RESEARCH PAPER

Telescopic Dentures for Oral Rehabilitation of a Young Patient with Papillon-Lefèvre Syndrome: A Rare Case Report Using a CAD/CAM–DMLS Framework and a Hybrid Analogue–Digital Workflow

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ABSTRACT

Background:
Papillon-Lefèvre syndrome (PLS) is a rare autosomal recessive disorder caused by loss-of-function mutations in the cathepsin C (CTSC) gene. It presents with palmoplantar keratoderma and an aggressive periodontitis that destroys the deciduous and permanent dentitions early in life. Most affected individuals reach adulthood with very few teeth and severely resorbed ridges. Prosthetic options that keep the remaining teeth in service are therefore of particular interest.

Case Presentation:

A 19-year-old male with PLS reported with difficulty in chewing, altered speech and a poor appearance because of missing teeth. Five teeth remained, each with generalised severe alveolar bone loss and 30–40% residual root support. After periodontal therapy and a period of stabilisation, the teeth were retained as abutments for maxillary and mandibular telescopic overdentures.

Intervention:
Closed base telescopic overdentures were fabricated for both the arches. Primary copings were made over which secondary copings and the connected framework were fabricated using Computer Aided Designing (CAD) and Computer Aided Manufacturing (CAM) technology. Conventional steps were combined with the digital steps to complete the prostheses.

Outcome:
At the 12-month review the prostheses were retentive and stable, the abutments were free of new inflammation, and the patient reported improved chewing, speech and appearance. No fracture, loosening or soft-tissue complaint was recorded during the follow-up period.

Conclusion:
In this patient, a telescopic overdenture built on a CAD/CAM–DMLS framework proved feasible and gave a satisfactory result at 12 months.

Keywords: Papillon-Lefèvre syndrome; telescopic denture; overdenture; CAD/CAM; direct metal laser sintering

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INTRODUCTION

Papillon-Lefèvre syndrome (PLS; OMIM #245000) is an inherited disorder that affects roughly one to four people per million.[1,2] Biallelic mutations in CTSC, the gene on chromosome 11q14.2 that encodes the lysosomal protease cathepsin C, abolish enzyme activity.[3,4] Cathepsin C activates the serine proteases of neutrophils and cytotoxic lymphocytes; when it is absent, the innate response in the gingival crevice is blunted and the periodontium is destroyed by an infection it cannot control.[5] The two cardinal signs are palmoplantar keratoderma, which appears within the first few years of life, and a periodontitis that begins with the eruption of the deciduous teeth, causes their loss by about five years of age, and then recurs when the permanent teeth erupt.[1,6] By 15–20 years of age most patients have lost most of their permanent teeth, and the alveolar bone that once supported them has resorbed along with them.[2,7]

The prosthodontic consequences are unusual. The patient is young, the ridges are flat, and the few teeth that remain have short roots and a history of periodontal breakdown. Conventional complete dentures are cheap and simple but rely entirely on mucosal support and do nothing to slow ridge resorption. Clasp-retained removable partial dentures load the remaining teeth laterally and can hasten their loss. Implants have been used in PLS, and a 2021 systematic review of 124 implants placed in 13 patients reported an overall survival of 84%, lower than that seen in healthy patients but not low enough to make implants a contraindication.[8] Even so, most reviewers advise that implants be postponed until craniofacial growth is complete and the periodontal infection has been brought under control, and a 19-year-old with untreated aggressive periodontitis meets neither condition.[2,6,8] Recent case reports of fixed implant rehabilitation in PLS have involved patients in their mid-twenties, extensive grafting or zygomatic fixtures, none of which was suitable here.[9,10]

Telescopic (double-crown) dentures occupy a middle ground. A primary coping is cemented to each abutment and a matching secondary coping is embedded in the denture framework; retention comes from friction or wedging between the two, and occlusal forces are transmitted along the long axis of the tooth rather than as tipping loads (Figure 1).[11,12] Long-term studies from Germany and Japan report ten-year prosthesis survival of 66–95% and comparable abutment survival, with outcomes that depend on how many abutments remain and how they are distributed.[13,14,15] The design also degrades gracefully: if an abutment is lost, its secondary coping can be filled in and the denture continues to function.[12] Computer-aided design and manufacture (CAD/CAM) and additive metal fabrication by selective laser melting or direct metal laser sintering (DMLS) have been shown to produce cobalt–chromium copings and frameworks whose marginal and internal fit is within clinically accepted limits and at least equal to that of cast metal.[16,17,18]

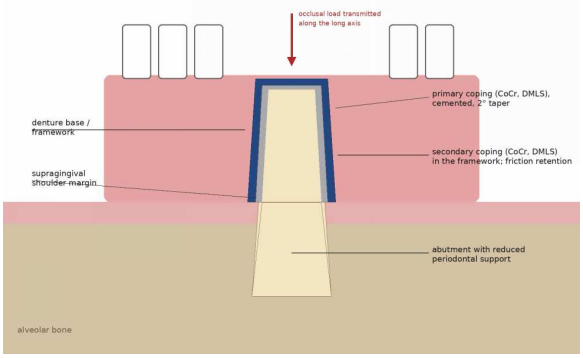


Figure 1: Schematic (not to scale) of the double-crown principle used in this case: a DMLS cobalt–chromium primary coping cemented to an abutment with reduced periodontal support, a secondary coping incorporated in the denture framework, friction retention between the two, and axial transmission of occlusal load.

Published prosthetic treatment of PLS has mostly used complete dentures, conventional partial dentures or implant-supported prostheses.[2,9,10,19] We were unable to find a report describing telescopic overdentures for a PLS patient in which the copings and framework were designed digitally and produced by DMLS; the closest reports describe conventional telescopic work or digitally produced implant frameworks. This report therefore has two aims: to describe, step by step, a hybrid analogue–digital workflow that preserved five compromised teeth as telescopic abutments in a 19-year-old with PLS, and to weigh its advantages and its limitations against the alternatives. The report follows the CARE guideline for case reports.[20]

CASE PRESENTATION

Patient information and chief complaint

A 19-year-old man attended the Department of Prosthodontics, Crown and Bridge with the complaint that he had lost most of his teeth and could no longer chew properly, that his speech had changed, and that he was embarrassed by his appearance. He was accompanied by his father.

Medical, family and dermatological history

The patient had been diagnosed with PLS at the age of six years. The diagnosis had been made on the combination of bilateral palmoplantar keratoderma, an early-onset periodontitis that had already led to the loss of deciduous teeth, and parental consanguinity; this triad is the accepted clinical basis for the diagnosis.[1,2] Genetic testing for a CTSC mutation was carried out to confirm the diagnosis. No sibling was reported to be affected. He had received dermatological care for the keratoderma and was not taking any systemic medication at presentation. There was no history of recurrent infections or hospital admission.

Dental and periodontal history

The deciduous teeth had erupted normally and had been lost early. His first permanent tooth was lost at the age of 11. Over the following eight years the remaining permanent teeth were lost one after another, despite repeated courses of scaling and root planing and antibiotics at various dental clinics. He had never worn a prosthesis. He brushed once daily with a manual toothbrush and did not use interdental aids or a mouthwash.

Clinical findings

On general examination the patient was of average build. Well-demarcated, thickened, brownish hyperpigmented hyperkeratotic plaques with fissuring were present symmetrically on the palms and soles and extended onto the dorsal surfaces of the hands and feet (Figure 2). The nails were normal.



Figure 2: Bilateral palmoplantar keratoderma with fissuring on the palms (a) and feet (b) at presentation.

Extraorally the face was symmetrical with a convex profile. The lower third of the face was reduced and the nasolabial folds were deepened, reflecting the loss of posterior support and a reduced vertical dimension of occlusion. The lips were competent. Mouth opening was normal and the temporomandibular joints were free of pain, clicking or deviation. No lymph nodes were palpable.

Intraorally, only five teeth were present: the maxillary left canine (23), maxillary left first and second molars (26, 27), and the mandibular left second premolar and second molar (35, 37) (Figure 3). The maxillary and mandibular ridges were severely resorbed, with a low, rounded form and a shallow vestibule in the anterior mandible. The mucosa covering the ridges was firm, keratinised and free of ulceration or hyperplasia. The palate was of medium depth. Periodontal examination of the five teeth showed probing depths of 1–2 mm and recession of 6–7 mm; the teeth were not mobile. Salivary flow was adequate.

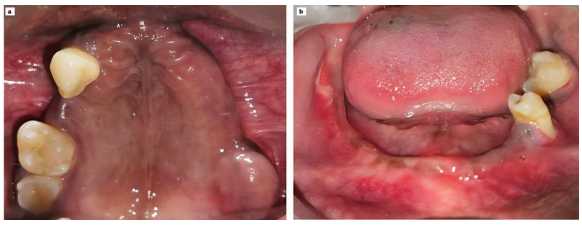


Figure 3: Pre-treatment intraoral views. (a) Maxillary arch showing teeth 23, 26 and 27 and the resorbed edentulous ridge. (b) Mandibular arch showing teeth 35 and 37.

Radiographic findings

A panoramic radiograph showed generalised horizontal bone loss around all five teeth with an average of 30–40% of root length still within bone (Figure 4). There were no periapical radiolucencies, no retained roots and no impacted teeth. The mandibular canals and the maxillary sinus floors were close to the ridge crests, and the vertical bone height available for implants in the edentulous segments was limited. Intraoral periapical radiographs of the abutments confirmed the bone levels seen on the panoramic view.



Figure 4: Pre-treatment panoramic radiograph showing generalised horizontal bone loss with 30–40% residual root support around the five remaining teeth.

Diagnosis and treatment planning

The diagnosis was partial edentulism with severely resorbed ridges secondary to PLS-associated periodontitis, Kennedy Class III modification 1 in the maxilla and Kennedy Class II modification 1 in the mandible, together with a reduced vertical dimension of occlusion.

The treatment options were discussed with the patient and his father. Extraction of the remaining teeth followed by complete dentures was rejected because it would sacrifice teeth that could provide support and proprioception, and because the resorbed mandibular ridge would give a complete denture very little stability. Implant-supported prostheses were deferred: the patient was 19 years old, implant survival in PLS is lower than in the general population, and the residual bone would have required extensive grafting.[8,9,10] A clasp-retained partial denture was thought likely to overload the abutments in the lateral direction. A telescopic overdenture on all five teeth was chosen because it loads the abutments axially, splints them through the framework, provides retention without clasps on resorbed ridges, and can be converted to a mucosa-borne denture if an abutment is later lost.[11,12,13]

The five teeth were accepted as abutments on the following basis. Each was vital, had no periapical lesion, and had a root length adequate for a primary coping with a supragingival margin. Their distribution, with a canine and two molars in the maxilla and a premolar and a molar in the mandible, gave the frameworks a reasonable support polygon on the left side, which the extended denture bases would complete on the right. The literature on double-crown dentures shows that the number and distribution of abutments are the main predictors of prosthesis survival, and that even a severely reduced dentition can support such a denture for several years if the periodontium is stable.[13,14,15] Bone levels were recorded so that any change during function could be measured.

The patient was referred to the Department of Periodontology before any prosthetic step was taken. He received full-mouth scaling and root planing, oral hygiene instruction and a chlorhexidine mouthwash. Re-evaluation after 4 weeks showed reduced probing depths and no bleeding on probing; the periodontium was regarded as stable and the prosthetic phase was begun. Written informed consent for treatment, photography and publication was obtained from the patient and his father.

PROSTHETIC PROCEDURE

The workflow combined conventional clinical steps with digital design and additive metal fabrication. It is described in the order in which it was carried out. Materials and equipment are listed with the step in which they were used. The sequence is summarised in Figure 5.

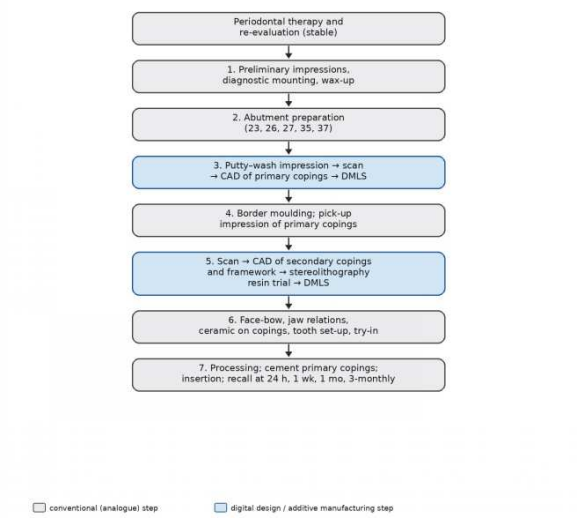


Figure 5: Flowchart of the hybrid analogue–digital workflow. Shaded boxes indicate steps carried out by digital design and additive manufacturing.

Step 1: Preliminary impressions and diagnostic mounting

Preliminary impressions of both arches were made in irreversible hydrocolloid (Algingum alginate impression material; Prime Dental Products Pvt. Ltd., Thane, India) in perforated stock trays and poured in type III dental stone. Record bases and wax occlusion rims were made on the diagnostic casts. The vertical dimension of rest was estimated by physiological methods (swallowing and phonetics) and the vertical dimension of occlusion was set 2–3 mm below it. The casts were mounted on a semi-adjustable articulator with a face-bow record and a tentative centric relation record. A diagnostic wax-up on the mounted casts was used to assess the space available for the copings, the framework and the denture teeth, and to show the patient the expected change in facial support.

Step 2: Abutment preparation for primary copings

Teeth 23, 26, 27, 35 and 37 were prepared for full-coverage metal primary copings under local anaesthesia. A circumferential shoulder finish line approximately 1.0 mm wide was placed 0.5 mm supragingivally so that the coping margin could be kept clean and the gingival margin would not be crowded. Axial reduction was 1.0–1.5 mm and occlusal reduction 1.5–2.0 mm, with rounded line angles (Figure 6).

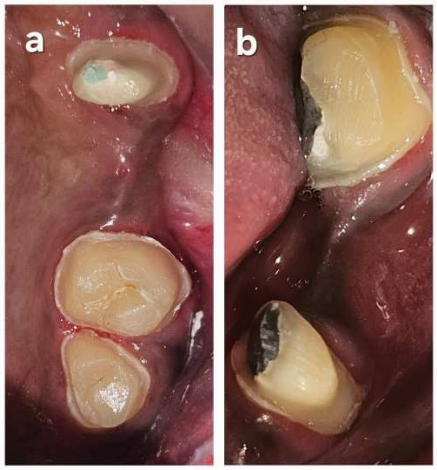


Figure 6: Tooth preparation for abutments. (a) Maxillary arch- 23,26,27. (b) Mandibular arch- 35,37

Because the primary copings would themselves be waxed and milled to a common path of insertion, the preparations did not need to be parallel, but the long axes were checked with a dental surveyor on the diagnostic casts so that the copings would not need excessive bulk on any one tooth. Provisional resin crowns were placed.

Step 3: Definitive abutment impressions and primary coping fabrication

Definitive impressions of the prepared teeth were made in polyvinyl siloxane using a two-stage putty–wash technique (Ad-Sil Acura soft putty and light body; Prime Dental Products Pvt. Ltd., Thane, India) after gingival retraction with cord, and were poured in type IV die stone. The casts were digitised with a laboratory scanner (E4; 3Shape A/S, Copenhagen, Denmark).

The primary copings were designed in dental CAD software (exocad DentalCAD; exocad GmbH, Darmstadt, Germany). A single path of insertion common to the five abutments in each arch was defined in the software, the external walls were given a 2° taper to that path, and the margins were drawn to the shoulder finish lines. The wall thickness was set at a minimum of 0.4 mm. The design files were exported in STL format and the copings were produced in cobalt–chromium alloy by DMLS (EOS M 100; EOS GmbH, Krailling, Germany) and then heat-treated, fitted to the dies, and finished (Figure 7). The external surfaces were milled on a parallelometer to the planned taper. The copings were tried on the abutments and the fit, margins and path of insertion were checked (Figure 8).

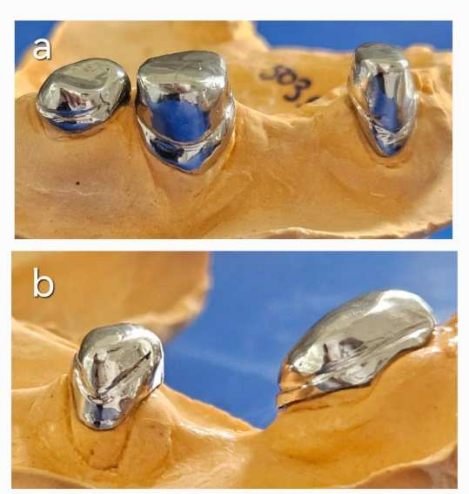


Figure 7: DMLS-fabricated cobalt–chromium primary copings milled to a common path of insertion.(a) Finished primary copings: Maxillary arch. (b) Finished primary copings: Mandibular arch

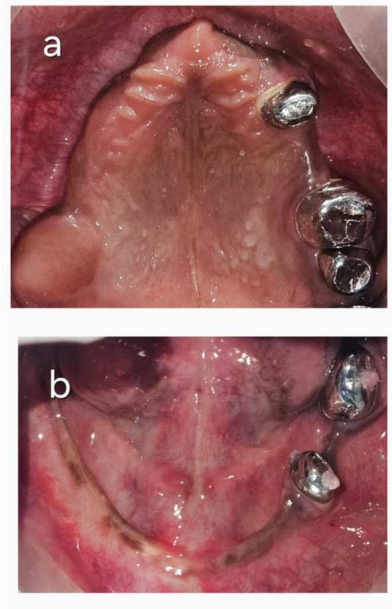


Figure 8: DMLS-fabricated cobalt–chromium primary copings : Intra oral Try-In

Step 4: Border moulding and pick-up impression of the primary copings

With the primary copings seated on the abutments, custom trays were made on the casts in autopolymerising acrylic resin, relieved over the copings and shortened 2 mm from the vestibular depth. The borders were moulded segment by segment with low-fusing modelling compound. Small acrylic resin spheres (Mortsch spheres) were attached to the occlusal surfaces of the primary copings so that the impression material could grip them and pull them out of the mouth. The final impression was made with light-body polyvinyl siloxane (Ad-Sil Acura light body; Prime Dental Products Pvt. Ltd., Thane, India); the copings were picked up in the impression (Figure 9). The intaglio of each coping was filled with a pattern resin core and a dowel pin so that the copings could be relocated accurately on the poured cast, and the remainder of the impression was poured in type IV stone. The result was a master cast that carried the primary copings in their exact position with a record of the peripheral tissues in function.(Figure 10)

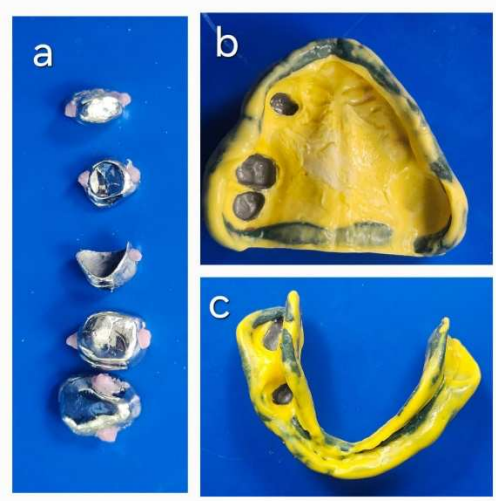


Figure 9: Final pick-up impressions of the seated primary copings in light-body polyvinyl siloxane. (a) Primary copings with acrylic Mortsch spheres (b) Maxillary arch. (c) Mandibular arch.

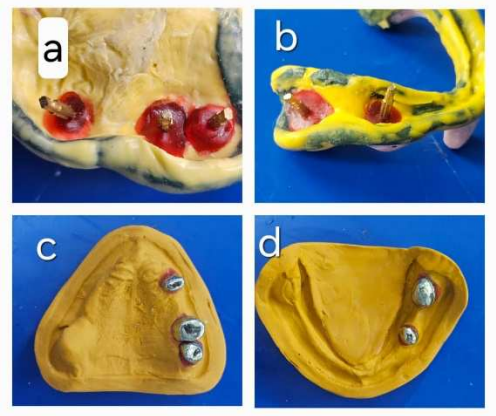


Figure 10: Pouring of master cast. (a,b) Intaglio of copings filled with pattern resin and stabilised with dowel pin. (c,d) Maxillary and Mandibular master casts respectively

Step 5: Digital design, resin verification and DMLS fabrication of the secondary copings and frameworks

The master casts with the primary copings in place were scanned. The secondary copings were designed on the scanned surface of each primary coping so that

the intaglio fitted the outer taper of the primary coping. The two secondary copings on the maxillary molars and the one on the canine were joined by a palatal major connector and retentive lattices for the acrylic; in the mandible the two secondary copings were joined with retentive meshes on the edentulous ridges. The frameworks were designed for a minimum thickness of 0.5 mm over the copings and 1.5 mm in the connectors.

Before any metal was made, the framework designs were printed in resin by stereolithography (Asiga Max; Asiga, Sydney, Australia). The resin patterns were seated on the master casts and tried in the mouth to check the seating over the primary copings, the adaptation of the connectors, the border relationship, and the presence of a single path of insertion (Figure 11). Minor corrections were made in the software. The corrected files were then produced in cobalt–chromium alloy by DMLS (EOS M 100; EOS GmbH, Krailling, Germany). DMLS was preferred to lost-wax casting because additively manufactured cobalt–chromium frameworks have shown marginal and internal fit within clinically accepted limits, with less porosity and less dimensional variation than castings, and because the same digital file could be reproduced if a framework were ever lost or damaged.[16,17,18] The frameworks were cleaned of support structures, heat-treated and finished. The fitting surfaces of the secondary copings were adjusted with fine abrasives until each seated fully on its primary coping with light, even friction; the frameworks were then tried in the mouth and checked for passive, complete seating on all abutments (Figure 12).

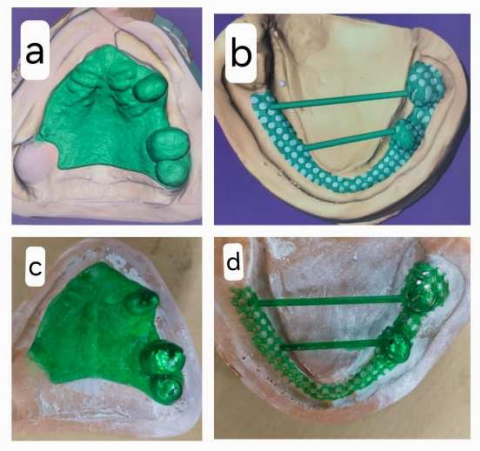


Figure 11: Digital design and resin verification of the secondary copings and frameworks. (a) Maxillary CAD design. (b) Mandibular CAD design. (c) Stereolithography-printed maxillary resin pattern on the master cast. (d) Mandibular resin pattern on the master cast.

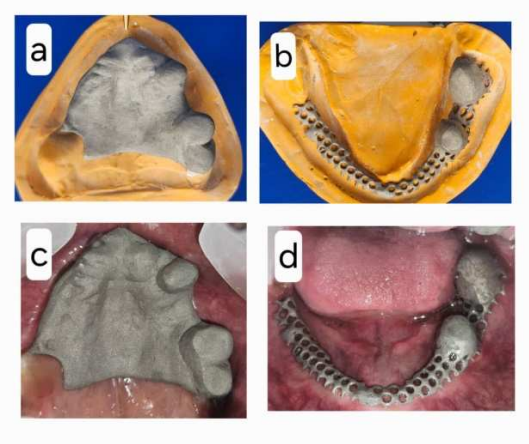


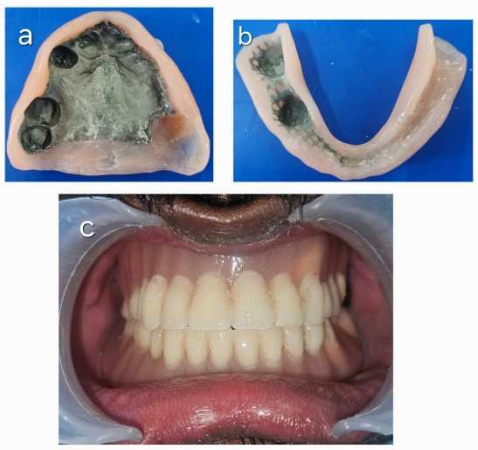
Figure 12: DMLS cobalt–chromium frameworks with secondary copings. (a) Maxillary framework on the master cast. (b) Mandibular framework on the master cast. (c) Maxillary intraoral try-in. (d) Mandibular intraoral try-in.

Step 6: Jaw relation records, tooth arrangement and try-in

Record bases were built on the frameworks and wax occlusion rims were added. The maxillary rim was adjusted for lip support, incisal display and occlusal plane orientation, and a face-bow transfer was made. The vertical dimension of occlusion was re-established at the value decided during diagnostic mounting, and centric relation was recorded with the frameworks in place using a wax interocclusal record. The mandibular cast was mounted and a protrusive record was used to set the condylar guidance. Feldspathic ceramic was layered over the visible surfaces of the secondary copings in the selected shade so that the metal would not show through the denture flange. Acrylic resin denture teeth in the same shade were set to a bilateral balanced scheme. At the wax try-in the midline, lip support, incisal display, occlusal plane, vertical dimension, centric contacts and phonetics (sibilant and fricative sounds) were checked and approved by the patient.

Step 7: Processing, insertion and post-insertion care

The dentures were flasked, and the waxed trial dentures were processed in heat-polymerised polymethyl methacrylate by compression moulding, with the frameworks embedded. After deflasking, the



dentures were remounted on the articulator to correct processing errors, then finished and polished. The primary copings were cemented on the abutments with glass ionomer luting cement under rubber dam isolation; excess cement was removed and the margins checked. The telescopic dentures were seated over the primary copings, the friction of each secondary coping was verified, and the occlusion was refined in centric and eccentric positions (Figure 13,14). The patient was shown how to remove and insert the dentures along the path of insertion without tilting, how to clean the primary copings and the gingival margins with a soft brush and interdental brushes, and how to clean the dentures with a brush and non-abrasive cleanser. He was told to leave the dentures out at night and to keep them in water. Chlorhexidine gel was prescribed for the abutment margins for two weeks.

Figure 13: Post-insertion views. (a) Intaglio surface of the maxillary telescopic denture showing the secondary copings. (b) Intaglio surface of the mandibular telescopic denture showing the secondary copings (c) Telescopic dentures in occlusion.



Figure 14: Extraoral view after insertion showing restored lower facial height and lip support (identifying features masked). (a) before treatment (b) Aftertelescopic dentures insertion.

Review appointments were held at 24 hours, one week and one month for occlusal refinement and relief of any pressure areas, and thereafter every three months for periodontal maintenance and inspection of the copings.

TREATMENT OUTCOME AND FOLLOW-UP

The patient has been followed for 12 months after insertion. At the one-month recall he reported that he could chew a normal diet, that his speech was clearer, and that he was comfortable smiling. The lower third of the face had regained its height, lip support and the nasolabial angle had improved, and the dentures were retentive when the patient spoke and chewed.

Objective assessment was repeated at 24 hours, one week, one month and then every three months, and again at the 12-month review. Retention of each denture was tested by pulling on the anterior teeth and was satisfactory in both arches; the friction of the secondary copings was unchanged from the day of insertion. Probing depths around the abutments remained 1–2 mm, with no bleeding on probing and no suppuration. Plaque control around the copings was good, with a plaque score of 1. The mucosa under the denture bases was healthy, with no ulceration, hyperplasia or denture stomatitis. Bilateral posterior occlusal contacts and a normal incisal relationship were present in centric occlusion, and there were no interferences in lateral or protrusive movement. Intraoral periapical radiographs of the abutments at 12 months showed same level of the crestal bone level. No fracture of the denture base, ceramic or framework occurred, no coping loosened, and no adjustment other than the routine post-insertion relief was needed.

These findings show that the prostheses were functional and well tolerated during the 12-month review period.

DISCUSSION

Why this patient was difficult

PLS presents the prosthodontist with a young patient whose dental age is that of an elderly one. The pathogenesis explains why. Cathepsin C is needed to activate neutrophil elastase, cathepsin G and proteinase 3 and the granzymes of cytotoxic ly[redacted]without it, neutrophils reach the gingival crevice but cannot mount an effective bactericidal response, and the periodontal ligament and bone are destroyed by a chronic infection dominated by Aggregatibacter actinomycetemcomitans and other periodontal pathogens.[3,4,5,6] Reviews published since 2020 agree that periodontal stability can be achieved in PLS, but only with intensive mechanical therapy, antibiotic support directed at A. actinomycetemcomitans, and frequent maintenance, and that suppression of that organism below detectable levels has been associated with periodontal stabilisation.[2,6] Any prosthesis built on the remaining teeth therefore depends on the periodontist as much as on the prosthodontist.

The residual ridges are a second problem. Teeth lost to periodontal disease take much of their alveolar bone with them, and the years without a prosthesis allow further resorption. In our patient the mandibular ridge in particular offered little resistance to lateral displacement, which made retention from the abutments more valuable than it would be in a patient with well-formed ridges.

Comparison with published rehabilitation of PLS

Most published prosthetic treatment of PLS falls into three groups. The first is complete or partial removable dentures for children and adolescents; the 2024 review by Raja Rajeswari and colleagues recommends removable prostheses during growth and reserves implants for after growth is complete.[2] Patil and colleagues rehabilitated a 17-year-old who had already lost all teeth with complete dentures, an approach that was not appropriate here because our patient still had teeth worth keeping.[19] The second group is implant treatment in adults. Nassani and colleagues' review of 124 implants found an 84% survival rate over follow-up periods of four months to nine years, with failures concentrated in patients whose periodontal infection was not controlled.[8] Pawan Kumar and colleagues restored a 25-year-old with fixed hybrid prostheses on ten axially placed implants and reported four years of function, although one implant was lost with its graft during healing.[9] Alzoubi and Wong used four zygomatic implants to avoids grafting in a maxilla with almost no alveolar bone.[10] These reports show what can be achieved, but each one involved a patient older than ours, a larger surgical burden, and costs that are beyond many patients in our setting. The third group, tooth-supported overdentures, is the smallest. Older reports describe conventional overdentures on retained roots or telescopic dentures produced by casting.[7,12] We found no report in which the telescopic components for a PLS patient were designed digitally and produced by DMLS, which is why we consider this workflow worth describing; the claim is limited to the searched English-language literature and does not rule out unpublished or non-indexed cases.

Telescopic overdentures: advantages and limitations

The rationale of the double-crown design in this patient align with those stated in the literature including the fact that axial loading protects abutments whose periodontal support has been reduced to a third of the root; a clasp on such a tooth acts as a lever on a short root. Splinting through the framework distributes the load between the abutments on each side. Retention that does not depend on the ridge is important when the ridge is flat. The proprioception of natural teeth improves the control of chewing forces. The prosthesis can be removed for cleaning of the abutments, which matters in a patient whose immune response to plaque is defective. And if an abutment is lost, the denture can be kept in service by filling its secondary coping with resin, relining the base, or converting the denture to mucosal support.[11,12]

The long-term studies give a realistic picture of what to expect. Yoshino and colleagues followed 213 double-crown dentures for a mean of 12.7 years and found ten-year denture survival of 94.7% and abutment survival of 83.8%, with loss of abutments the main reason for remaking a denture.[13] Hinz and colleagues, who studied non-precious double crowns with friction pins, found that ten-year denture survival fell from 95.0% in patients with more than four abutments to 57.9% in severely reduced dentitions, and abutment survival fell from 81.4% to 53.5%.14 Klotz and colleagues reported five-year survival of 86% in general practice, with better outcomes in younger patients and in those with more abutments.[15] Seo and Cho's analytical review found cumulative survival of tooth-supported rigid double-crown dentures of 69–95% over five to ten years.11 Our patient has five abutments, which places him at the boundary between the favourable and the unfavourable groups in these studies, and he is younger than almost all of the patients they include. Whether the periodontal condition that cost him his other teeth will spare these five remains the central clinical uncertainty.

There are other limitations of the design. Telescopic dentures need more tooth reduction than an overdenture on root caps, and they need more vertical space than a clasp-retained denture, which is why the vertical dimension was assessed carefully at the diagnostic stage. Friction retention wears with use and may need adjustment or the addition of retentive elements. Preparation of five teeth, two sets of copings, two frameworks and ceramic veneering make the prosthesis more expensive and more technique-sensitive than a conventional partial denture, and the laboratory must have access to a scanner, CAD software and an additive manufacturing service. Complications such as loss of cementation of a primary coping, fracture of the acrylic around a secondary coping, and caries at the coping margin are well described and require regular recall.[11,15]

CAD/CAM and DMLS: what they added and what they did not

The digital steps served three purposes. First, the common path of insertion for the primary copings was defined on the scanned casts rather than by hand milling alone, which made it easier to obtain a consistent taper on five copings in two arches. Second, the secondary copings were designed on the actual surface of the primary copings after they had been picked up in the final impression, so the fit between the two was determined by a scan rather than by a second impression and a duplicate cast. Third, the framework was verified as a resin print before metal was made. This last step caught minor

discrepancies at the connector and border that would otherwise have required adjustment of the metal or a remake.

The evidence for the accuracy of additively manufactured cobalt–chromium is reasonable but should not be overstated. Svanborg and Hjalmarsson's systematic review concluded that the marginal and internal fit of cobalt–chromium fixed prostheses made by selective laser melting is within the limits usually regarded as clinically acceptable and is at least comparable to that of milled and cast restorations.[16] Al-Saleh and colleagues reported lower marginal misfit for laser-sintered copings than for lost-wax castings.[17] Yu and colleagues showed that the preparation design influences the fit of laser-melted crowns, with rounded shoulder finish lines performing well, which supports the shoulder preparation used here.[18] Revilla-León and colleagues' review of additive metal fabrication notes that outcomes depend on build orientation, support placement, post-processing and heat treatment, and that the surface roughness of as-built parts requires finishing.[21] Our earlier draft quoted a dimensional accuracy of ±0.05 mm; we no longer make that claim, because it was a manufacturer's figure rather than a clinical measurement, and because the fit that matters clinically is the friction between the copings, which was adjusted by hand in any case.

Two features of the workflow deserve a caution. Additively manufactured secondary copings and frameworks have been studied mostly in fixed and implant prostheses; data on the wear of DMLS-produced friction surfaces in telescopic dentures over years of insertion and removal are scarce, and the friction may change differently from that of cast or electroformed copings.[11,21] And the resin verification step, although useful, checks seating and adaptation rather than friction, which can only be assessed on the metal.

Restoration of the vertical dimension

The patient had lost occlusal support and with it several millimetres of facial height. The vertical dimension was assessed at the diagnostic stage with rest position, phonetics and facial appearance, tested during the wax try-in, and reproduced in the definitive dentures. Restoring the dimension in one step is generally tolerated when the increase is modest and the occlusion is balanced, and the patient adapted without muscle discomfort or joint symptoms; a gradual increase with interim prostheses is an alternative when the loss is large.[22]

Maintenance and the periodontal partnership

The survival of this prosthesis will be decided at the recall appointments rather than in the laboratory. The reviews of PLS management are consistent on this point: periodontal stability has been achieved in the reported cases only with a strict programme of professional cleaning every few months, reinforcement of home care, and antibiotic therapy when A. actinomycetemcomitans is detected, and it has been lost in patients who did not comply.2,6 The design choices in this case were made with that programme in mind. The coping margins were placed supragingivally so that they can be seen and cleaned. The denture is removed at night, which exposes the abutments to the toothbrush and to saliva for several hours of the day. The framework is rigid enough to splint the abutments but leaves the gingival margins uncovered. At each three-monthly visit the abutments are probed, the copings are checked for cement washout and marginal caries, the friction of the secondary copings is tested, and the denture bases are examined for the need for relining. Radiographs of the abutments are planned annually. The patient has been told that loss of an abutment would not mean loss of the denture, and that the treatment is a way of keeping his teeth for as long as they can be kept rather than a permanent solution.

Patient perspective

The patient's own account of the treatment was sought at the 6-month review. He said that his main worry before treatment had been that he would have to lose his remaining teeth, and that keeping them had mattered to him. He found the dentures easy to insert and remove after the first week, had no difficulty with the cleaning routine, and said that he had started eating with his family again and was no longer avoiding speaking in class. He described the number of appointments as the most demanding part of the treatment.

Limitations of this report

This is a single case with a 12-month follow-up, and its conclusions must be read in that light. The observation period is too short to say anything about abutment survival, coping wear, or the need for maintenance, all of which determine the value of a telescopic denture over five to ten years. Assessment was clinical. The patient's periodontal condition may deteriorate despite maintenance, as it has in other PLS patients, and the prosthesis may then have to be converted to a mucosa-borne denture. The cost and laboratory requirements of the digital workflow limit its use to centres with access to a scanner, CAD software and an additive manufacturing service, and no comparison with a conventionally cast telescopic denture was possible in a single patient. Finally, the claim that this exact workflow has not been described before in PLS rests on a literature search and cannot be proved.

Implications for practice

For a young PLS patient who still has a few periodontally compromised but stable teeth, a

telescopic overdenture is a reasonable way to keep those teeth in service while implant treatment is deferred. The digital design of the copings and framework, with a resin verification step before metal production, fitted into a conventional clinical sequence without difficulty. The treatment requires a periodontist to stabilise the dentition first and to maintain it afterwards, a laboratory able to design and manufacture additively, and a patient who will attend regularly. Reports with longer follow-up, ideally with standardised outcome measures, are needed before the approach can be recommended more generally.

CONCLUSION

In a 19-year-old man with Papillon-Lefèvre syndrome and five remaining teeth, maxillary and mandibular telescopic overdentures with digitally designed primary and secondary copings and DMLS-produced cobalt–chromium frameworks were fabricated using a hybrid analogue–digital workflow. The treatment was feasible, the prostheses were retentive, stable and comfortable, and the patient's chewing, speech and appearance improved over 12 months of follow-up. The abutments remained free of new inflammation during that period. The workflow allowed the fit of the frameworks to be verified before metal was produced and preserved the option of converting the dentures to mucosal support if an abutment is lost. Continued periodontal maintenance and longer observation are planned, and further cases with longer follow-up will be needed to establish the place of this approach in the management of PLS.

DECLARATIONS

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Patient consent: Written informed consent was obtained from the patient for the treatment described, for clinical photography, and for publication of the clinical details and images in this report. Identifying facial features have been masked in the figures.

Reporting guideline: This report was prepared in accordance with the CARE guidelines for case reports.[20]

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