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Single-Retainer Glass-Ceramic Resin-Bonded Bridge for Maxillary Lateral Incisor Replacement: A Clinical Case Report

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Abstract: Congenitally missing maxillary lateral incisors present a significant esthetic and functional challenge, particularly in young adults with high esthetic expectations. Although implant-supported restorations are frequently considered, anatomical limitations may preclude implant placement. Single-retainer cantilever resin-bonded fixed dental prostheses (RBFDPs) represent a minimally invasive alternative that preserves the integrity of adjacent teeth. It is about a 26-year-old female patient with bilateral congenital absence of the maxillary lateral incisors was referred for definitive prosthetic rehabilitation following orthodontic space opening. The adjacent central incisors and canines were intact, caries-free, and periodontally healthy. Although implant-supported rehabilitation was initially planned, preoperative cone-beam computed tomography revealed insufficient residual ridge dimensions for implant placement. Two single-retainer cantilever RBFDPs were therefore selected. The prostheses were fabricated from lithium disilicate-reinforced glass-ceramic using a digital CAD/CAM workflow and bonded to the palatal surfaces of the maxillary central incisors. Treatment involved conservative enamel-dominant preparations, soft-tissue management, immediate dentin sealing of localized exposed dentin, digital prosthetic design, and adhesive resin cementation. At completion, the restorations demonstrated satisfactory adaptation, esthetic integration, and functional occlusion, and the patient reported satisfaction with the outcome. Within the limitations of a single case report, lithium disilicate single-retainer cantilever RBFDPs provided a conservative and esthetically satisfactory treatment option for replacing congenitally missing maxillary lateral incisors while preserving the possibility of future implant therapy. Long-term follow-up is required to evaluate the durability and clinical stability of this approach.

Keywords: Congenital Tooth Agenesis, Maxillary Lateral Incisors, Resin-Bonded Fixed Dental Prosthesis, Cantilever RBFDP, Lithium Disilicate, CAD/CAM, Adhesive Dentistry.

Case Report

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INTRODUCTION

Congenitally missing teeth in the anterior region often require timely therapeutic management to address significant esthetic and functional concerns [1, 2]. Among these conditions, the congenital absence of maxillary lateral incisors is particularly significant, as these teeth play a central role in smile esthetics and facial harmony. Their absence may therefore have a considerable impact on patients' psychosocial well-being, including in young individuals who place a strong emphasis on an esthetically pleasing appearance [3, 4]. Hypodontia, defined as the developmental absence of one or more permanent teeth, affects approximately 2.5% to 6.9% of the population. Maxillary lateral incisors are among the most commonly missing anterior teeth and frequently present with bilateral agenesis [5, 6]. The condition may occur unilaterally or bilaterally, either as an isolated dental anomaly or as part of a broader genetic disorder [7]. Several treatment options are available for the management of congenitally missing maxillary lateral incisors, including orthodontic space closure, autotransplantation of deciduous or permanent teeth, implant-supported restorations, conventional fixed dental prostheses (FDPs), cantilever resin-bonded fixed dental prostheses (RBFDPs), and removable partial dentures [8, 2]. Each treatment modality presents specific advantages and limitations, and the choice should be guided by the individual clinical situation, with particular consideration given to the preservation of hard and soft tissues, functional requirements, esthetic expectations, and patient comfort.

Dental implant placement may represent a reliable treatment option for replacing congenitally missing teeth. However, its feasibility depends on adequate bone volume and quality. Limited space between adjacent teeth or roots, financial considerations, or patient preferences may also necessitate alternative treatment solutions [10, 11].

In the present case, implant placement to replace the two maxillary lateral incisors was initially considered; however, cone-beam computed tomography (CBCT) revealed inadequate bone volume and quality for implant surgery, indicating the need for an alternative restorative approach.

Removable partial dentures offer a non-invasive and cost-effective solution; however, their use in the anterior region is frequently associated with compromised esthetics, reduced comfort, and limited long-term acceptance [12]. Conventional fixed dental prostheses provide reliable function and esthetics but require extensive preparation of the adjacent teeth, which may compromise sound tooth structure and increase the risk of pulpal complications [13].

Resin-bonded fixed dental prostheses (RBFDPs), particularly those fabricated from lithium disilicate, provide a minimally invasive alternative to both implant-supported restorations and conventional crown-retained prostheses. They have demonstrated favorable outcomes in terms of longevity, esthetics, function, and overall patient satisfaction [8-14]. Moreover, compared with the potentially severe biological and technical complications associated with implant-supported restorations and conventional FDPs, failures of RBFDPs are generally less invasive and rarely catastrophic [15].

The renewed interest in RBFDPs has been supported by advances in adhesive dentistry, high-strength ceramic materials, and digital workflows, which have contributed to improved predictability and clinical performance [16]. Computer-aided design and computer-aided manufacturing (CAD/CAM) technologies are now widely used for the fabrication of various ceramic restorations, including inlays, onlays, crowns, and fixed dental prostheses [17]. These developments have further expanded the indications for minimally invasive adhesive prosthetic approaches, particularly in the management of congenitally missing anterior teeth.

This paper aimed to describe through a clinical case, the management of a bilateral congenital absence of the maxillary lateral incisors with lithium disilicate cantilever RBFDPs as a minimally invasive alternative to implant-supported or conventional fixed prosthetic rehabilitation.

CASE PRESENTATION

A 26-year-old female patient with no significant medical history presented to the Department of Dentistry at Sahloul Hospital for the replacement of bilaterally missing maxillary lateral incisors (teeth 12 and 22) (Fig 1).

Figure 1: Frontal intraoral view demonstrating the bilateral missing maxillary incisors

The patient had previously undergone orthodontic treatment with space opening to facilitate the prosthetic replacement of the maxillary lateral incisors. Following orthodontic debonding, she had been provided with a thermoformed removable splint incorporating prosthetic teeth to temporarily maintain the edentulous spaces and provide an interim esthetic solution (Fig 2).

Figure 2: Thermoformed splint supporting prosthetic teeth

At the initial clinical examination, oral hygiene was satisfactory, with twice-daily toothbrushing. The adjacent teeth are intact and caries-free. The periodontium was healthy, with no clinical signs of gingival inflammation. The remaining dentition was complete, except for the congenitally missing maxillary lateral incisors. The patient presented with an Angle Class I occlusion and preserved anterior functional guidance.

The patient expressed a desire for a fixed and esthetically pleasing restorative solution. The different treatment options were discussed, including implant-supported restorations, conventional fixed dental prostheses (FDPs), and resin-bonded fixed dental prostheses (RBFDPs).

The initial treatment plan involved the placement of dental implants to replace the two missing maxillary lateral incisors. However, preoperative computed tomography (CT) revealed insufficient ridge dimensions for implant placement at the lateral incisors' sites (Fig 3).

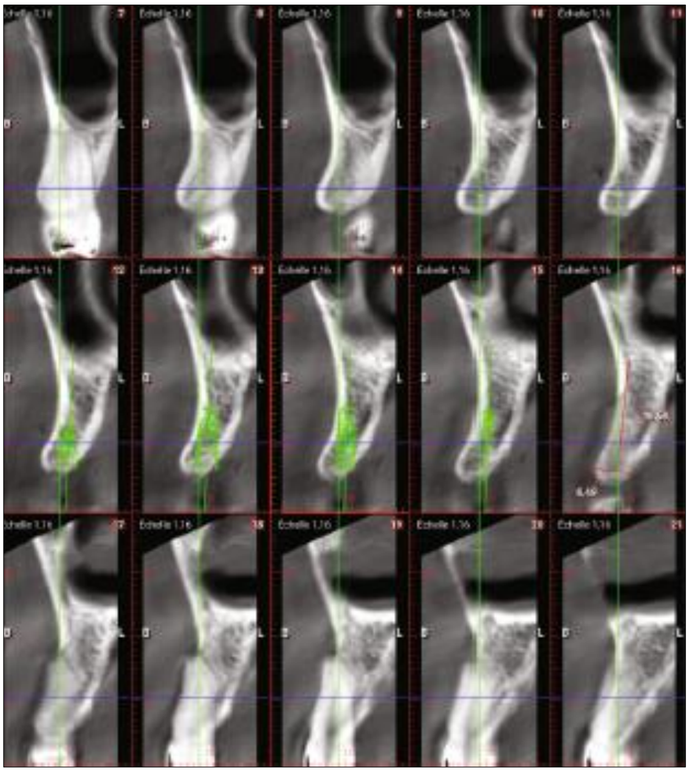

Figure 3: Sagittal cone-beam computed tomography (CBCT) cross-sectional image of the lateral incisor region demonstrating limited residual alveolar ridge width

Implant-supported rehabilitation was therefore considered unsuitable. In addition, the favorable occlusal relationship and adequate mesiodistal space available for the replacement of the missing teeth supported the use of two single-retainer cantilever resin-bonded fixed dental prostheses (RBFDPs).

The prostheses were planned using lithium disilicate-reinforced glass-ceramic (IPS e.max CAD) and designed with a single palatal retainer wing bonded to the palatal surface of each maxillary central incisor. This treatment approach was selected as a minimally invasive alternative in accordance with the principles of adhesive dentistry, while preserving the integrity of the adjacent teeth.

To enhance the accuracy of prosthetic fabrication and improve treatment predictability, a digital workflow was implemented.

CLINICAL PROCEDURE

Periodontal Approach

A gingivectomy was first performed due to short clinical crowns resulting from altered passive eruption, thereby increasing the bonding surface area for the RBFDP retainer wing. After completion of the healing period, the orthodontic retention wires previously bonded to the palatal surfaces of the maxillary central incisors were removed (Fig 4, 5, 6).

Figure 4: Bleeding points marked on the anterior maxillary gingiva during periodontal probing to delineate the incision line for crown lengthening

Figure 5: Immediate post-operative view following gingivectomy, demonstrating the increased clinical crown height of the anterior teeth

Figure 6: Post-operative healing view displaying proper tissue maturation and harmonious gingival contours prior to prosthetic restoration.

Prosthetic Approach

Following preliminary maxillary and mandibular impressions, a diagnostic wax-up was prepared to visualize the anticipated prosthetic result and assess whether the available edentulous spaces were compatible with the dimensions of the teeth to be replaced. Provisional bridges were subsequently fabricated from a silicone index using a direct technique, allowing evaluation of the planned tooth morphology and temporary assessment of the esthetic and functional outcome.

A conservative preparation was then performed on both maxillary central incisors using fine-grit diamond burs, with maximal preservation of sound tooth structure and the preparation predominantly restricted to enamel. A supragingival chamfer finish line, approximately 1 mm in thickness, was established on the palatal surface using a chamfer bur.

The preparation was extended coronally to within 2 mm of the incisal edge to preserve the natural translucency of the incisal third. This limit was established with an olive-shaped bur oriented perpendicular to the incisal edge, producing a depth of approximately 1 mm. The palatal surface was subsequently reduced by 1 mm using the same bur, maintained parallel to the palatal surface.

A macro-retentive pit, 1 mm in depth, was created with a round bur to facilitate accurate seating and repositioning of the prosthetic restoration. A connector box with a cross-sectional area of 12 mm² (4 mm in height × 3 mm in width) was also prepared using a round bur, in accordance with the mechanical requirements of the ceramic material and to reduce the risk of connector fracture.

The completed preparations were evaluated according to the following criteria:
A 1:mm-thick supragingival chamfer finish line on the palatal surface;
A connector box measuring 12 mm² (4 mm in height × 3 mm in width);
A 1-mm reduction of the palatal surface;
A 1-mm-deep macro-retentive pit.

Immediate Dentin Sealing

Immediately after tooth preparation, any localized areas of exposed dentin were identified and managed using an immediate dentin sealing (IDS) protocol. The exposed dentin was etched with 37% phosphoric acid (Total Etch®, Ivoclar Vivadent AG, Schaan, Liechtenstein) for 30 seconds, thoroughly rinsed, and gently air-dried. The adhesive system (All-Bond Universal® light-cured dental adhesive (BISCO, Inc., Schaumburg, IL, USA) was subsequently applied in accordance with the manufacturer's instructions and light-cured. The IDS procedure was performed immediately after preparation and before definitive impression-making and laboratory fabrication. This approach aimed to protect the freshly exposed dentin, maintain the integrity of the dentin–adhesive interface, and promote a favorable substrate for subsequent adhesive cementation of the resin-bonded fixed dental prostheses (Fig. 7).

Figure 7: Clinical Sequence for Resin-Bonded Fixed Dental Prosthesis (RBFDP) Preparation, Bonding, and Provisionalization

The shade was selected using a digital VITA easy shade-taking system (Fig 8, 9).

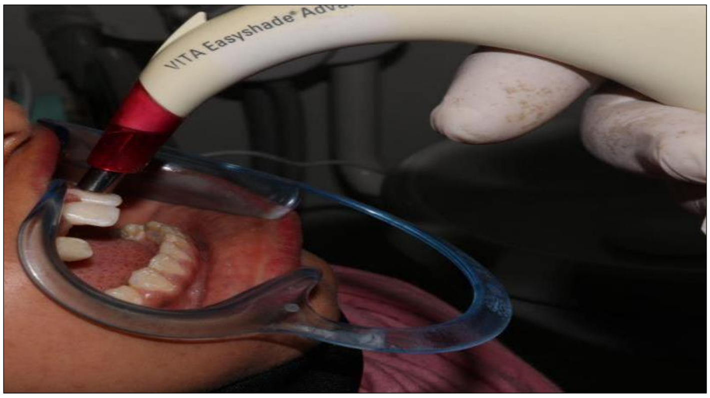

Figure 8: Digital Shade Selection

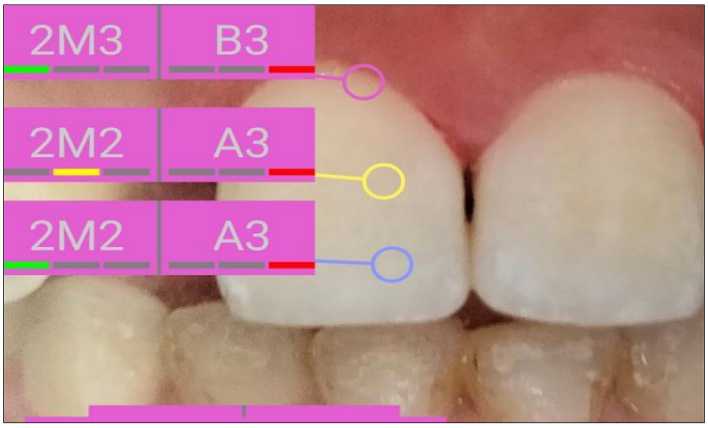

Figure 9: Spectrophotometric shade mapping

Digital shade analysis of the maxillary central incisor segmented into cervical, middle, and incisal thirds. Corresponding shade values are recorded using both the VITA Toothguide 3D-MASTER® (2M3, 2M2, 2M2) and VITA Classical (B3, A3, A3) shade systems to guide chromatic layering for the lab technician.

Following scanning of the working cast, the prostheses were digitally designed and milled by the laboratory technician using a CAD/CAM workflow and lithium disilicate-reinforced glass-ceramic blocks (IPS e.max CAD) (Fig 10, 11, 12).

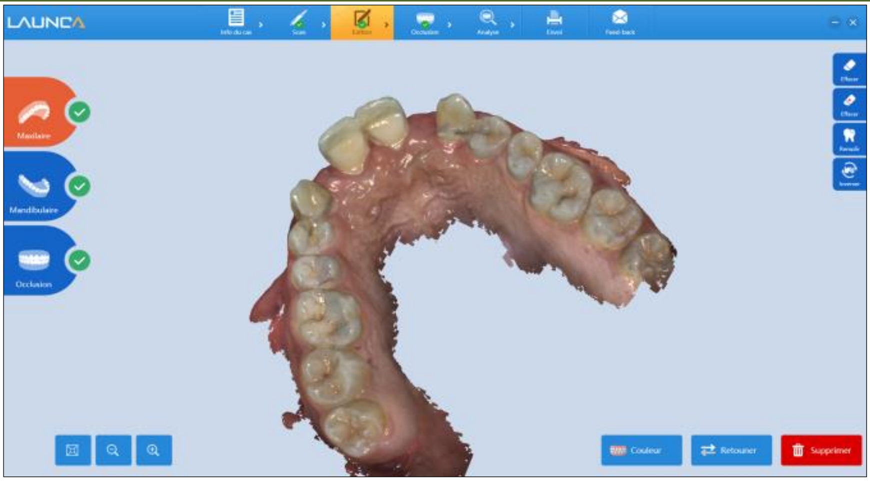

Figure 10: Digital scan of the preparation

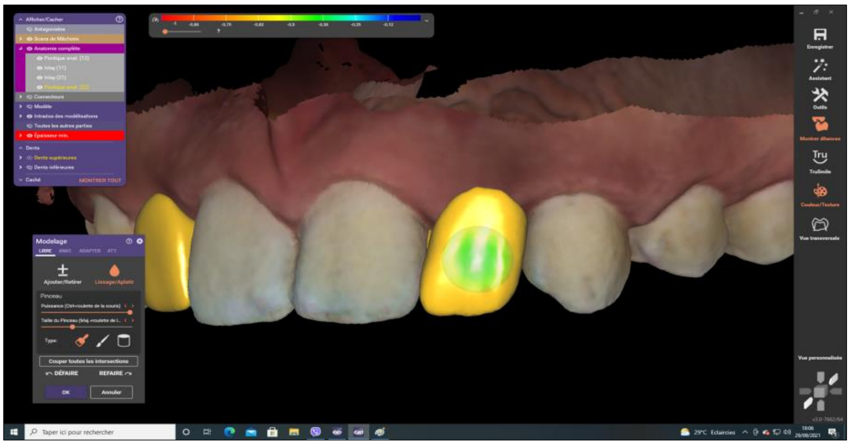

Figure 11: Digital conception

Figure 12: Cantilever bridges fabricated using CAD/CAM (all-ceramic material IPS Empress)

After fabrication, both prostheses were evaluated during a clinical try-in appointment. Their fit, esthetic integration, and relationship with the adjacent teeth were assessed. After the patient approved the proposed result, the seating and adaptation of both prostheses were verified clinically.

The definitive adhesive cementation was performed under rubber dam isolation. The intaglio surfaces of the prostheses were etched with 4% hydrofluoric acid (Porcelain Etchant® (9.5% hydrofluoric acid gel; BISCO, Inc., Schaumburg, IL, USA;) for 30 seconds, thoroughly rinsed, and air-dried. A silane coupling agent (Monobond N® universal primer (Ivoclar Vivadent AG, Schaan, Liechtenstein;) was then applied for 2 minutes.

The palatal surfaces of both maxillary central incisors were conditioned with 37% phosphoric acid (Total Etch®, Ivoclar Vivadent AG, Schaan, Liechtenstein) for 30 seconds, followed by thorough rinsing and drying. A universal adhesive (All-Bond Universal® light-cured dental adhesive (BISCO, Inc., Schaumburg, IL, USA;) was subsequently applied and light-cured for 20 seconds.

The two resin-bonded fixed dental prostheses were then luted with a dual-cure adhesive resin cement (Duo-Link Universal™ adhesive resin cement (BISCO, Inc., Schaumburg, IL, USA). Excess cement was carefully removed, and each surface was light-cured for 20 seconds. This polymerization cycle was repeated three times to promote adequate polymerization of the resin cement.

After cementation, the occlusion was assessed under both static and dynamic conditions. Final finishing and polishing were performed to achieve smooth and well-adapted restoration margins.

The patient expressed satisfaction with the final esthetic and functional result and received instructions regarding appropriate oral hygiene and regular maintenance (Fig 13).

Figure 13: Final restoration showing good esthetic and functional results

DISCUSSION

Anterior tooth replacement remains a significant challenge in prosthodontics, particularly when a single edentulous space is involved.

To address this, multiple treatment approaches exist, ranging from opening the space followed by prosthetic replacement, to closing the gap and transforming the canines into lateral incisors [18].

In such situations, the choice of treatment depends not only on the general clinical context, patient age, financial situation, and occlusal status, but also on personal preferences regarding fixed restorations and an evidence-based prognostic assessment.

Ultimately, for this specific case, several anatomical and patient-centered factors strongly directed the therapeutic decision toward a cantilever RBFDP.

Firstly, although implant therapy is often considered a first-line option for single-tooth replacement, pre-operative computed tomography (CBCT) revealed severely narrow ridge dimensions at the sites of the missing upper lateral incisors (12 and 22). Opting for implants would have required extensive bone augmentation surgeries, which the patient wished to avoid due to increased cost, morbidity, and treatment duration.

Secondly, since the adjacent central incisors and canines were completely sound and free of restorations, conventional fixed partial dentures were ruled out to adhere to the principles of minimally invasive dentistry.

Finally, following recent orthodontic debonding, providing a stable, fixed, and highly aesthetic solution was paramount to prevent orthodontic relapse and restore patient confidence.

Indeed, over recent years, the all-ceramic cantilever (single-retainer) resin-bonded fixed dental prosthesis (RBFDP) has emerged as a highly conservative and biologically favorable option for anterior tooth replacement [19-21]. Consequently, a lithium disilicate cantilever RBFDP emerged as the most predictable, conservative, and biomimetic alternative to fulfill both the functional and aesthetic demands of this young patient.

Comparative Longevity: Single-Retainer versus Dual-Wing Configurations

When evaluating the predictability and longevity of this prosthetic design, literature indicates that while cantilever RBFDPs may show slightly lower survival rates than conventional three-unit fixed bridges, they are significantly more reliable and cost-effective than traditional two-abutment (dual-wing) resin-bonded designs [22].

One of the main complications historically observed with dual-wing configurations was partial debonding, which typically affected only one of the two retainers. Often unnoticed by patients, this unilateral loss of adhesion allowed micromovements that inevitably led to secondary caries beneath the detached wing.

This failure was especially common when the abutments exhibited different axes of physiological mobility—such as an incisor paired with a canine—causing stress concentration and subsequent failure on one side.

Interestingly, clinical experience has demonstrated that simply removing the detached wing from a failing two-wing RBB can significantly extend the longevity of the restoration [11].

This clinical observation is heavily backed by long-term data; in a landmark study, Kern reported a five-year survival rate of 92.3% for cantilever RBBs compared to only 73.9% for two-wing designs over the same period [23]. Furthermore, a comprehensive literature review by Pjetursson, [24], confirmed these findings, estimating the five-year survival of cantilever RBFDPs between 86.9% and 94.4%, while maintaining a favorable ten-year survival rate of 75.2% to 84.4%.

By contrast, the cantilever configuration avoids the risk of partial debonding entirely, offering superior esthetics, easier hygiene access, and no chance of undetected debonding with underlying decay [25-26]. Furthermore, this conservative approach maximizes enamel preservation, maintains pulpal vitality, and minimizes postoperative sensitivity, representing a clear biological advantage over more invasive fixed alternatives [19-13].

From a clinical standpoint, a cantilever bridge can be delivered in as few as two appointments without initial operative intervention, safely preserving the option for future dental implant therapy if required. While unpredictable debonding is often perceived as a major limitation, evidence suggests this is typically a consequence of technical design, clinical technique, or poor case selection rather than an inherent flaw of the treatment itself. When utilized appropriately with strict case selection, cantilever resin-bonded bridges yield excellent, highly predictable long-term outcomes [27, 28].

Material Selection: Zirconia versus Lithium Disilicate

When selecting the ceramic material for all-ceramic cantilever RBFDPs, literature demonstrates that they exhibit higher survival rates and more favorable esthetic outcomes compared with metal-ceramic alternatives, reinforcing their reliability in anterior tooth replacement [21-29].

Historically, zirconia has been considered a material of choice due to its high mechanical strength, fracture resistance, and ability to blend harmoniously with the natural dentition. Furthermore, biomechanical analyses demonstrate that zirconia restorations incorporating a 3-mm incisal overlap exhibit high fatigue resistance, outperforming lithium disilicate and E-glass fiber-reinforced systems [30, 31].

Long-term clinical studies support this evidence, with Kern and colleagues reporting zirconia survival rates of 100% at three to six years and 98.2% at ten years [32]. Similarly, newer generations of zirconia, such as 5% yttria-stabilized tetragonal zirconia polycrystal (5Y-TZP), have shown clinical promise, displaying high failure-free survival rates when excluding isolated debonding events [33, 34].

Nevertheless, a significant cohort of clinicians prefers silica-based glass-ceramics, particularly lithium disilicate, due to their superior and highly predictable adhesion potential. Although actual initial bond strength values can be similar to zirconia, the chemical nature of the resin bond to etched and silanized silica-based ceramics is inherently more durable over time [35].

Clinical evidence regarding the use of lithium disilicate for anterior cantilever resin-bonded fixed dental prostheses remains relatively limited. (Sun., 2013) [36], reported a case series of 35 patients treated with cantilevered IPS e.max Press veneer-retained fixed partial dentures, with a mean follow-up of 46.57 months and a 100% survival rate. In a retrospective clinical study, (Sailer., 2013) [37], evaluated single-retainer glass-ceramic resin-bonded fixed dental prostheses at a mean follow-up of 6 years. Among the 35 RBFDPs available for follow-up, the 6-year survival rate was 100%, with no debonding recorded; however, ceramic chipping occurred in 5.7% of the restorations. These findings suggest promising short- to medium-term clinical outcomes for lithium disilicate cantilever RBFDPs, although the available clinical evidence remains limited.

However, this material choice introduces a distinct biomechanical trade-off: whereas zirconia offers high mechanical strength but may be susceptible to debonding, lithium disilicate demonstrates favorable bonding performance but remains susceptible to structural fracture, particularly in the connector area [38, 13].

Consequently, to safely utilize lithium disilicate, the lower structural fracture strength must be compensated for by strictly incorporating significantly larger connector and retainer wing dimensions [13]. Ultimately, the clinical success of such restorations relies heavily on strict case selection, requiring completely healthy, structurally sound abutment teeth capable of supporting the increased functional load [39, 40], paired with a favorable occlusal context and meticulous execution of the bonding protocol. When these strict parameters are met, cantilevered resin-bonded restorations not only yield excellent long-term predictability, but also restore a post-operative quality of life for the patient that is entirely comparable to implant-supported single crowns [41].

The Impact of the Digital Workflow

Furthermore, recent advancements in digital dentistry have significantly strengthened the predictability and clinical execution of all-ceramic cantilever RBFDPs. While the literature extensively discusses milled or 3D-printed zirconia configurations [42], fully digital workflows have proven equally revolutionary for silica-based glass-ceramics like lithium disilicate.

The integration of intraoral scanning, computer-aided design (CAD), and computer-aided manufacturing (CAM) allows for unparalleled precision in managing the material's specific geometric requirements.

Crucially, the CAD software enables the clinician and laboratory technician to precisely control and verify the cross-sectional area of the connector, ensuring it meets the minimum threshold required to prevent structural fracture of the disilicate wing.

Additionally, fixed prostheses derived from digital impressions consistently exhibit superior marginal adaptation and internal fit compared with those fabricated through conventional impression techniques, thereby optimizing both biological and mechanical performance. From the patient’s perspective, this fully digital workflow drastically minimizes chairside time, eliminates the discomfort of traditional impression trays, and ensures a highly predictable and satisfactory clinical experience [43].

Conclusion

Single-retainer cantilever resin-bonded fixed dental prostheses (RBFDPs) provided a minimally invasive and esthetically satisfactory solution for the replacement of the congenitally missing maxillary lateral incisors in this patient. The use of lithium disilicate-reinforced glass-ceramic combined with a digital CAD/CAM workflow allowed accurate prosthetic design and fabrication while preserving the integrity of the abutment teeth.

The favorable outcome of this case highlights the importance of careful treatment planning, appropriate soft-tissue management, conservative tooth preparation, and strict adherence to the adhesive cementation protocol. Within the limitations of a single case report, lithium disilicate single-retainer cantilever RBFDPs may represent a suitable alternative to implant-supported or conventional fixed prosthetic rehabilitation in carefully selected patients with congenitally missing maxillary lateral incisors. Long-term clinical follow-up is necessary to assess the stability and durability of this treatment approach.

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