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Long-Term Esthetic-Functional Rehabilitation of Unilateral Cleft Lip and Palate With a Cross-Arch Monolithic Zirconia Fixed Dental Prosthesis Following Multidisciplinary Treatment: 5-Year Post-Prosthetic Follow-Up

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ABSTRACT

Objective: This case report describes the esthetic-functional rehabilitation of a patient with unilateral complete cleft lip and palate who was managed multidisciplinarily from 10 to 18 years of age, and reports the clinical outcome 5 years after definitive prosthetic rehabilitation, which was undertaken after late secondary alveolar bone grafting had yielded insufficient bone volume for implant placement.

Clinical Considerations: Phased orthodontic treatment from age 10–17 (slow maxillary expansion, fixed appliances, growth-coordinated space management) was followed by late secondary alveolar bone grafting at age 17, with concurrent extraction of the periodontally compromised lateral incisor. Although grafting achieved meaningful structural and soft-tissue reconstruction of the cleft zone, postoperative cone-beam computed tomography confirmed that the residual bone height and width remained insufficient for implant placement; after the patient declined further augmentation, a six-unit canine-to-canine monolithic zirconia fixed dental prosthesis incorporating a pink-ceramic-extended ovate pontic was adhesively cemented at age 18 with a 10-methacryloyloxydecyl dihydrogen phosphate–containing dual-cure resin cement, combined with continued dual orthodontic retention.

Conclusion: Five years after definitive cementation, the restoration was clinically intact, with non-inflamed abutment periodontal conditions and maintenance of bilateral Class I occlusal relationships, transverse maxillary arch form, and esthetic outcome. Maintenance of the transverse arch form is most plausibly multifactorial and is attributed principally to the sustained orthodontic retention protocol rather than to the anterior restoration. This case illustrates the 5-year performance of cross-arch tooth-supported zirconia rehabilitation combined with prosthetic soft-tissue masking and continued orthodontic retention in a cleft patient in whom implant therapy was not feasible.

Previous presentation: This case was briefly presented as one of four cases within an oral presentation entitled "Multidisciplinary Treatment Approaches in Unilateral Complete Cleft Lip and Palate Patients: A 4-Case Series" (Abstract SB-103) at the XIXth International Turkish Orthodontic Society Symposium, Rixos Tersane, Istanbul, Turkey, November 1–4, 2025. The detailed clinical course, prosthodontic protocol, and 5-year post-prosthetic follow-up reported in the present manuscript have not been previously published or presented in this form.

Clinical Significance: Cross-arch monolithic zirconia rehabilitation with a pink-ceramic-extended ovate pontic can provide an esthetic-functional pathway in cleft lip and palate patients in whom implant therapy is not feasible. In the present case, transverse maxillary arch form was maintained over 5 years under continued orthodontic retention, indicating that anterior-only prosthetic rehabilitation is compatible with preservation of arch form when retention is sustained.

1 | Introduction

Final prosthetic rehabilitation of the cleft alveolus is one of the most demanding components of cleft lip and palate care. The maxillary lateral incisor is the most frequently affected tooth in this population, being either congenitally absent or rendered prosthetically unrestorable by reduced periodontal support within the cleft zone, and its replacement defines the esthetic and functional outcome of the entire treatment sequence. Although orthodontic preparation, transverse correction, and alveolar bone grafting are well-established preliminary steps [1], the prosthetic decision—how to replace the missing tooth in an anatomically and biomechanically compromised site—remains the central long-term clinical question.

Three principal prosthetic strategies are available: orthodontic canine substitution, an implant-supported single crown, and a tooth-supported fixed dental prosthesis (FDP), with the resin-bonded design as a more conservative variant [2]. Canine substitution is generally limited by morphological and color mismatch in the anterior region [3]. Implant-supported rehabilitation is widely regarded as the contemporary first choice when adequate bone volume is available, as it preserves adjacent natural teeth. Resin-bonded FDPs are appropriate when the abutments are intact and periodontally healthy, but are not indicated when splinting of compromised cleft-adjacent teeth is required.

Implant placement in the cleft zone is contingent on adequate three-dimensional alveolar bone volume. Secondary alveolar bone grafting is the established step intended to create these conditions, but reported success rates vary widely (32%–95%), with large cleft defects, the presence of erupted canines, and patient age identified as predictors of suboptimal outcome [4, 5]. When grafting yields insufficient volume, the clinician faces a binary choice between further augmentation or selecting a non-implant prosthetic alternative [6].

When salvage augmentation is not feasible or is declined by the patient, a tooth-supported FDP extending across the cleft remains a clinically valuable solution. A canine-to-canine design is particularly suited because it replaces the missing tooth and splints the abutments adjacent to the cleft, which are themselves frequently affected by reduced bone support and labial recession [7]. Monolithic zirconia is a frequently chosen framework material for this indication, given its high flexural strength [8], favorable biocompatibility, and reduced risk of chipping compared with bilayer designs [9]. Adhesive cementation with 10-methacryloyloxydecyl dihydrogen phosphate (MDP) monomer–containing resin cements supports retention on short or periodontally compromised abutments [10].

Prosthetic options for cleft patients and interdisciplinary cleft workflows have been described repeatedly. What remains scarce is documented information on what happens after an anterior-only tooth-supported reconstruction in a cleft arch: most reports end at delivery of the restoration or provide short, qualitative follow-up, and serial transverse arch dimensions are rarely reported.

The purpose of this report is therefore not to introduce a novel treatment technique, but to document the 5-year outcome of a six-unit cross-arch monolithic zirconia FDP incorporating a pink-ceramic-extended ovate pontic in a patient with unilateral complete cleft lip and palate in whom late secondary grafting did not provide implant-compatible bone volume and further augmentation was declined. Serial cephalometric and arch-dimension records are presented, together with cone-beam computed tomographic (CBCT) verification of the post-grafting bone deficit.

2 | Clinical Report

All clinical procedures were conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent for treatment, photographic and radiographic recording, and academic publication of clinical materials was obtained from the patient. Prosthodontic terminology in this report follows the Glossary of Prosthodontic Terms, 9th edition.

2.1 | Diagnosis

A 10-year-old female sought evaluation for esthetic concerns regarding her smile. She had a right-sided complete cleft of the lip, alveolus, and palate, classified as Veau type III; in the Veau classification, type III denotes a complete unilateral cleft involving the lip, alveolus, and palate (Table 1) [11]. The cleft had been treated with primary lip repair at 3 months and two-flap palatoplasty at 18 months of age. No syndromic features or systemic conditions were present, and the family history was negative for cleft-related anomalies.

Extraoral examination showed nasal tip deviation to the left, flattening of the right alar cartilage, a short columella, and asymmetry of the upper lip with a flattened Cupid's bow that reduced maxillary incisor display during smiling. The facial profile was convex, associated with retrognathic maxilla and mandible (Figure 1).

Intraoral examination revealed a constricted maxillary arch with a residual alveolar defect on the right side. The right permanent lateral incisor was present but with severely reduced periodontal support, less than half of its root length lying within alveolar bone. The right central incisor showed mild distal root resorption on the surface facing the cleft, and the right canine had drifted mesially with significant tipping and loss of buccal bone coverage. Both of these cleft-adjacent teeth therefore presented reduced alveolar bone support; however, neither showed increased probing depths, bleeding on probing, or mobility, and no active periodontal inflammation was present at any stage (i.e., a reduced but non-inflamed periodontium). A bilateral Class I molar relationship was present, but the anterior teeth were in crossbite. Oral hygiene was satisfactory, with no caries or active periodontal disease.

TABLE 1 | Veau classification of cleft lip and palate.

Type	Description
Veau I	Cleft of the soft palate only.
Veau II	Cleft of the soft and hard palate extending to the incisive foramen; the alveolar ridge is intact.
Veau III	Complete unilateral cleft involving the soft palate, hard palate, alveolus, and lip.
Veau IV	Complete bilateral cleft involving the soft palate, hard palate, alveolus, and lip.

Note: The present patient presented a right-sided complete cleft of the lip, alveolus, and palate, corresponding to Veau type III.

Cephalometric evaluation revealed bimaxillary retrognathism with a Class I sagittal interjaw relationship and a mildly increased vertical growth pattern. The upper incisors were significantly lingually tipped, while the lower incisor inclination was within acceptable limits. The panoramic radiograph confirmed a wide bony gap between the right central incisor and the canine region. Periapical radiographs of the cleft area demonstrated insufficient bone support around the lateral incisor root, suggesting a poor long-term prognosis for this tooth without bone grafting (Figure 2; Table 2, T0).

2.2 | Treatment

Active orthodontic treatment was carried out over approximately 7 years (between 10 and 17 years of age), reflecting the phased, growth-coordinated approach typical in unilateral cleft lip and palate care, including transverse correction during mixed dentition, monitoring of cleft-region eruption and of the periodontally compromised lateral incisor, space management awaiting completion of skeletal growth, and final detailing prior

FIGURE 1 | Pretreatment extraoral and intraoral photographs: (a) frontal at rest, (b) frontal smiling, (c) three-quarter, (d) profile, (e) right buccal, (f) frontal in occlusion, (g) left buccal, (h) maxillary occlusal, (i) mandibular occlusal.

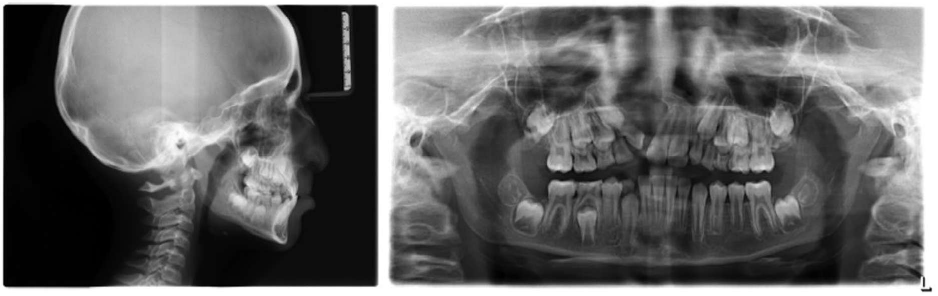

FIGURE 2 | Pretreatment radiographs: (a) lateral cephalometric, (b) panoramic.

TABLE 2 | Cephalometric analysis at pretreatment (T0), end of treatment (T1), and 5-year follow-up (T2).

Parameter	Norm	T0	T1	T2
SNA (°)	82 ± 2	76	78	78
SNB (°)	80 ± 2	74	76	76
ANB (°)	2 ± 2	2	2	2
Wits (mm)	0 ± 2	1.5	2	2
SN-GoGn (°)	32 ± 5	39	35	35
FMA (°)	25 ± 5	29	27	26
A to N-Perp (mm)	0 ± 2	−7	−4	−5
U1-SN (°)	104 ± 2	85.5	102	104
U1-NA (°/mm)	22/4	9.1/1.7	26/4.5	27/5
L1-NB (°/mm)	25/4	23/4.5	24/5	26/6
IMPA (°)	90 ± 5	94	95	98
Upper lip–E line (mm)	−4 ± 2	−4.3	−3.5	−3
Lower lip–E line (mm)	−2 ± 2	1.7	−0.5	0
Nasolabial angle (°)	102 ± 8	107	100	94

Note: T0, pretreatment; T1, end of orthodontic treatment (debonding); T2, 5-year post-prosthetic follow-up. Norm values are given as mean ± standard deviation.

to bone grafting. A quad-helix appliance was first bonded to the upper first permanent molars for slow maxillary expansion and was maintained passively for 3 months [12, 13]. Full-arch fixed appliances were subsequently placed for leveling, alignment, and normalization of the upper incisor torque, resolving the anterior crossbite. The right lateral incisor was retained throughout active orthodontic treatment under periodic clinical and radiographic monitoring, while orthodontic space management preserved adequate room for prosthetic replacement. Bilateral Class I molar and canine relationships were achieved before debonding, with overjet of 2 mm and overbite of 2 mm (Figures 3 and 4; Table 2, T1).

At 17 years of age, late secondary alveolar bone grafting was performed using a corticocancellous block harvested from the anterior iliac crest. Preoperative CBCT documented the residual alveolar cleft on the right side and the associated bone deficiency at the site of the lateral incisor (Figure 5a). During the same surgical session, following multidisciplinary consultation that confirmed no viable bone support remained around the right lateral incisor, the tooth was extracted concurrently with placement of the graft, optimizing surgical access and avoiding a separate procedure.

Clinical and radiographic re-evaluation after graft healing showed that although the graft had achieved a meaningful reconstruction of the cleft zone—narrowing the residual alveolar gap and improving the local soft-tissue contour compared with the pre-grafting baseline—the reconstructed site did not provide the three-dimensional volume required for predictable implant placement. CBCT obtained 1 year after grafting showed that, although thin bony bridges had formed across parts of the cleft, no bone bridge of sufficient volume to support an implant was present at the site of the missing right lateral incisor, and a labial concavity persisted (Figure 5b,c); the residual bone height and width were therefore judged inadequate for predictable placement of a standard-diameter implant without further augmentation. The pre-grafting and post-grafting examinations were performed at different centers, with different CBCT units and acquisition parameters; the two examinations are therefore reported qualitatively, and no quantitative volumetric or linear comparison between the time points was attempted. On the basis of these findings a second augmentation procedure was proposed; however, after detailed discussion of the surgical morbidity, additional treatment time, and the limited probability of achieving adequate volume in the cleft zone, the patient declined further surgical intervention, and prosthetic planning proceeded on a non-implant basis. The patient subsequently elected to undergo secondary rhinoplasty at an external center by an independent surgical team for esthetic correction of the residual nasal deformity; the consequent changes in nasal tip projection, alar symmetry, and nasolabial angle should be considered when interpreting post-prosthetic soft tissue cephalometric values.

Definitive prosthetic rehabilitation was completed at 18 years of age, after confirmation of completed craniofacial growth on serial cephalometric records. Pre-prosthetic evaluation confirmed adequate prosthetic space, absence of periodontal inflammation at the prospective abutments (probing depths ≤ 3 mm, no bleeding on probing, no mobility) on the reduced alveolar support described above, and a stable centric relation. Diagnostic casts were mounted on a semi-adjustable articulator using a facebow transfer, and a diagnostic wax-up was performed to plan the definitive contours, pontic morphology, incisal edge position, and occlusal scheme.

FIGURE 3 | Post-orthodontic-treatment extraoral and intraoral photographs: (a) frontal at rest, (b) frontal smiling, (c) three-quarter, (d) profile, (e) right buccal, (f) frontal in occlusion, (g) left buccal, (h) maxillary occlusal, (i) mandibular occlusal.

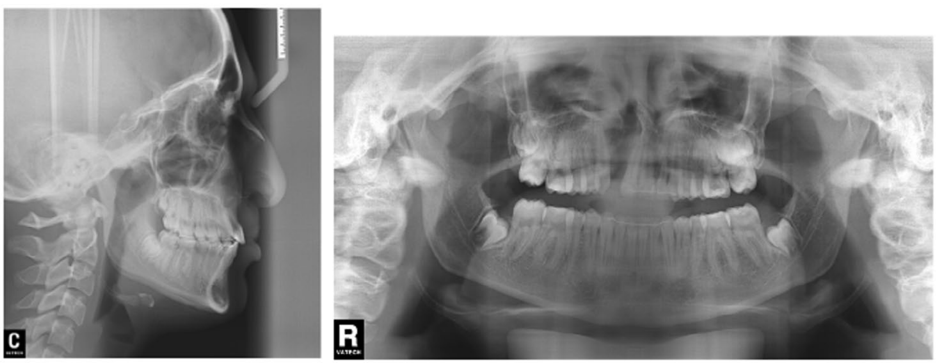

FIGURE 4 | Post-orthodontic-treatment radiographs: (a) lateral cephalometric, (b) panoramic.

The four abutment teeth (maxillary right and left central incisors and canines) were prepared under local anesthesia with a 360° chamfer finish line approximately 1.0 mm deep at the free gingival margin, axial reductions of 1.2–1.5 mm, and incisal reductions of 1.5–2.0 mm. A modified ovate pontic was selected for the missing right lateral incisor; its apical portion was extended into the residual alveolar concavity and finished in pink ceramic to reproduce the gingival contour and mask the alveolar deficiency in the cleft zone. After double-cord retraction, a definitive polyvinyl siloxane impression (Express; 3M ESPE, St. Paul, MN, USA) was made in a custom acrylic tray, with an opposing alginate impression and an interocclusal record in maximum intercuspation. Shade was selected (VITA classical A1–D4; VITA Zahnfabrik, Bad Säckingen, Germany). Splinted bis-acryl provisional restorations (Protemp 4; 3M ESPE, St. Paul, MN, USA) were luted with a non-eugenol temporary cement (RelyX Temp NE; 3M ESPE, St. Paul, MN, USA).

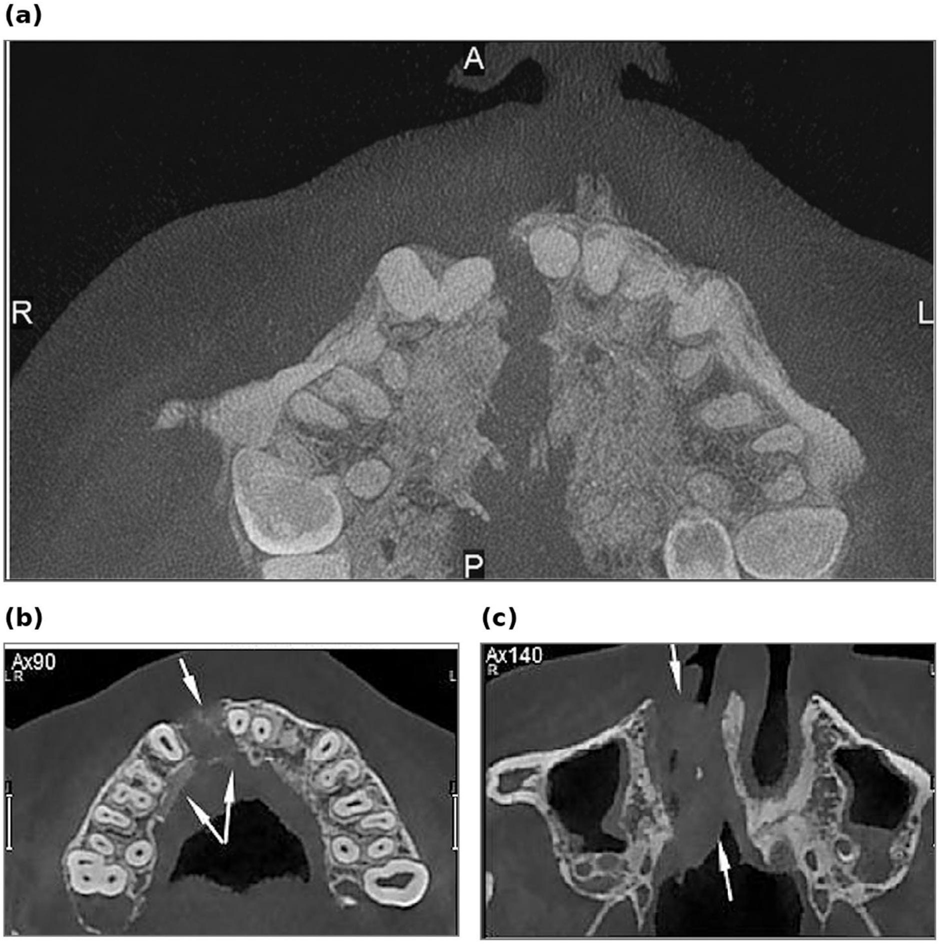

FIGURE 5 | Cone-beam computed tomographic assessment of the alveolar cleft-region. (a) Preoperative axial section, before late secondary alveolar bone grafting at 17 years of age, demonstrating the residual alveolar cleft defect on the right side. (b) Axial section 1 year after grafting, showing thin bony bridging of the cleft (arrows) without bone volume sufficient to support an implant at the site of the missing right lateral incisor. (c) Corresponding coronal section 1 year after grafting, demonstrating the persistent residual alveolar bone deficiency that precluded predictable implant placement (arrows). The preoperative and postoperative examinations were acquired at different centers with different units and imaging parameters and are therefore presented as qualitative documentation of the residual defect; they were not used for quantitative comparison.

A six-unit monolithic restoration extending from the maxillary right canine to the left canine was designed and milled using a CAD/CAM workflow from a multilayered, pre-shaded yttria-stabilized tetragonal zirconia polycrystal (Y-TZP) blank with a manufacturer-reported flexural strength exceeding 1000 MPa, then sintered, characterized, glazed, and polished according to the manufacturer's recommendations. At try-in, marginal adaptation, proximal contacts, and the occlusal relationship were verified in centric occlusion and in protrusive and lateral excursions; minor adjustments were performed and refinished with zirconia-specific polishing rubbers.

Prior to definitive cementation, the intaglio surfaces were conditioned according to the manufacturer's protocol; the abutments were isolated, cleaned with a fluoride-free pumice slurry, rinsed, and air-dried. The restoration was cemented with an MDP monomer–containing dual-cure resin cement (PANAVIA; Kuraray Noritake Dental, Tokyo, Japan), strictly following manufacturer instructions. After polymerization, the occlusion was refined to establish a canine-protected articulation, with the canines disoccluding the posterior teeth during lateral excursions and the anterior teeth providing guidance during protrusion. This occlusal scheme had been largely set up during the orthodontic phase and was preserved and refined prosthetically, with the aim of limiting non-axial loading on the cleft-adjacent abutments. No occlusal interferences were detected in eccentric movements. Oral hygiene instruction included superfloss and an interdental brush around the pontic site (Figure 6).

Following debonding, a fixed bonded lingual retainer was placed on the lingual surfaces of the lower anterior teeth from canine to canine, and a wraparound Hawley retainer was delivered in the upper arch. The Hawley appliance was worn full-time from debonding until definitive prosthetic rehabilitation; after cementation of the zirconia fixed dental prosthesis, nighttime wear was continued in order to maintain the orthodontic result and the maxillary arch form, and has been continued to date. Recall appointments were scheduled at 3-month intervals during the first year and 6-month intervals subsequently.

FIGURE 6 | Post-prosthodontic-rehabilitation extraoral and intraoral photographs: (a) frontal at rest, (b) frontal smiling, (c) three-quarter, (d) profile, (e) right buccal, (f) frontal in occlusion, (g) left buccal, (h) maxillary occlusal, (i) mandibular occlusal.

2.3 | Outcomes and 5-Year Follow-Up

At debonding (age 17), bilateral Class I molar and canine relationships were achieved with an overjet of 2 mm and an overbite of 2 mm; the anterior crossbite was resolved, and the maxillary arch form was clinically symmetrical with adequate transverse width. Sufficient prosthetic space was maintained for the lateral incisor pontic. Following definitive prosthetic rehabilitation at age 18, smile esthetics demonstrated improved lip support, harmonious gingival contours, and satisfactory incisor display.

At the 5-year post-prosthetic review (patient age 23 years, corresponding to 6 years after orthodontic debonding), the bilateral Class I molar and canine relationships were maintained, with no occlusal relapse and stable overjet and overbite values. Maxillary transverse dimensions remained stable between debonding (T1) and the 5-year review (T2): maxillary intercanine width measured 34.8 mm at T1 and 34.4 mm at T2, and maxillary intermolar width 49.2 mm at T1 and 48.7 mm at T2, indicating that the transverse arch form was maintained, with no reduction of posterior arch width over the post-treatment period. Cephalometric comparison between the end-of-treatment and 5-year records revealed no clinically significant skeletal changes (Table 2, T1 vs. T2), indicating that post-treatment growth and remodeling did not adversely affect the corrected skeletal pattern.

The six-unit zirconia FDP was clinically intact, with no observed framework fracture, chipping, decementation, marginal discoloration, or recurrent caries. The abutment teeth showed no clinical signs of periodontal inflammation on examination, and periapical radiographs showed no detectable progressive bone loss compared with the post-prosthetic baseline; radiographic technique was not standardized and quantitative marginal bone level measurements were not performed (see Limitations). Soft tissues around the pontic site were healthy, with no signs of inflammation or mucosal irritation. The patient-reported high satisfaction with both the functional and esthetic outcomes (Figures 7 and 8).

In the mandibular arch, occlusal discoloration of the second molars was noted at the 5-year review. Comparison with the post-orthodontic records showed that this appearance was already present at debonding and was unchanged in extent; clinical and radiographic examination revealed no cavitated lesions, and the teeth were managed preventively with reinforced hygiene

FIGURE 7 | Five-year post-prosthetic extraoral and intraoral photographs: (a) frontal at rest, (b) frontal smiling, (c) three-quarter, (d) profile, (e) right buccal, (f) frontal in occlusion, (g) left buccal, (h) maxillary occlusal, (i) mandibular occlusal.

FIGURE 8 | Five-year post-prosthetic radiographs: (a) lateral cephalometric, (b) panoramic.

instruction and topical fluoride application and kept under observation. No restorative intervention was required in the maxillary arch during the follow-up period.

3 | Discussion

This case documents the 5-year outcome of an anterior cross-arch tooth-supported zirconia rehabilitation in a patient with unilateral cleft lip and palate in whom implant therapy was not feasible. Two aspects are reported quantitatively and are rarely available in comparable reports: serial maxillary transverse dimensions and cephalometric records from debonding to the 5-year review, and CBCT verification that the late secondary graft, although structurally beneficial, did not reach implant-compatible volume. A third, qualitative aspect is the use of a pink-ceramic-extended ovate pontic to complete a soft-tissue contour that surgery could not re-establish.

Tooth agenesis is among the most common dental anomalies in cleft patients, with the maxillary lateral incisor most frequently affected [14, 15]. In the present case the lateral incisor was present but with severely reduced periodontal support; combined with the marked recession reported in nongrafted alveolar clefts [7], this supported extraction rather than retention of a tooth with a poor long-term prognosis.

The timing of grafting is clinically relevant. Classic secondary alveolar bone grafting is performed during mixed dentition, before canine eruption (between 8 and 11 years of age), when reported success rates are highest [16, 17]. In the present patient grafting was undertaken late, at 17 years of age, in conjunction with the completion of orthodontic treatment, and the outcome was consistent with the literature for this timing: despite an uneventful healing course, CBCT confirmed insufficient bone volume for implant placement. After informed discussion of the morbidity and limited expected benefit of a further augmentation procedure, the patient declined it, and the prosthetic decision was framed around a non-implant pathway. Patient-centered decision-making of this kind is increasingly recognized as a legitimate clinical determinant in cleft prosthodontics.

Even though the late graft did not achieve implant-supporting volume, it narrowed the residual alveolar gap and produced a more favorable receptor site, reducing the effective pontic span and supporting integration of the pink-ceramic-extended pontic with the residual ridge. A binary success-or-failure framing of grafting outcomes may therefore under-represent the practical benefit of partial reconstruction for a subsequent non-implant rehabilitation.

In selecting the definitive prosthetic strategy, the alternatives were each precluded by the clinical conditions of this case: orthodontic canine substitution by the residual cleft-zone defect width and the morphological and color discrepancy it introduces in adult cleft patients; implant-supported designs by the inadequate post-grafting bone volume; a removable partial denture by patient preference; and a resin-bonded design by its inability to provide the cross-arch splinting required by the cleft-adjacent abutments. The canine-to-canine six-unit design distributes the prosthetic load across multiple abutments per side and splints the teeth bordering the cleft, which carry reduced bone support [7, 18–20], and additionally acts as a permanent anterior retention element stabilizing the orthodontic result.

Monolithic zirconia was selected for its high flexural strength [8], favorable biocompatibility, and lower chipping risk than bilayer designs [9], with the CAD/CAM workflow supporting a passive framework fit that limits residual stress on abutments with reduced periodontal support. Because polycrystalline zirconia cannot be reliably etched or silanized, an MDP-based adhesive protocol was used; MDP-containing resin cements have been shown to yield the highest bond strengths among luting agents tested on zirconia [10, 21], which was particularly relevant here given the reduced clinical crown height of the cleft-side abutments. A conventional polyvinyl siloxane impression technique was preferred over a fully digital workflow given the irregular palatal contours, scarred mucosa, and residual alveolar concavities frequent in repaired cleft patients, which can introduce stitching errors during intraoral scanning of long-span anterior restorations with multiple subgingival margins.

At the 5-year review both the orthodontic and the prosthodontic outcomes were clinically stable, and maxillary intercanine and intermolar widths were essentially unchanged from debonding. Unilateral cleft patients are predisposed to transverse contraction following palatal scarring and growth deficiency, and an anterior canine-to-canine prosthesis cannot by itself account for stability of the posterior segments, which it neither spans nor supports. Maintenance of the transverse arch form in this patient is therefore most plausibly multifactorial. Sustained orthodontic retention is likely to have been the principal factor—a wraparound Hawley appliance worn full-time from debonding until prosthetic rehabilitation and nightly thereafter, together with a bonded mandibular lingual retainer—since long-term Hawley retention has been reported to limit transverse relapse in cleft patients [22, 23]. The rigid cross-arch splinting of the anterior segment and the canine-protected occlusal scheme established orthodontically and preserved at cementation may have contributed by limiting non-axial loading of the abutments. A single observation cannot separate these contributions; the clinically useful message is that anterior-only prosthetic rehabilitation was compatible with maintenance of arch form while retention was sustained.

The rhinoplasty performed between debonding and prosthetic rehabilitation produced measurable changes in the nasolabial profile; the soft tissue cephalometric values at the post-prosthetic and 5-year stages therefore reflect the cumulative effect of orthodontic treatment, rhinoplasty, and prosthetic rehabilitation rather than any single intervention.

Within the limits of a single case, these observations suggest that a cross-arch monolithic zirconia FDP with a pink-ceramic-extended ovate pontic, adhesively cemented to cleft-adjacent abutments with reduced bone support, can provide an esthetically and functionally stable rehabilitation when late grafting fails to provide implant-compatible volume and further augmentation is declined, provided that orthodontic retention is continued.

4 | Limitations

Several limitations should be acknowledged. First, this is a single case, which precludes any inference about survival rates or generalizability. Second, and most importantly, the treatment was not conservative: four sound or minimally restored teeth—both central incisors and both canines—were prepared for a six-unit restoration in a patient in her late teens, with irreversible loss of tooth structure. This biological cost was accepted here because of the splinting requirement of the cleft-adjacent abutments and the absence of an implant option, but it is an important argument against extending the approach to patients in whom a shorter-span, resin-bonded, or implant-supported solution would suffice. Any future complication affecting a single abutment may compromise the entire cross-arch restoration, and the long-term risk of pulpal complications in four prepared vital anterior teeth is not negligible.

Third, periodontal assessment during follow-up was clinical and descriptive: full-mouth standardized periodontal charting (probing depths at six sites per tooth, recession, clinical attachment level, and plaque and bleeding indices) was not recorded at each timepoint, so the statement that periodontal conditions remained stable rests on the absence of clinical inflammation rather than on quantitative data. Fourth, radiographic follow-up was not standardized: periapical radiographs were not obtained with a reproducible paralleling technique, and neither quantitative marginal bone level measurements nor a CBCT examination was performed at the 5-year review, so subtle progressive bone loss around the abutments cannot be excluded. In addition, the pre-grafting and post-grafting CBCT examinations were acquired at different centers with different units and imaging parameters, so that the assessment of the grafted site is necessarily qualitative and no quantitative comparison of bone volume between the two time points is possible. Fifth, no validated prosthetic outcome measures (modified USPHS or FDI criteria, instrumental shade assessment) or patient-reported outcome instruments were applied; patient satisfaction was recorded descriptively. Prospective cohort studies comparing tooth-supported and implant-supported solutions in cleft patients, with standardized periodontal, radiographic, and patient-reported protocols, are warranted.

5 | Conclusion

In this patient with unilateral complete cleft lip and palate, followed multidisciplinarily from 10 to 18 years of age, a cross-arch monolithic zirconia fixed dental prosthesis incorporating a pink-ceramic-extended ovate pontic and adhesively cemented with a phosphate monomer–containing dual-cure resin cement provided esthetic-functional rehabilitation that remained clinically stable 5 years after definitive cementation with respect to the restoration itself, the absence of periodontal inflammation at the abutments, occlusal relationships, transverse arch dimensions, and esthetic outcome. Transverse maxillary arch form was maintained under continued dual orthodontic retention; this stability is most plausibly multifactorial and is attributed principally to the retention protocol rather than to the anterior restoration. Within the constraints of a single-case design, and weighed against the biological cost of preparing four sound anterior teeth, these findings support cross-arch tooth-supported fixed prosthetic rehabilitation, combined with prosthetic soft-tissue reconstruction and sustained orthodontic retention, as one esthetic-functional pathway in cleft patients in whom implant therapy is not feasible.

Author Contributions

G.A. conceived and designed the multidisciplinary treatment plan, performed the orthodontic treatment, collected and analyzed the clinical and radiographic data, drafted the manuscript, and is the corresponding author responsible for the integrity of the work as a whole. S.G. carried out the prosthetic rehabilitation, including treatment planning, restoration design, fabrication oversight, definitive cementation, and follow-up of the prosthetic outcomes, and contributed to the prosthodontic sections of the manuscript. E.K. performed the late secondary alveolar bone grafting procedure, including the iliac crest harvest, and contributed to the surgical sections of the manuscript. S.Ş.B. contributed to the early orthodontic management of the patient prior to transfer of care and reviewed the manuscript. A.D.G.Ç. supervised the orthodontic treatment, provided senior clinical input, and critically revised the manuscript for orthodontic content. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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The authors have nothing to report.

Consent

Written informed consent was obtained from the patient for publication of all clinical photographs, radiographs, and case details.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

All data generated or analyzed during this case are included in this published article. Additional anonymized records are available from the corresponding author on reasonable request.

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