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Ceramic Veneers for Esthetic Restoration of Retained Primary Teeth: A 4-year Follow-up Case Report

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Clinical Relevance

The clinical longevity of esthetic ceramic restorations bonded to retained primary teeth is not well documented. This case report provides clinical evidence of the 4-year survival of ceramic veneers used for the esthetic rehabilitation of retained primary canines with mild teeth malalignment.

SUMMARY

Retained primary teeth in the smile zone can cause patient dissatisfaction, especially if associated with malposition of teeth. Orthodontic and prosthetic treatment options to treat the situation may not be accepted by some patients. Therefore, these patients tend to maintain their primary teeth and seek different esthetic options. Ceramic veneers may provide an esthetic treatment option to restore these teeth. However, the survival rates of ceramic restorations in such cases have not yet been established. This case report provides a step-by-step clinical description of the use of ceramic veneers for the restoration of retained primary canines and mild teeth malalignment, with a 4-year follow-up report, in a 28-year-old female patient. During restorative treatment, an effort was made to maintain the occlusion in group function to minimize stress and eliminate destructive forces on the retained primary teeth. After 4 years of function, the patient was still satisfied with the provided treatment.

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INTRODUCTION

Interest in achieving a beautiful smile with bright and well-aligned teeth is dramatically increasing worldwide. Patient dissatisfaction with the appearance of their teeth, and factors related thereto, has been investigated.[1-4] Tin-Oo and others reported dental appearance dissatisfaction in about 53% of 235 adult patients; and of these, around 32% blamed poorly aligned teeth.[3]

Retained primary teeth in the smile zone may cause patient dissatisfaction because of the size, alignment and/or color, along with associated malalignment of other teeth.

Persistent primary teeth are usually associated with impaction or agenesis of their successors. The prevalence of impacted permanent maxillary canines in adult dentition has been well-documented and varies according to population; it is estimated to be between 1% and 3.3% in different parts of the world.[5-10]

Patients with impacted maxillary canines must undergo clinical and radiographic evaluation before treatment. The usual orthodontic treatment of such cases involves surgical exposure of the impacted tooth, then guided orthodontic traction to align the tooth into the dental arch after creation of an adequate space following the extraction of the retained primary tooth.[11]

Multiple complications are associated with this treatment, including bone loss and injury to the adjacent teeth and soft tissue around the treated teeth.[12-14] Therefore, maintaining retained sound primary teeth may be justified. The literature supports keeping healthy retained primary teeth in adults when such teeth are nonmobile and functioning.[15,16]

It has been stated in the literature that if the tooth structures of retained primary teeth are in good condition, but in poor occlusion or otherwise requiring esthetic improvement, the primary tooth may be retained and reshaped with suitable direct or indirect restorations, such as composite or porcelain.[15] To reshape, resize, or minimally realign teeth, dentists' choices include: composite resin or ceramic laminate veneers.

Direct and indirect composite veneers can be used to address cosmetic dental problems by closing diastemas, changing tooth color, and/or resizing the teeth. However, composite restorations have certain limitations in color stability, wear resistance, and polymerization behavior.[17]

Direct composites are conservative restorations. They are easy to repair, have a relatively low cost, and achieve acceptable esthetic results; therefore, they are indicated in young patients.[18,19]

Indirect composite veneers have been shown to have properties superior to those of the direct composite restorations.[20,21] However, the quality of veneer surfaces, marginal staining, and patient satisfaction were found to be better in ceramic veneers compared with bonded indirect composite restorations.[22,23]

Ceramic laminate veneers are considered to be among the most popular esthetic restorations in clinical dentistry today. The wide acceptance of such esthetic restorations among patients is attributable to the use of ceramic veneers to solve dental problems like minimal malalignment, spaces, tooth discoloration, and/or defects.

The prognosis for any treatment option is critical to the success of the planned treatment. The correct management of retained primary teeth can extend the prognosis for their maintenance. Studies have shown that the prognosis for maxillary and mandibular primary canines is better than that for incisors and first molars.[24,25]

Only a few clinical cases on the restoration of retained primary teeth with ceramic veneers have been reported.[26-31] However, the survival rates of ceramic restorations in such cases have not yet been established. Therefore, this case report describes the esthetic rehabilitation of retained primary canines with malaligned maxillary anterior teeth by using ceramic laminate veneers; a 4-year follow-up is also presented.

CLINICAL CASE REPORT

A 28-year-old medically fit female patient presented to the restorative dentistry clinic seeking an esthetic restorative treatment for her malaligned maxillary teeth in order to achieve a more attractive smile. The patient summarized her chief complaints (in the vernacular) as follows: 1) crooked upper front teeth, 2) remaining unattractive baby teeth, and 3) long upper two centrals.

In a review of her dental history, the patient mentioned that she had performed home bleaching about 2 weeks previously and had no previous history of clenching or grinding her teeth or any other parafunctional habits. She also mentioned a prior orthodontic consultation but preferred to seek different options, such as ceramic veneers.

Clinical Examination

Oral examination revealed the following (Figure 1a through d):

- Good oral hygiene
- Right and left Class I malocclusion with maxillary and mandibular dental crowding
- Retained maxillary right and left primary canines (teeth numbers C and H)

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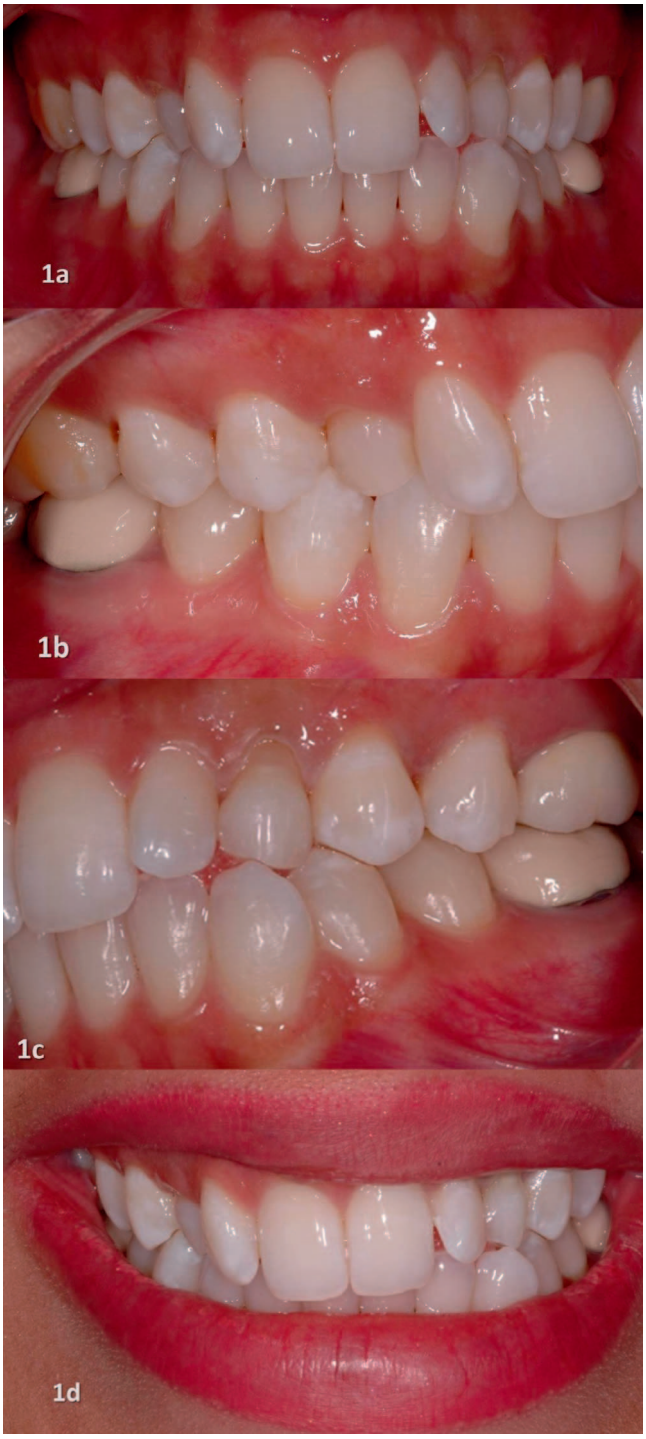

Figure 1. *Preoperative images showing teeth malalignment with retained primary maxillary canines. (a): Front view. (b): Right lateral view. (c): Left lateral view. (d) Front smile view.*

- Missing maxillary right and left permanent canines (teeth numbers 6 and 11)
- Rotated maxillary right and left lateral incisors and mandibular left canine (teeth numbers 7, 10, and 22)
- No mobility on the retained primary canines
- No periodontal pockets

Radiographic examination revealed the presence of impacted maxillary permanent canines and retained primary predecessors with good roots.

Treatment Options

Although the patient was not interested in orthodontic treatment, both orthodontic and oral surgery consultations were performed to finalize the treatment options to address her dental needs and concerns. The findings of clinical and radiographic examinations were presented and discussed with the patient, and treatment options, with potential risks and complications of each option, were presented. However, further diagnostic examinations and images were required to determine the exact locations of the impacted teeth and to evaluate the risks and time needed for the oral surgery/orthodontic treatments. Two treatment options were presented: option 1 was extraction of the retained primary canines with or without surgical extraction of impacted successor teeth, orthodontic treatment to correct the malalignment, and then implants to replace the maxillary permanent canines; option 2 was extraction of the retained primary canines, followed by surgical exposure and guided traction of the impacted permanent canines, and orthodontic treatment to correct the malalignment.

However, the patient wanted to maintain her primary teeth for as long as possible and refused any surgical treatment to expose or extract the impacted canines. She was interested in achieving esthetic results with less-invasive procedures, less time and without orthodontia. Therefore, the following options were presented, with their limitations and disadvantages: option 3 was maintaining the retained primary canines and restoring them with composite resin restorations; and option 4 was maintaining the retained primary canines and preparing them, with the maxillary anterior teeth, for ceramic laminate veneers.

After thorough discussion, the patient opted to veneer eight maxillary teeth, from the maxillary right first premolar to maxillary left first premolar, including the retained primary canines, with ceramic laminate restorations. However, she was informed that the impacted permanent canines would need to be monitored for early diagnosis of bony lesions or resorption.

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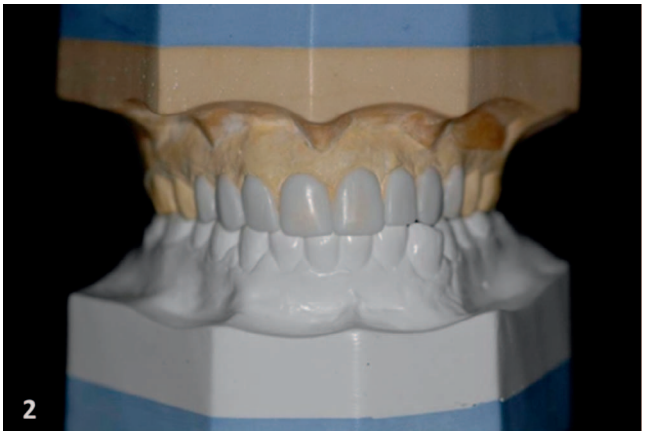

Figure 2. *Front view of the diagnostic wax-up for teeth 5, C, 7, 8, 9, 10, H, and 12, which were planned to receive ceramic laminate veneers.*

Diagnostic Wax-up

Maxillary and mandibular alginate impressions (Jeltrate, Dentsply Pharmaceuticals, York, PA, USA) were taken for the construction of study models and fabrication of maxillary diagnostic wax-ups for the teeth that were planned for ceramic laminate veneers. These were assessed, visualized, and discussed with the patient, along with the possible outcomes of the proposed treatment (Figure 2). The diagnostic wax-up model was duplicated for construction of a custom transparent plastic stent to be used in the fabrication of the temporary veneers.

Tooth Preparation and Temporary Veneers

Tooth preparation was initiated with nos. 834-016 and 834-021 depth-oriented diamond burs of 0.3 mm and 0.5 mm diameter, respectively (Hager & Meisinger GmbH, Neuss, Germany). Diamond burs nos. 852-012 and 852-014 (Hager & Meisinger GmbH) were then used to prepare the teeth, with reduction ranging from 0.3 mm to 0.5 mm, with equal gingival or slightly supragingival chamfer finish lines. The incisal edges were reduced for about 1.0 to 1.5 mm with round facial incisal line angles and a butt-joint margin along the lingual incisal edges. For teeth numbers 5 and 12, facial round chamfer preparations were used without reduction in the lengths of the cusp edges to preserve the natural occlusal surface. The interproximal contacts were left intact for all teeth. For lateral incisors, more reduction was performed, especially on tooth number 10, to correct the malalignment of these teeth. To preserve the structure of the retained primary canines, the facial surface of tooth number C received minimal facial reduction, while tooth number H was just rounded, with about 0.3 mm chamfer finish line on both teeth.

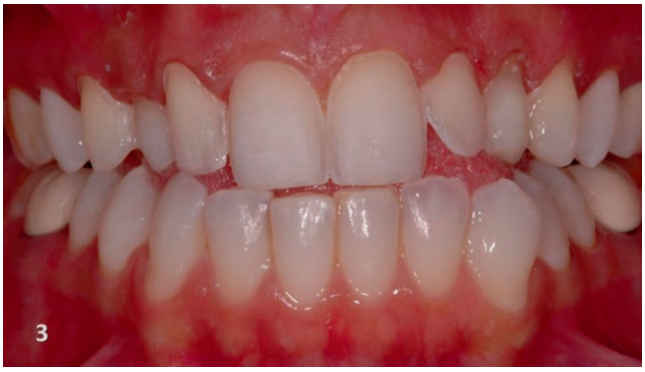

Figure 3. *Front view of the prepared teeth 5, C, 7, 8, 9, 10, H, and 12 for ceramic laminate veneers.*

After the preparation was finalized (Figure 3), Ultrapak size 0 retraction cord (Ultradent, South Jordan, UT, USA) was placed around each tooth. An immediate dentin sealing procedure was carefully performed on the areas of exposed dentin on teeth numbers 7 and 10 using OptiBond Solo Plus adhesive bonding agent (Kerr, Orange, CA, USA) according to the manufacturer's instructions. The final impression was taken with President Plus polyvinyl siloxane impression material (Coltène Whaledent AG, Altstätten, Switzerland) in a full-arch tray, and bite was registered with a face bow record.

After discussion with the patient, A1 Vitapan classic shade was selected as a stump-shade for the prepared teeth (VITA Zahnfabrik H. Rauter GmbH & Co. KG, Bad Säckingen, Germany), and BL2 bleach shade (Ivoclar Vivadent AG, Schaan, Liechtenstein) was the selected shade for the final laminate veneers.

Temporary veneers were fabricated with self-cure provisional material Systemp.c&b II (Ivoclar Vivadent AG) in a customized plastic stent. The spot-etch technique was used to help hold the temporary in place by applying a very small drop of Total Etch 37% phosphoric acid (Ivoclar Vivadent AG) onto the facial surfaces of prepared teeth for 10 seconds, after which teeth were thoroughly rinsed for 30 seconds and air-dried with gentle air spray. Areas of preparation that were treated with immediate dentin sealing were isolated with a separating layer of petroleum jelly before fabricating the temporary veneers. Interproximal embrasures of the splinted provisional restoration were opened, and gingival excess was removed carefully by means of a Bard-Parker knife with scalpel blade number 12. Occlu-

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sion was then checked, and the provisional was finished and polished.

The final impression with the mandibular cast model and the bite registration were sent to the dental laboratory, where ceramic laminate veneers were fabricated with the BL2 shade of the IPS e.max Press lithium disilicate glass-ceramic system (Ivoclar Vivadent AG). Instructions were given for maintaining the occlusion in a bilateral group function with decreased load on the retained primary canines to protect them during function.

Cementation

Before the patient arrived for the cementation visit, the ceramic veneers were tried-in on the working cast to evaluate the contours, marginal fit, proximal contacts, and axial contours.

The provisional veneers were carefully removed, and teeth were cleaned with a soft rubber cup and fine pumice. Teeth were isolated with cotton rolls, and laminate veneers were tried-in individually and all together in the presence of the transparent shade of the Variolink II Try-In paste (Ivoclar Vivadent AG).

After careful evaluation and patient's approval of the laminate veneers, the tissue surface of each veneer was prepared for final cementation. Cleaning with Total Etch 37% phosphoric acid (Ivoclar Vivadent AG) was performed followed by thorough rinsing. Each veneer was acid-etched according to the manufacturer's instructions with 9% hydrofluoric acid for 20 seconds (Ultradent), thoroughly rinsed with water spray, and dried with oil-free air.

A thin layer of Monobond-S silane primer (Ivoclar Vivadent AG) was then applied to the tissue surface and left for 60 seconds. Subsequently, any remaining excess was dispersed with a stream of air.

Thin, clear Mylar matrix strips (Patterson Dental Supplies, St Paul, MN, USA) were used to protect adjacent tooth structures from the etchant/bonding agents. Prepared tooth surfaces were acid-etched for 15-30 seconds with Total Etch 37% phosphoric acid (Ivoclar Vivadent AG), thoroughly rinsed with water/air spray for 30 seconds, then lightly air-dried with a gentle stream of compressed air. Adhesive bonding agent (Excite DSC, Ivoclar Vivadent AG) was then applied, according to the manufacturer's instructions, on the prepared tooth surfaces for 10 seconds, followed by light drying with a gentle stream of compressed air to spread an even thickness of the bonding agent on the prepared tooth surfaces and to evaporate the solvent in the bonding agent. The bonding agent was then light-cured for 10 seconds with an Elipar S10 LED curing unit at 1100 mW/cm^2 (3M ESPE, Minneapolis, MN, USA).

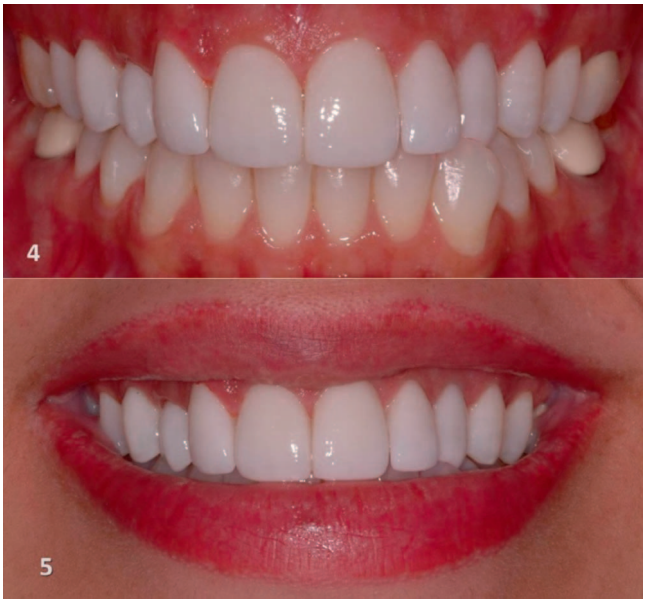

Figure 4. *Front view of the cemented ceramic laminate veneers.*
Figure 5. *Postoperative front view of the patient's smile.*

Laminate veneers were cemented, starting with the two central incisors, with a transparent shade of Variolink II base resin cement (Ivoclar Vivadent AG) according to the manufacturer's instructions. Veneers were light-cured for 40 seconds on the gingival, facial, incisal, mesial, and distal surfaces of each veneer. The excess luting cement was gently removed, and occlusion was examined in centric and eccentric movements by means of ultrathin articulating paper (Henry Schein, Melville, NY, USA) to ensure that the occlusion was maintained in a bilateral group function and to eliminate contacts on the retained primary teeth during eccentric movements. Occlusion was adjusted with fine finishing diamond burs then polished with diamond-impregnated cups and points (Brasseler, Savannah, GA, USA). Veneers were then viewed from each profile and were finally inspected by the patient (Figures 4 and 5).

After 1 week, the patient returned for evaluation of her gingival health and any further adjustment or finishing. She was satisfied with the result of the cemented laminate veneers and reported no sensitivity or discomfort.

Four-Year Follow-up

A 4-year follow-up visit was arranged to evaluate the status of the retained primary teeth, the

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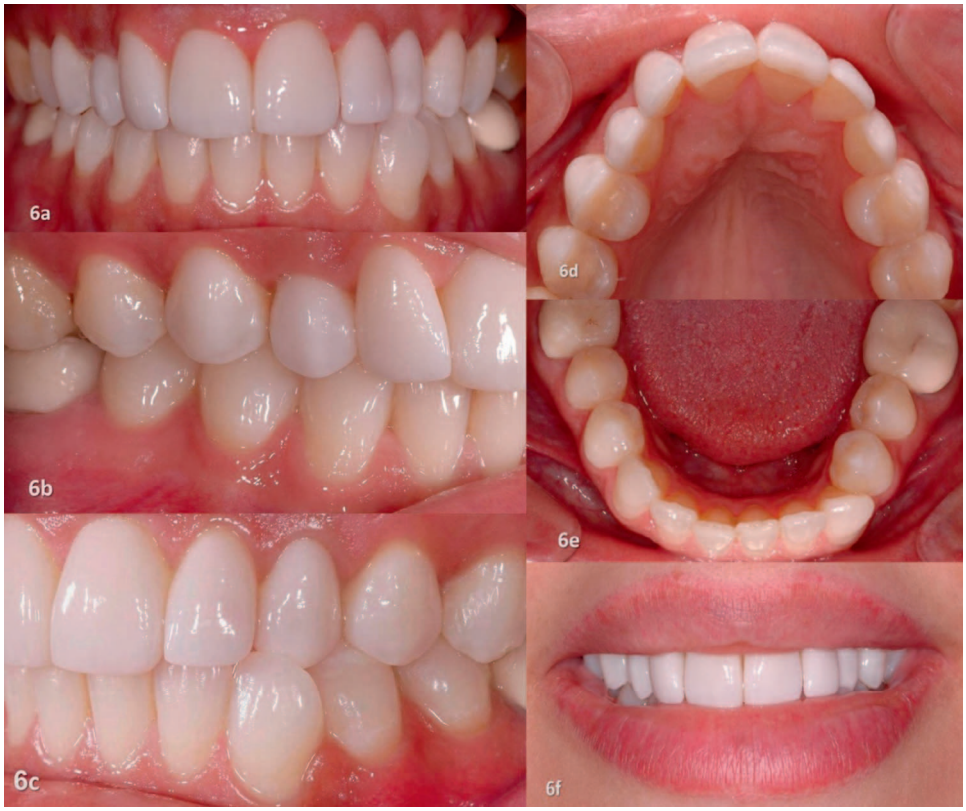

Figure 6. *Four-year follow-up images. (a): Front view. (b): Right lateral view. (c): Left lateral view. (d): Maxillary occlusal view. (e): Mandibular occlusal view. (f); Front smile view.*

occlusion and the ceramic laminate veneers (Figure 6a through f). No mobility, caries lesions or periodontal pockets were found on the retained primary teeth. No marginal gap, fracture, or debonding was observed on the laminate veneers. There was no sensitivity or discomfort on the veneered teeth. Some plaque accumulation, mild gingival inflammation, and staining could be seen on some of the teeth. Therefore, oral hygiene instructions were reinforced, and the patient was referred to the hygienist for professional tooth cleaning. Radiographs showed no noticeable changes in the status of the retained primary teeth or the impacted permanent teeth.

DISCUSSION

Dental malalignment associated with small-sized retained primary teeth may dramatically affect the esthetics of the anterior teeth and, therefore, the smile. This case report describes a detailed procedure for esthetic rehabilitation of the maxillary anterior teeth in a 28-year-old female patient with retained primary canines and mild dental malalignment who presented to the dental clinic to improve her smile. A list of the materials and instruments used in this case is shown in Table 1.

Treatment of impacted maxillary canines is considered a common clinical challenge.[32] Comprehensive diagnostic evaluation is required to finalize the treatment options. Options of treatment may include[6,33] 1) oral surgery and orthodontic and prosthodontic treatments, or 2) no treatment if the patient does not accept the first option or if the impacted canines are severely displaced with no evidence of adjacent pathology or teeth resorption. However, a periodic clinical and radiographic evaluation should be maintained so that any pathologic changes can be noted.

Surgical intervention with orthodontic and prosthetic treatments may provide a good long-term prognosis with reliable results, especially for young patients; therefore, this is a commonly accepted treatment option. However, this option may not be accepted by others because of the lengthy procedures and risks involved, including possible surgical complications, bone loss, and/or periodontal problems.[12-14] Therefore, these patients tend to seek different treatment options.

Advantages and Limitations

In this case, restorative treatment options with ceramic or composite veneers were offered to the

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Table 1: *List of Materials and Instruments Used in This Case*

Material/Instrument	Description/Use	Manufacturer
Jeltrate	Alginate impression material	Dentsply Pharmaceuticals, York, PA, USA
834-016 bur	Depth-oriented diamond burs	Hager & Meisinger GmbH, Neuss, Germany
834-021 bur		
852-012 bur	Tapered round-end chamfer diamond burs	Hager & Meisinger GmbH.,Neuss, Germany
852-014 bur		
Ultrapak	Tissue retraction cord	Ultradent, South Jordan, UT, USA
Total-Etch	37% phosphoric acid etchant	Ivoclar Vivadent AG, Schaan, Liechtenstein
OptiBond Solo Plus	Adhesive agent (for immediate dentin sealing)	Kerr, Orange, CA, USA
President Plus	Polyvinyl siloxane impression material	Coltène Whaledent AG, Altstätten, Switzerland
A1, VITAPAN	Classic shade tab	VITA Zahnfabrik H. Rauter GmbH & Co. KG, Bad Säckingen, Germany
BL2	Bleach shade tab	Ivoclar Vivadent AG, Schaan, Liechtenstein
Systemp c&b II	Self-cure provisional material	Ivoclar Vivadent AG, Schaan, Liechtenstein
12-fluted carbide and fine diamond burs	Finishing of provisional restorations	Ultradent, South Jordan, UT, USA
Rubber points and cups	Composite polishing kit	Shofu Inc, Kyoto, Japan
IPS e.max Press	Lithium disilicate glass-ceramic veneers	Ivoclar Vivadent AG, Schaan, Liechtenstein
Variolink II Try-In	Try-in paste	Ivoclar Vivadent AG, Schaan, Liechtenstein
Ultradent Porcelain Etch	9% hydrofluoric acid	Ultradent, South Jordan, UT, USA
Monobond-S	Silane primer	Ivoclar Vivadent AG, Schaan, Liechtenstein
Mylar strip	A clear matrix band	Patterson Dental Supplies, St Paul, MN, USA
Excite DSC	Adhesive bonding agent	Ivoclar Vivadent AG, Schaan, Liechtenstein
Elipar S10 LED	Light-curing unit	3M ESPE, Minneapolis, MN, USA
Variolink II	Resin luting cement	Ivoclar Vivadent AG, Schaan, Liechtenstein
OptraStick	Veneer placement tip	Ivoclar Vivadent AG, Schaan, Liechtenstein
Articulating Papers	Occlusion checker	Henry Schein, Melville, NY, USA
Fine diamond burs and diamond-impregnated cups and points	Porcelain finishing and polishing kits	Brasseler, Savannah, GA, USA

patient. Advantages, disadvantages, and limitations of the composite resin restorations, such as color instability, limited mechanical properties, and overall esthetic results were explained.

Advantages of ceramic veneers, including the ability to recreate natural tooth dimensions and proportions, correct malalignment, and change tooth color were also discussed. Conversely, the disadvantages of tooth preparation for ceramic laminate veneers and limitations of their repairability compared with those of composite resin, in addition to the limitations to achieve good alignment were all explained. The patient was also informed that tooth number 10 would need more aggressive reduction to create acceptable alignment.

Potential Problems

In the present case, after an orthodontic and oral surgery consultation, the patient decided to keep and modify her primary canines without surgical or orthodontic intervention. The risks of root resorption, extensive caries, and/or periodontal disease, all of which can lead to extraction of the retained primary teeth, were explained. The patient was also informed about the prosthetic options for replacing these teeth.

Dentin Exposure and Postoperative Sensitivity

Teeth with malalignment may require aggressive reduction, with care taken to avoid pulpal damage during tooth preparation. In the present case, both lateral incisors required more reduction (especially tooth number 10); therefore, an effort was made to align these teeth as much as possible without violating the pulp.

Exposing dentin during the preparation of malaligned teeth or teeth with gingival recession is inevitable. Hence, immediate dentin sealing may be used to improve dentin bond strength and decrease postoperative sensitivity by the gentle application of a dentin bonding agent to the freshly cut dentin surfaces immediately after tooth preparation.[34-38] A

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light-cured three-step total-etch bonding agent was used here.

Long-Term Prognosis

The long-term prognosis of restored retained primary teeth depends on multiple factors, such as root resorption and risk of destructive recurrent caries, periodontal disease, and debonding or failure of the restoration. In this case, an effort was made to maintain occlusion in a bilateral group function to minimize stress and eliminate destructive forces on the retained primary teeth during function. The rate of root resorption of the retained primary teeth varies widely among individuals and has been found to decrease with age.[39]

Bond strength to the tooth structure is an important factor in the survival of the bonded restoration. Optimum bond strength of resin restorations to the conditioned enamel and dentin of primary teeth has been documented in the literature.[40-42] Furthermore, this bond strength was found to be similar to that of the permanent teeth.[43-47] Meola and Papaccio[48] reported that grinding the enamel surface with a diamond bur helps remove the prismless enamel layer, resulting in improved bond of the restoration to the enamel.

Survival of ceramic veneers has been well documented in the literature.[49-52] A recent investigation evaluated the 21-year cumulative survival rate of porcelain laminate veneers bonded to prepared enamel and estimated it to be 96% ± 2%.[49]

In the present case, a lithium disilicate glass-ceramic system (IPS e.max Press, Ivoclar Vivadent AG) was used to fabricate the laminate veneers. The fracture rate of IPS e.max ceramic veneers in a 4-year cross-sectional study was found to be relatively low (1.3%).[52]

In another study, lithium disilicate ceramic veneers cemented on 60 incisors and canines with different preparation designs showed 100% survival rates.[51] Although it has been reported in the literature that retained primary canines have a good predictable life span,[24] the long-term prognosis of the restored retained primary teeth remains unclear. Therefore, further research and clinical studies in this area are warranted.[15]

CONCLUSIONS

- Using ceramic laminate veneers to restore maxillary retained primary canines can provide satisfactory and esthetic clinical results in terms of correcting mild discrepancies in tooth shape, size, and occlusion.
- This case report provides clinical evidence of an esthetic restorative treatment of malaligned maxillary anterior teeth, with retained primary canines, by the use of ceramic laminate veneers; the 4-year follow-up is also reported.
- It is critical that the patient understand the limitations of this treatment option and the odds of losing one or both retained primary teeth in the future, as well as proposed treatment options to replace them.
- More research and clinical reports are needed on the long-term survival of indirect restorations on retained primary teeth.

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REFERENCES

1. Samorodnitzky-Naveh GR, Geiger SB, & Levin L (2007) Patients' satisfaction with dental esthetics *Journal of the American Dental Association* **138(6)** 805-808.
2. Moura C, Cavalcanti AL, Gusmão ES, Soares RS, Moura FT, & Santillo PM (2013) Negative self-perception of smile associated with malocclusions among Brazilian adolescents *European Journal of Orthodontics* **35(4)** 483-490.
3. Tin-Oo MM, Saddki N, & Hassan N (2011) Factors influencing patient satisfaction with dental appearance and treatments they desire to improve aesthetics *BioMed Central Oral Health* **11(Feb)** 6.
4. Qualtrough AJ, & Burke FJ (1994) A look at dental esthetics *Quintessence International* **25(1)** 7-14.
5. Schindel RH, & Duffy SL (2007) Maxillary transverse discrepancies and potentially impacted maxillary canines in mixed-dentition patients *Angle Orthodontist* **77(3)** 430-435.
6. Bishara SE (1992) Impacted maxillary canines: A review *American Journal of Orthodontics and Dentofacial Orthopedics* **101(2)** 159-171.
7. Shapira Y, & Kuftinec MM (1998) Early diagnosis and interception of potential maxillary canine impaction *Journal of the American Dental Association* **129(10)** 1450-1454.
8. Sajnani AK, & King NM (2014) Prevalence and characteristics of impacted maxillary canines in southern Chinese children and adolescents *Journal of Investigative and Clinical Dentistry* **5(1)** 38-44.
9. Aydin U, Yilmaz HH, & Yildirim D (2004) Incidence of canine impaction and transmigration in a patient population *Dentomaxillofacial Radiology* **33(3)** 164-169.
10. Shah RM, Boyd MA, & Vakil TF (1978) Studies of permanent tooth anomalies in 7,886 Canadian individuals I: Impacted teeth *Dental Journal* **44(6)** 262-264.
11. Litsas G, & Acar A (2011) A review of early displaced maxillary canines: Etiology, diagnosis and interceptive treatment *Open Dentistry Journal* **5(Mar)** 39-47.

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12. Bishara SE, Kommer DD, McNeil MH, Montagano LN, Oesterle LJ, & Youngquist HW. (1976) Management of impacted canines *American Journal of Orthodontics* **69(4)** 371-387.
13. Ericson S, & Kurol PJ (2000) Resorption of incisors after ectopic eruption of maxillary canines: A CT study *Angle Orthodontist* **70(6)** 415-423.
14. Anand KS, & Nigel MK (2014) Complications associated with the occurrence and treatment of impacted maxillary canines *Singapore Dental Journal* **35(Dec)** 53-57.
15. Robinson S, & Chan MF (2009) New teeth from old: treatment options for retained primary teeth *British Dental Journal* **207(7)** 315-320.
16. Aktan AM, Kara I, Sener I, Bereket C, Celik S, Kirtay M, Ciftçi ME, & Arici N (2012) An evaluation of factors associated with persistent primary teeth *European Journal of Orthodontics* **34(2)** 208-212.
17. Cramer NB, Stansbury JW, & Bowman CN (2011) Recent advances and developments in composite dental restorative materials *Journal of Dental Research* **90(4)** 402-416.
18. Allen PF (2003) Use of tooth-coloured restorations in the management of tooth wear *Dental Update* **30(10)** 550-556.
19. Özcan M, & Pekkan G (2013) Effect of different adhesion strategies on bond strength of resin composite to composite-dentin complex *Operative Dentistry* **38(1)** 63-72.
20. Terry DA, & Leinfelder KF (2006) Development of a processed composite resin restoration: Preparation and laboratory fabrication Part I *International Dentistry SA* **8(4)** 12-20.
21. Terry DA, & Leinfelder KF (2006) Development of a processed composite resin restoration: Adhesive and finishing protocol Part II *International Dentistry SA* **8(4)** 44-53.
22. Gresnigt MM, Kalk W, & Ozcan M (2013) Randomized clinical trial of indirect resin composite and ceramic veneers: Up to 3-year follow-up *Journal of Adhesive Dentistry* **15(2)** 181-190.
23. Meijering AC, Roeters FJ, Mulder J, & Creugers NH (1997) Patients' satisfaction with different types of veneer restorations *Journal of Dentistry* **25(6)** 493-497.
24. Haselden K, Hobkirk JA, Goodman JR, Jones SP, & Hemmings KW (2001) Root resorption in retained primary canine and molar teeth without permanent successors in patients with severe hypodontia *International Journal of Paediatric Dentistry* **11(13)** 171-178.
25. Stanley HR, Collett WK, & Hazard JA (1996) Retention of a maxillary primary canine: Fifty years above and beyond the call of duty *ASDC Journal of Dentistry for Children* **63(2)** 123-130.
26. McConnell RJ, Boksman L, & Jones G (1987) Esthetic restoration of a primary canine in the adult dentition by means of an etched porcelain veneer. Report of a case *Quintessence International* **18(2)** 121-124.
27. Caine DR (1987) The aesthetic restoration of ankylosed primary teeth utilizing porcelain laminates. Report of a case study *New York State Dental Journal* **53(2)** 21-23.
28. Aron VO (1995) Porcelain veneers for primary incisors: A case report *Quintessence International* **26(7)** 455-457.
29. Aristidis GA (2000) Etched porcelain veneer restoration of a primary tooth: A clinical report *Journal of Prosthetic Dentistry* **83(5)** 504-507.
30. Beyabanaki E, & Alikhasi M (2014) Restoration of primary canines with porcelain laminate veneers: A clinical report *Oral Health and Dental Management* **13(3)** 717-720.
31. Christian FS (2015) An interdisciplinary noninvasive all-ceramic treatment concept for nonsyndromic oligodontia in adolescence *Quintessence International* **46(2)** 111-118.
32. Counihan K, Al-Awadhi EA, & Butler J (2013) Guidelines for the assessment of the impacted maxillary canine *Dental Update* **40(9)** 770-775.
33. McSherry PF (1998) The ectopic maxillary canine: A review *British Journal of Orthodontics* **25(3)** 209-216.
34. Pashley EL, Comer RW, Simpson MD, Horner JA, Pashley DH, & Caughman WF (1992) Dentin permeability: Sealing the dentin in crown preparations *Operative Dentistry* **17(1)** 13-20.
35. Magne P, & Belser U (2002) Immediate dentin bonding In: Magne P, & Belser U (eds) *Bonded Porcelain Restorations in the Anterior Dentition: A Biomimetic Approach* Quintessence, Chicago IL 270-273,358-363.
36. Magne P, Kim TH, Cascione D, & Donovan TE (2005) Immediate dentin sealing improves bond strength of indirect restorations *Journal of Prosthetic Dentistry* **94(6)** 511-519.
37. Magne P, So WS, & Cascione D (2007) Immediate dentin sealing supports delayed restoration placement *Journal of Prosthetic Dentistry* **98(3)** 166-174.
38. Magne P (2005) Immediate dentin sealing: A fundamental procedure for indirect bonded restorations *Journal of Esthetic and Restorative Dentistry* **17(3)** 144-154.
39. Kurol J, & Thilander B (1984) Infraocclusion of primary molars and the effect on occlusal development: A longitudinal study *European Journal of Orthodontics* **6(4)** 277-293.
40. Scherrer SS, Cesar PF, & Swain MV (2010) Direct comparison of the bond strength results of the different test methods: A critical literature review *Dental Materials* **26(2)** e78-e93.
41. Lenzi TL, Gimenez T, Tedesco TK, Mendes FM, Rocha RO, & Raggio DP. (2015) Adhesive systems for restoring primary teeth: A systematic review and meta-analysis of in vitro studies *International Journal of Paediatric Dentistry* 12 November 2015, doi: 10.1111/ipd.12210. [Epub ahead of print].
42. Kensche A, Dähne F, Wagenschwanz C, Richter G, Viergutz G, & Hannig C (2016) Shear bond strength of different types of adhesive systems to dentin and enamel of deciduous teeth in vitro *Clinical Oral Investigation* **20(4)** 831-840.
43. Fagan TR, Crall JT, Jensen ME, Chalkley Y, & Clarkson B (1986) A comparison of two dentin bonding agents in primary and permanent teeth *Pediatric Dentistry* **8(3)** 144-146.

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44. García-Godoy F, & Donly KJ (2002) Dentin/enamel adhesives in pediatric dentistry *Pediatric Dentistry* **24(5)** 462-464.

45. Ilie N, Schöner C, Bücher K, & Hickel R (2014) An in-vitro assessment of the shear bond strength of bulk-fill resin composites to permanent and deciduous teeth *Journal of Dentistry* **42(7)** 850-855.

46. Shimada Y, Senawongse P, Harnirattisai C, Burrow MF, Nakaoki Y, & Tagami J (2002) Bond strength of two adhesive systems to primary and permanent enamel *Operative Dentistry* **27(4)** 403-409.

47. Tedesco TK, Soares FZ, Grande RH, Filho LE, & Rocha RO (2014) Effect of cariogenic challenge on bond strength of adhesive systems to sound and demineralized primary and permanent enamel *Journal of Adhesive Dentistry* **16(5)** 421-428.

48. Meola M, & Papaccio GA (1986) Scanning electron microscope study of the effect of etching time and mechanical pre-treatment on the pattern of acid etching on the enamel of primary teeth *International Dental Journal* **36(1)** 49-53.

49. Layton DM, & Walton TR (2012) The up to 21-year clinical outcome and survival of feldspathic porcelain veneers: Accounting for clustering *International Journal of Prosthodontics* **25(6)** 604-612.

50. Layton DM, Clarke M, & Walton TR (2012) A systematic review and meta-analysis of the survival of feldspathic porcelain veneers over 5 and 10 years *International Journal of Prosthodontics* **25(6)** 590-603.

51. Bergoli CD, Meira JBC, Valandro LF, & Bottino MA (2014) Survival rate, load to fracture, and finite element analysis of incisors and canines restored with ceramic veneers having varied preparation design *Operative Dentistry* **39(5)** 530-540.

52. Sulaiman TA, Delgado AJ, & Donovan TE (2015) Survival rate of lithium disilicate restorations at 4 years: A retrospective study *Journal of Prosthetic Dentistry* **114(3)** 364-366.

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