth are needed, these new protocols may still need to gain popularity among most dentists, especially in undeveloped countries where access to digital technology is limited.

Thin ceramic veneers are considered the gold standard for esthetic anterior restorations once they achieve predictable results in form, color, and mechanical properties [3]. Also, ceramic restorations are highly successful, mainly because they can maintain gloss, textures, and color stability over time [4]. This is one of the reasons why even partial laminate veneers are currently used [5, 6]. However, a pristine marginal

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adaptation is necessary when planning ceramic veneers to prevent marginal discoloration, gingival inflammation, and failures [4]. Therefore, dental preparation is usually required to obtain a complete adaptation of the ceramic restoration. Also, as a disadvantage, ceramic veneers may require multiple sessions and incur higher fees for the patient. These aspects, combined, may prompt other clinical alternatives in many clinical scenarios as an option to avoid overtreatment or expensive procedures.

Resin composite (RC) restorations have shown long-lasting and predictable results in the anterior and posterior dentition, and they might be an alternative for esthetic procedures [7]. For instance, a recently published clinical retrospective study has proven that RCs show survival rates as high as 70%, with an annual failure rate (AFR) ranging from 1% to 2.5% [8] in challenging clinical scenarios after 33 years. Conversely, systematic reviews on anterior restorations have demonstrated that, unlike posterior restorations—where the main reason for failure is related to fracture and secondary caries—anterior composite restorations are prone to fail primarily due to esthetic reasons [7, 9]. Thus, to achieve long-lasting results with anterior RCs, some considerations related to the operator's skills, adhesive procedures [10], patients' occlusion, habits [11, 12], and the inherent mechanical properties of the selected RC [13] should not be disregarded.

The clinical challenges described involving a direct RC approach include subgingival polish, marginal discoloration, staining, wear, inadequate anatomy, and interproximal gloss maintenance [14–16]. For this reason, alternative strategies using prefabricated veneers and templates have also been described to facilitate RC placement [17, 18]. Although these strategies might be helpful in some cases, they require more personalization. These kits' default shade and tooth form templates make achieving a precise fit challenging and render the implementation of more elaborate layering techniques elusive, especially in single-tooth restorations. Their use is also limited in single-tooth partial restorations or when multiple restorations are needed. Thus, some of the issues with direct RC placement still need to be solved, discouraging clinicians from using these strategies.

A third option for restoring anterior teeth has been reported [19], which may avoid some of the challenges associated with the previously described techniques. The so-called "Direct–indirect technique" allows personalized outcomes in terms of shape, color, textures, and optimal mechanical properties, leading to a complete blending of the RC restorations with the natural dentition. Depending on the clinical scenario, this can be done with no tooth preparation and in fewer clinical appointments than other techniques—sometimes in one appointment only. The direct–indirect technique consists of directly placing and sculpting a composite restoration onto the tooth without previous adhesive preparation, light-activating, removing the restoration from the tooth, additional light-curing and heat tempering, extraoral finishing and polishing, and finally luting, following the same principles as an indirect restoration. This technique may present advantages compared to traditional RC placement: (1) It might improve the restoration's mechanical properties due to supplemental extra-oral light polymerization and heat tempering [20, 21]. (2) Lead the clinician to better marginal polishing and adaptation since the restoration is refined and polished in the operator's hand, which may promote gingival health. (3) Differently from the conventional direct placement, the direct–indirect technique offers the possibility of final shade corrections as try-in pastes can be used before final luting, and (4) It may be considered a cost-effective procedure for the patient compared to indirect ceramic restorations [19]. Despite all the advantages of the direct–indirect technique, this technique was first described as being used with ultra-thin veneers with less than 0.5 mm thickness (in some cases described as a contact lens) [22] or traditional veneer restorations. Due to its versatility, the authors have found other applications related to this technique that adapt the original technique to different clinical scenarios, even for creating dental fragments.

Thus, this clinical report showcases the versatility and mid-term results of the direct–indirect technique by describing a step-by-step protocol for restoring the anterior dentition in challenging scenarios. Two techniques were used applying the principles of the polychromatic layering technique (PLT) [23] were used: a direct–indirect fragment build-up, and direct–indirect veneer. Varying RC brands and strategies were used on each tooth to realize an optimal blending effect and life-likeness.

## 2 | Case Report

The present clinical report was divided into two phases: an urgent procedure on tooth #10 was followed by a complete esthetic improvement on teeth #8, #9, and #7, which the patient later requested.

A 23-year-old female patient came to the clinic, and her main complaint was related to the loss of an interim restoration on tooth #10 (Figure 1). Periodontal and endodontic health were confirmed after anamnesis, clinical examination, dental probing, and routine X-rays of the patient's anterior teeth. The left maxillary lateral incisor presented an existing veneer preparation due to the debonding of an interim restoration.

Given the patient's age and the teeth's characteristics, RC restorations following the principles of the PLT were employed. The restoration methods were selected according to each tooth's function and aesthetics.

### 2.1 | Direct–Indirect Veneer on Tooth #10

The restorative process of the left lateral incisor followed the logical sequence described by Fahl and Ritter 2020 [19]. Once both lateral incisors' heights and incisal edges were checked, a window-type veneer was selected to restore tooth #10. According to the veneer classification proposed by Fahl and Ritter 2020, the authors decided to classify it as a V1C veneer type since no chromatic alterations were seen. All sharpened edges of the already present preparation in the tooth were rounded with a coarse grit Soflex disc (Soflex, 3M, Minnesota, Minneapolis, USA). (Figure 1A–C).


**FIGURE 1** | Initial analysis of the patient. (A) Facial initial photography. (B) and (C) Extraoral images with the initial situation. Note the absence of restoration in tooth #10.

#### 2.1.1 | Shade Selection

The RC layers were selected using the resin button technique, with the aid of cross-polarization photography, to enhance the visualization of the tooth shade and internal anatomy without the interference of the specular reflection of the enamel. Increments of dentin and enamel RC were placed according to the dental region where they are more evident. Thus, dentin layers were placed in the cervical region, body enamel layers were placed in the middle third of the tooth, and value enamel and translucent effect RCs were placed in the incisal third (Figure 2D).

#### 2.1.2 | Application of RC

A relative isolation technique was employed for this step, with the aid of a cheek and lip retractor (Optra Gate, Ivoclar, Schaan, Liechtenstein) to begin the veneer sculpting. A rolled Teflon cord (Oral B, Pro-Health, Procter & Gamble, Cincinnati, Ohio, USA) was used for gingival retraction. Then, a thin layer of Vaseline was placed on the tooth surface. Two dentin RCs were utilized for the dentin layer: an A3 layer to mimic the chroma of the cervical region of the analog lateral incisor and an A1 shade for the middle and incisal region (Empress Direct, Ivoclar). The anatomy of the mamelons was manually sculpted. This layer was light-cured with a Bluephase 20i light-curing unit (LCU) in standard mode at 1200 mW/cm$^2$ for 20s (Figure 3C).

Two RCs were used to sculpt the enamel layer. As a body enamel (used in the cervical and middle thirds), a UA1 shade was selected (Tetric N Ceram, Ivoclar), and a UBL-L (Tetric N Ceram, Ivoclar) was used as a value enamel for the incisal third. No translucent layer was used due to the slight translucency of the incisal third that the analog tooth showed. This layer was placed and shaped with slight excess over the gingival region and light-cured, as previously described for the dentin layer (Figure 3D).

#### 2.1.3 | Restoration Removal and Supplemental Extraoral Light-Curing

The excess created in the enamel layer allowed for the easy removal of the veneer, avoiding any unwanted fractures (Figure 4A) Then, the veneer was light cured for 1 min on both the inner and outer surfaces with a Bluephase 20i light-curing unit in standard mode at 1200 mw/cm$^2$.

#### 2.1.4 | Heat Tempering

Once the veneer was supplementally light-cured, it was heat-tempered in a microwave at 450 W for 3 min in a dry environment to enhance its mechanical properties [20].

#### 2.1.5 | Initial Contouring and Finishing

This step is mainly performed extra-orally. The veneer margins were outlined, and the outer RC excess was removed with a high coarse disc (Flexi D, EVE Ernst Vetter GmbH, Keltern Germany). Then, the incisal third was flattened until the facioincisal line angle was aligned adequately in facial volume and incisal length


**FIGURE 2** | Initial Intraoral analysis. (A) Right side of the anterior dentition (B) Left side of the anterior dentition and the absence of restoration in tooth #10 (C) Front view of the anterior dentition (D) Shade Selection of the resin composite using cross-polarized photography. From cervical to incisal: Two Dentin Shades, Enamel shade, Translucent shade.


**FIGURE 3** | (A) Retraction Teflon cord placement. (B) Isolation of the tooth. (C) Establishing the anatomy of the dentin layers creates more pronounced mamelons due to the use of a more opaque enamel shade. (D) Enamel placement with an excess in the cervical region to allow the displacement of the restoration after polymerization.


**FIGURE 4** | (A) Veneer removal. (B) Establishing the correct position of the facial thirds by outlining them in the homologous tooth and the restoration until reaching the same position in the restoration. (C) Establishing the position of the transitional line angles in the homologous tooth and the restoration until reaching the same position in the restoration to achieve symmetry. (D) Final aspect of the restoration when achieving the primary anatomy.

with the analog lateral incisor. Then, the emergence profile and facial planes were established while the restoration was seated (before bonding procedures). Coarse discs were again used to blend the cervical and incisal thirds anatomically, establishing the correct facial contours. With the veneer still in place, the facioproximal transitional line angles were outlined with a pencil to match their ideal position. The veneer was then removed, and the facial embrasures were finished with proper morphology. Finally, finishing and polishing were accomplished with discs of varying grits (Flexi D, EVE, Germany) until the primary anatomy of the veneer was achieved (Figure 4D). High-shine RC polishing spiral wheels (Diacomp Twist, EVE, Germany) were used sequentially to finalize polishing in the margins.

### 2.1.6 | Primary Anatomy Refinement

The incisal third was flattened with a high coarse disc (Flexi D, EVE) until the facioincisal line angle was correctly aligned in facial volume and incisal length. Next, the restoration was repositioned on the tooth, and the emergence profile and facial planes were established. Following this, coarse discs were again used to anatomically blend the cervical and incisal thirds, establishing the correct facial contours. The veneer was then in complete facial alignment with the adjacent teeth. With the veneer still in place, the facioproximal transitional line angles were outlined with a pencil to match their ideal position. The veneer was removed, and the facial embrasures were finished to ideal morphology. Finally, finishing and polishing were accomplished with discs of varying grits until the primary anatomy of the veneer was achieved. Ideally, secondary anatomy is carried out when the veneer is bonded. This step facilitates mimicking micro and macro texture through direct comparison with the natural dentition while avoiding the chances of veneer fracture.

### 2.1.7 | Shade Try-In

The try-in stage requires three steps: (1) try-in dry—the restoration should ideally show a slightly higher value; (2) try-in with a drop of water or a clear (transparent) try-in paste—this should lower the value to the desired level; (3) try-in with opaque pastes and pastes of varying hue saturation—this allows for modulating the value and chroma to the desired pattern. The veneer was tried in with neutral and light try-in pastes (Variolink LC try-in, Ivoclar) and the light shade was selected.

### 2.1.8 | Adhesive Procedures

The adhesive procedures were divided according to the substrate (Veneer or Tooth):

1. The veneer intaglio surface was particle air-abraded (27 µ Al2O3) followed by the application of 35%–40% phosphoric

acid (Ultra-etch, Ultradent Products Inc., Sandy, Utah) for 10 s. Next, silane (Monobond N, Ivoclar) was applied vigorously for 1 min and maintained untouched for two additional minutes. A hydrophobic adhesive resin (Step 2, Adhesive, Optibond FL) was used on the intaglio surface and air-thinned.

2. The tooth's enamel surface was particle air-abraded for 10 s and then etched with phosphoric acid (N-Etch, Ivoclar) for 15 s, rinsed, and dried. A thin layer of a Universal Adhesive (UA; Tetric N Universal Pen, Ivoclar) was applied to the tooth surface for 20 s and air-dried to volatilize the solvent for an additional 20 s. Since a simplified adhesive was used and a thin layer unable to interfere with the veneer adaptation was obtained, the authors decided to light-cure the adhesive system before luting procedures.
3. The veneer was luted with the light-cured resin cement of equal shade selected at the try-in (Variolink N, Light Shade, Ivoclar). A layer of cement was placed onto the intaglio surface, and the veneer was seated to a snug position, checking the margins and leaving the excess to gently ooze. Excess cement was carefully removed, the veneer was tack-cured and sequentially light-cured from the facial and palatal aspects for 1 min each with a light-curing unit (Bluephase 20i, Ivoclar) at standard mode (1200 mw/cm2), followed by 20s with turbo mode (2000 mW/cm2). (Figure 5A–D)

#### 2.1.9 | Secondary and Tertiary Anatomy

Even though primary anatomy is obtained at previous stages, refinement might be required to achieve symmetry between the teeth with discs and spiral wheels.

The secondary and tertiary anatomy were carried over once the veneer was bonded at the primary anatomy stage. The tertiary anatomy's anatomic details, such as split lobes, depressions, perikymata, and stippling, were added according to the adjacent tooth pattern. Multi-fluted carbide and fine diamond burs were carefully used to avoid over-reducing the thin veneer enamel layer or causing perforations.

#### 2.1.10 | Polishing

The over-accentuated texture was softened to match the natural adjacent teeth with spiral wheels (Diacomp Twist, EVE) to reach a natural morphological level. Rubber rotaries of varying levels of abrasiveness were used for initial polishing, followed by a silicone carbide brush and diamond polishing pastes (Jiffy Brush, Diamond Polishing Paste, Ultradent, UT) and aluminum oxide polishing paste (Enamelize, Cosmedent, Chicago, Illinois, USA), and buffing discs (Flexi Buff, Cosmedent). Substantiated by one of the advantages of the direct–indirect technique, no finishing was carried out on the intrasulcular margins to preserve the high-quality features

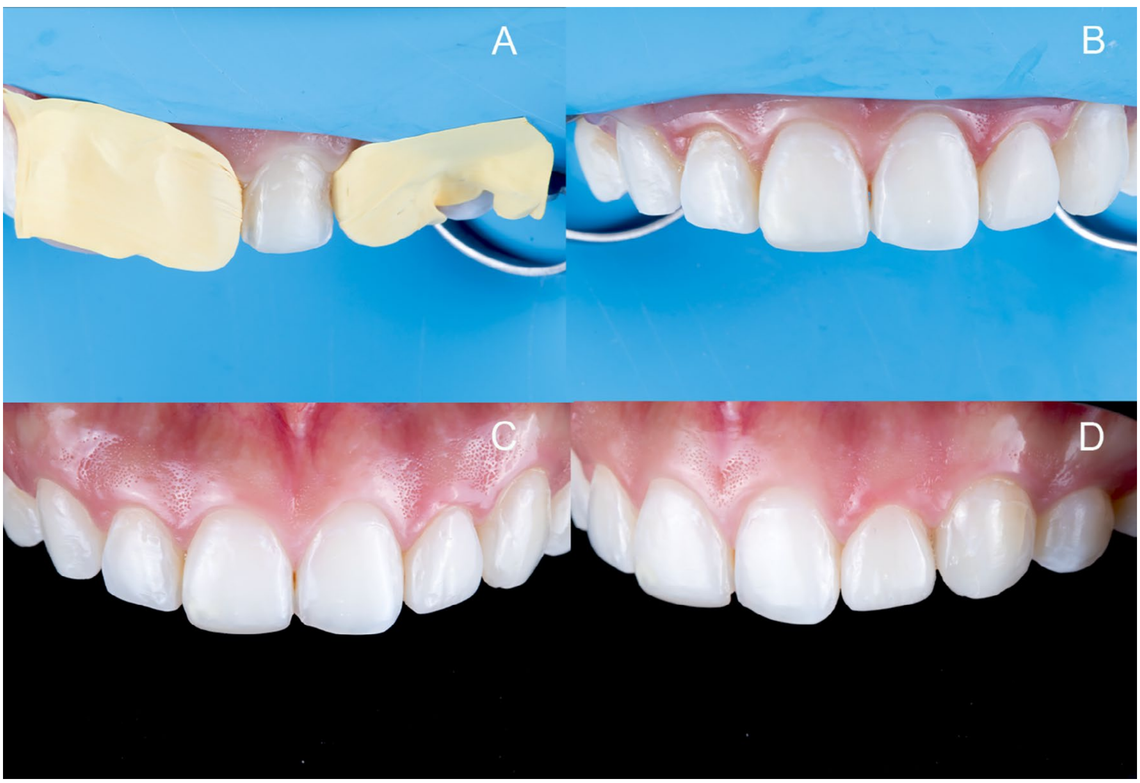


**FIGURE 5** | (A) Isolation of the tooth for cementation using the slit rubber dam technique. (B) Immediate luting of the veneer in tooth #9. (C) Frontal view of the restoration. (D) Lateral view of the restoration after luting. In this stage, the secondary and tertiary anatomy is completed.

achieved by the extra-oral finishing and polishing protocol. Further subgingival polishing was accomplished with flexible polishing cups (Flexi-cups, Cosmedent, IL) and polishing pastes (Diamond Polishing Paste, Ultradent, UT).

### 2.2 | Six-Month Follow-Up and Central Incisors Restoration With a Direct Incisal Edge Augmentation and Direct–Indirect Fragment

During the 6-month follow-up appointment (Figure 6A), the patient requested improvement of the central incisors. Tooth #8 showed an old incisal edge restoration, while tooth #9 presented signs of dental wear at the mesial portion of the incisal edge and a slight rotation to the mesial (Figure 6B). Once the patient agreed with the proposed treatment, an impression was made, and a model was obtained to establish a symmetrical anatomy for the central incisors (Figure 6C) A silicone matrix (Virtual, Ivoclar) was then made to assist in the restoration layering (Figure 6).

#### 2.2.1 | Shade Selection

The previously described shade selection technique was also used for the central incisors. Given the clinical situation of each central incisor, different RC types and shades were selected, following the concepts of the PLT [23]. For tooth #8, the 50–50 (50% translucent-50% opaque resins) concept was employed. Only three shades were selected: a milky-white resin for the palatal shell (Pearl Frost PF, Vit-l-scence, Ultradent. USA), one high-value and opaque dentin shade (BL-L, Empress Direct, Ivoclar, Lichtenstein), and a value enamel shade (MW, Estelite Omega, Tokuyama, Tokyo, Japan). A more elaborate polychromatic layering was devised for tooth #9, which required extensive anatomic modification of the facial aspect. For the palatal shell, a milky-white RC was selected (Pearl Frost, Vit-l-scence, Ultrandent, USA). Due to the rotation of tooth #9, which made the distal lobe more prominent, a dentin shade was only placed in the mesial and central thirds of the tooth (Light Dentin, Essentia, GC Corp, Tokyo, Japan). An opalescent resin was selected to obtain a translucent natural effect on the incisal edge (Opalescent Modifier, Essentia, GC Corporation, Japan). Finally, for the outer enamel layer, two types of resins were selected: A Body Enamel (A1, Palfique LX5, Tokuyama) and a value enamel (MW, Estelite Omega, Tokuyama).

#### 2.2.2 | Direct Incisal Edge Augmentation on Tooth #8

To establish a reference and create the anatomy with a correct position of the incisal edge of tooth #9, the central incisor #8 was addressed restoratively following the principles of the PLT. A thin milky-white enamel shade (Enamel BL-L Empress Direct, Ivoclar) layer was applied onto the matrix and light-activated for the 20s with a poly-wave light curing unit (LCU; Valo Grand, Ultradent) at the standard mode (1000 mW/cm$^2$). Next, a dentin layer (Dentin BL-L, Empress Direct, Ivoclar) was applied over the incisal third to conceal the incisal edge transition line and light-activated. A value enamel (MW, Estelite Omega, Tokuyama) shade was applied to the facial aspect, contoured to the ideal morphology, and light-activated (Figure 6D).

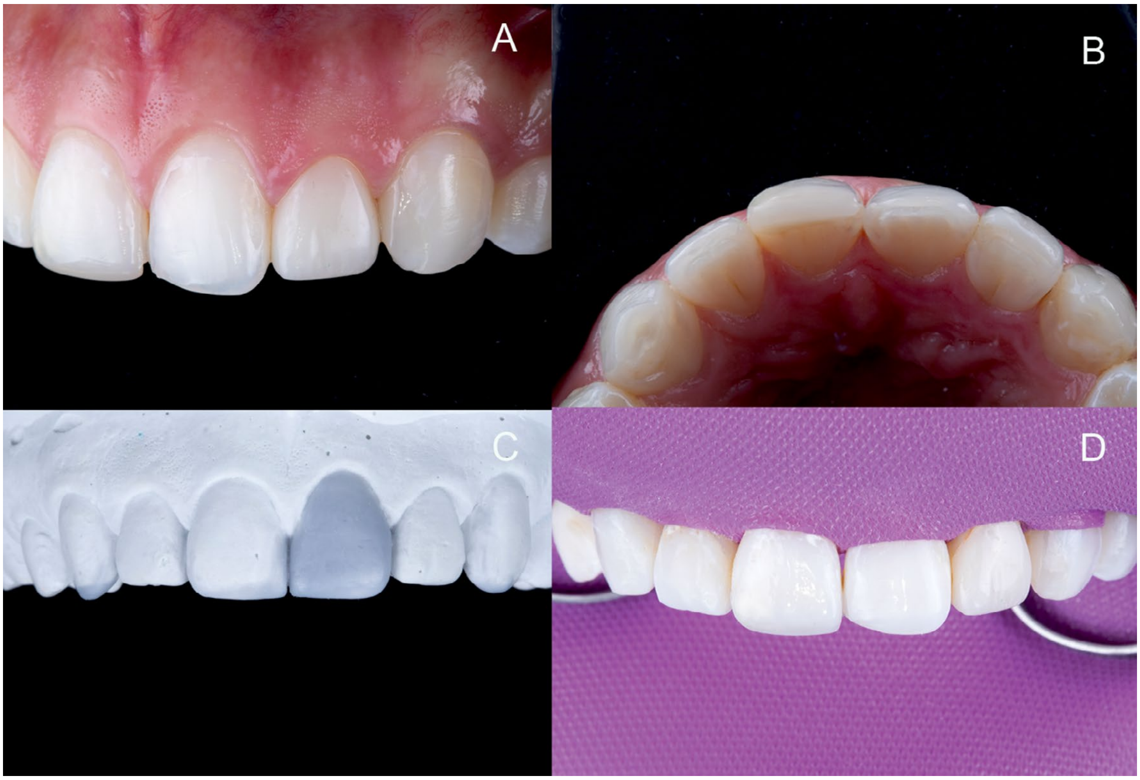


**FIGURE 6** | 6 months follow-up of the direct–indirect veneer in tooth #9 (A). Due to the patient's request, an improvement of both central incisors was planned. (B) Oclussal view of the anterior dentition. Note the position of the distal lobe in tooth #9, ultimately resulting in a partial veneer. (C) Wax-up of teeth #8 and #9 to create a silicon matrix. (D) Direct restoration of tooth #8 using the Polychromatic Layering technique principles.

### 2.2.3 | Direct–Indirect Resin Fragment

The silicon matrix was maintained in position for the incisal modification until the dentin layer was finished. Due to the rotation and root torque in tooth #9, the distal portion of the tooth remained RC uncovered, turning the restoration into a dental fragment Figure 7B.

### 2.2.4 | Application of RC

Gingival retraction and dental isolation were performed as previously described for tooth #10. A milky-white shade (Vit-l-scence, Pearl Frost, Ultradent Inc.) was applied and molded to a thin layer onto the silicone matrix, positioned in the arch, and light-activated for 20s. Next, a dentin layer (Essentia, Light Dentin, GC Corporation) was placed onto the tooth's mesial and central vertical thirds to establish the correct facial contours and fully align with the adjacent teeth once the subsequent layers were placed. After the dentin layer was sculpted and light-activated for 20s, a thin layer of translucent resin (Essentia, Opalescent Modifier, GC Corporation) was placed over the incisal and mesial regions of the restoration. Then, this layer was cured for 20s, and the silicon matrix was removed. The enamel layers were placed in two steps: First, an A1 body enamel layer (EA1, Palfique LX5, Tokuyama) was placed with excess over the gingival and middle thirds of the tooth, leaving space for the subsequent value enamel layer (Milky White, Estelite Omega, Tokuyama). All layers were light-cured for 20s with a light-curing unit (Valo Grand, Ultradent) using a standard mode (1000 mW/cm$^2$).

The subsequent stages of this restoration follow the same stages as described for tooth #10. The final result of the three restorations is shown in Figure 8.

## 2.3 | Twenty-Seven-Month Direct–Indirect Veneer Follow-Up and Twenty-One-Month Follow-Up of the Direct–Indirect Fragment and Direct Incisal Edge Modification

All the restorations were followed up every 6 months until a mean of 2 years of follow-up was reached. Each appointment included dental prophylaxis and restoration maintenance, including using aluminum oxide paste and buffing discs (Enamelize and Flexi Buff Discs, Cosmedent) to keep the surface shiny. None of these procedures were performed at the last check-up.

All restoration margins, adaptation, and gingival health were evaluated at every check-up appointment. The patient received hygiene and care instructions at all of these appointments,


**FIGURE 7** | (A) Displacement of the dental fragment to achieve primary anatomy. (B) Direct–Indirect fragment with its primary anatomy. (C) Using a glossy silver powder allows an easier comparison of the textures between anterior teeth to mimic the restoration. The secondary and tertiary anatomy is compared and established during this stage. (D) Final result of the direct incisal edge augmentation, direct–indirect fragment, and direct–indirect veneer using different RC but obtaining full blending of the restorations in the anterior dentition by applying the principles of the Polychromatic Layering Technique.


**FIGURE 8** | (A) Occlusal view of the initial situation after 6 months follow up of the direct–indirect veneer on tooth #10. (B) Occlusal view of the final result with teeth #8, #9, and #10 restored. (C) Front view of the final result. (D) Front view of the final result using cross-polarized photography to show how all the restorations blended with the natural dentition.

stressing the importance of the patient's role in maintaining oral health conditions.

On recall appointments, the patient presented optimal gingival health conditions. All the margins showed adequate adaptation, with clear, shiny, and clean margins in both the veneer and fragment. Figures 9 and 10 present the two-year follow-up images.

## 3 | Discussion

The versatility of the direct–indirect technique has made it possible to use a wide range of indications. Initially designed for ultra-thin veneers [22] (thin veneers with less than 0.5 thickness) and veneers, the present clinical report has also shown new possibilities for this technique, as a fragment was also made following the same principles as in the case of complete veneers/ultra-thin veneers. Initially described for ceramic restorations, fragments (also called partial laminate veneers) are esthetic, ultra-conservative, and thin restorations commonly used for diastema closures and in cases involving the middle and incisal thirds [5, 6]. However, unlike the case in this report, the success of ceramic fragments relies on the ceramist's artistic expertise, the dentist-ceramist communication workflow, and the operator's skills to perform the luting protocols. An added challenge to ceramic fragments is their brittle nature, which predicates the potential for fracture during their laboratory and clinical manipulation [5]. Also, as a disadvantage, ceramic veneers may require multiple sessions and incur higher fees for the patient. On the other hand, direct–indirect resin composite restorations can be considered an ultra-conservative restorative approach since no tooth preparation is required to achieve excellent fit and marginal adaptation without the risk of a fracture at a lower cost for the patient.

Clinical studies have reported the importance of keeping as much sound tissue as possible to obtain long-lasting restorations [1, 7, 11, 12]. The present clinical report shows that the direct–indirect technique frequently allows for prepless interventions, except for discolored or excessively labially positioned teeth. In this regard, adhesive protocols are crucial to success once the debonding of veneers has been described as one of the main reasons for restoration failure. A reasonable strategy to avoid any adhesive challenges with time has been related to the presence of enamel over the tooth surface [16]. Enamel can be considered a reliable tissue to bond to, and multiple studies have proven that regardless of the type of adhesive used, bonding to enamel can be long-lasting [10]. The present study used a UA during the bonding procedures. Recent studies have shown promising results with the use of these agents [10]. However, given the lack of clinical studies regarding the use of these adhesives for luting thin materials, the authors decided to perform careful volatilization of the vehicle present in the composition of the material and increase the polymerization time to enhance their properties [10] and avoid any unwanted clinical outcomes, such as marginal staining, a critical aspect when restoring anterior teeth.

Other essential criteria for determining the quality of an anterior restoration are related to the marginal integrity and


**FIGURE 9** | Facial (A) and extraoral photographs (B, C) of the 2-year (mean) follow-up of the restorations. Note the quality of the margins and the periodontal health.


**FIGURE 10** | Two-year follow-up of the anterior restoration. (A) Patient smile after 2 years. (B) Front view of the anterior dentition. (C) and (D) Lateral view of the restorations after 2-year (mean) follow-up. The restorations maintained a shiny and clean appearance after the follow-up time.

gingival biocompatibility of the restorative material [4, 14–16]. The direct–indirect technique is advantageous over traditional direct veneering techniques. The possibility of extraoral finishing and polishing the margins while checking the restoration's intraoral fit made this technique an excellent alternative to restoring the anterior dentition. In traditional direct veneers, subgingival margins are challenging to finish and polish, leaving a rough surface that might induce bacterial colonization over the resin surface, leading to inflammation. Reciprocating devices that allow subgingival finishing and polishing (e.g., Profin, W&H, Wien, Austria) are available, but their polishing ability is inferior to that presented by the direct–indirect approach. They also add additional costs to the clinician's armamentarium. Further investigation is needed to compare the performance of such devices with the technique employed by the authors regarding marginal quality.

Concerning the isolation technique employed in the present case report, the original method for luting direct–indirect veneers used relative isolation techniques [19, 24]. Moisture control is an essential aspect of dental restorative procedures. In the present case report, we wanted to move a step forward and use the slit rubber dam technique and a crevicular fluid control by using a Teflon retractor cord; as for the authors, in cases where a reliable substrate as enamel is present, it is clinically easier to have a better perspective on the final position of the veneer related to the adjacent teeth, while ensuring the final fit of the veneer, mainly in the cervical area, in a dry operatory field. However, it is worth mentioning that clinicians might be aware of the importance of maintaining moisture control during adhesive procedures to avoid any interference that might compromise bonding and, ultimately, restoration survival [25], mainly in cases where dentin is exposed in the cervical region [26]. In such cases, total isolation might be a helpful strategy, as this is a more critical substrate to bond to. In this sense, we encourage clinicians to have special care while placing the veneer in its final position to ensure a correct fit and adaptation.

The mechanical properties of resinous materials are directly related to the polymerization rate, known as the "degree of conversion" of a polymeric material [13]. This term describes the percentage of Carbon double bonds that turn into Carbon single bonds during the RC's polymerization process. The present study used two types of high-quality multi-wave LCUs. In this regard, a recent in vitro study showed the correlations between the cost of the LCU and the quality of the delivered energy by these types of devices [21]. Clinical evidence showing the differences using different types of LCU is scarce. With the current study's limitations, no clinical differences were seen in the two-year follow-up between all the restorations. This might reinforce the importance of using high-quality materials and clinical protocols. Along with the LCU, another advantage of the direct–indirect technique is the possibility of a supplementary light cure of the veneer outside the mouth. This step might ensure correct RC polymerization and increase the degree of conversion while avoiding excessive tooth heating.

One of the steps in the direct–indirect technique involves heat tempering the restoration after it has been removed from the tooth. Heat-induced polymerization has been shown to be an effective strategy for improving the mechanical properties of RC [20]. The dentist can efficiently perform this procedure in his office, as a microwave or even an autoclave could be enough to produce the necessary heat to improve RC outcomes. Also, after the two-year follow-up of the restorations, the glossy aspect of the veneers was evident (Figures 9 and 10), even when a nanohybrid composite was used (Tetric N Ceram) in the lateral incisor, confirming the importance of heat tempering as a tool to make RC restorations more resistant to wear, keeping a smooth surface for a longer time [20]. This could also be proven in the interproximal areas of the direct–indirect restorations, where no signs of staining were seen, showing again the advantages of both extra-oral polishing and heat tempering and the clinical impact that the steps of the direct–indirect technique might have on the overall appearance and lasting of the restoration. Systematic reviews have studied [1, 7] the leading causes of replacing an anterior restoration, finding that one of the main reasons for restoration replacement is related to esthetic reasons, in which case the described technique could be helpful to avoid replacement.

Randomized clinical trials have compared the outcomes regarding the longevity of ceramic and indirect resin restorations. For instance, Gresnigt et al. [14, 15] showed that in the midterm (1 to 3 years follow-up), no differences were seen between both materials. After a 10-year follow-up, ceramics showed better longevity than those from an indirect resin material. However, the main reasons for failure in the RC group were related to debonding or fracture. The RC composite group also showed lower results regarding the quality of the surviving restorations (Color match, surface roughness, and wear). Despite these results, in comparison with the direct layering veneer technique, indirect RCs usually require sophisticated equipment, mainly used in a dental laboratory environment, making the direct–indirect technique a better choice for clinicians, especially when few teeth are restored. The parameters of this clinical study considered only one laboratory RC, while in the current study, we used the PLT. One of the advantages of this technique is the chance to select the best properties for each layer. In this regard, the natural look must be combined with the desired mechanical properties that the clinician prefers. For this reason, microfills or nanofills, along with suprananofill RC, are selected for the outer facial layers, as different in vitro studies have shown the quality and gloss of these types of RC compared to those of other types of composites [13]. While the resins mentioned above are preferred in the outer layers, in the palatal and inner layers, the PLT describes the use of micro or nanohybrid composites to build up layers resisting flexural forces. In the current clinical report, we used different RC brands and types following the principles of the PLT [23]. The final esthetic outcome showed another advantage of this technique, which, also based on the optical properties of the different RC, allows the clinician to naturally blend restorations with the natural dentition, showing that RC materials, when correctly used, are still an excellent esthetic option for anterior restorations [23].

The direct–indirect technique offers several benefits that make it useful in various clinical scenarios. Previous studies have indicated its broad applications, such as addressing discolorations in one or a few teeth, making anatomical size and color adjustments, or even for Class V restorations [24]. This technique allows clinicians to adapt their approach to different situations, providing new treatment options at a lower cost for both practitioners and patients. The materials and equipment used in this case report are more affordable for patients than advanced chair-side CAD-CAM technology. From the clinician's perspective, this technique enhances control over critical factors such as marginal adaptation, surface finishing, polishing, and the restoration's anatomy since these elements are crafted outside the patient's mouth. This can improve outcomes, as illustrated in Figures 9 and 10.

However, the direct–indirect technique may pose some challenges when restoring multiple teeth and exceptionally long chairside times for less experienced clinicians. This issue can be addressed by indirectly fabricating composite resin veneers on flexible PVS models, as referenced in Fahl N. and Ritter A.'s work. These approaches remain aligned with minimally invasive, cost-effective protocols that empower clinicians to take ownership of their craft.

As with any technique in dentistry, mastering new protocols and restorative methods demands thorough study and ongoing practice. This commitment is essential to achieve a level of clinical proficiency that justifies integrating these techniques into daily practice, making them both operatively effective and financially feasible.

Many new CAD-CAM materials with improved properties have been launched into the market in the last few years. Many of them are being studied; these materials have obtained encouraging results [2]. However, they still require expensive laboratory or chairside equipment, restricting access to such technology, especially in undeveloped countries. Also, clinical evidence regarding the use of these variations of RC in anterior restoration remains limited. In a digital and CAD-CAM dentistry world, knowledge regarding the mechanical properties of dental materials, combined with evidence-based clinical protocols and good communication with the patient, may still make RC restorations a choice for many restorative scenarios. We should not forget all the scientific evidence from all levels, from in vitro, randomized clinical trials to systematic reviews and meta-analyses that have shown the high success rates of RC [1, 7, 11, 12, 14–16], a material developed more than 60 years ago, whose main component, Bis-GMA, was first described by Prof. Bowen to change the way we do restorative dentistry.

## 4 | Conclusion

Within the limitations of the current case report, we can conclude that:

1. The direct–indirect technique showed optimal clinical outcomes after a mid-term follow-up and might be an option to traditional veneering using RCs or ceramics.
2. Correctly selecting the restorative material and layering technique, along with improving the mechanical properties, is a valuable tool for the clinician to enhance RC mid-term clinical results.

**Conflicts of Interest**

The authors declare no conflicts of interest.

**Data Availability Statement**

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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