Periodontal and Implant Research (2024) 8:5
https://doi.org/10.1007/s41894-024-00132-9

CASE REPORT

Periodontal plastic surgery and regenerative periodontal surgery in a forty-seven-year-old patient with cleft lip and palate

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Received: 12 March 2024 / Accepted: 11 July 2024

Abstract

Cleft lip and palate represent one of the most prevalent congenital malformations in humans, with an estimated prevalence of 0.45 per 1,000 individuals. During childhood and adolescence, affected patients undergo lengthy and complicated interdisciplinary treatment including treatment from specialists in pediatric medicine, oral and maxillofacial surgery, orthodontics, and otorhinolaryngology. The patient exhibited scarred adhesions with localized mucogingival deformities of the premaxilla (region 12 – 11), bilateral cleft lip and palate, and a complex underlying one-wall intrabony osseous defect on tooth 11, in addition to hard- and soft-tissue deficiencies at the dental implant in region 12. Following the administration of localized antiinfective periodontal therapy, regenerative periodontal surgery, regenerative surgical therapy of periimplantitis, and periodontal plastic surgery were performed. This resulted in a long-term, stable improvement in the clinical situation. Regenerative periodontal therapy and periodontal plastic surgery in patients with palato-alveolar cleft present a significant challenge due to the poor condition of the mucosa and gingiva adjacent to the defect and the insufficient bone dimensions. For this reason, it seems beneficial to include the periodontist in the interdisciplinary treatment team of a patient with cleft lip and palate from the outset. It is recommended that the patient be provided with dental prophylaxis measures and receive individualized oral hygiene instructions in addition to the main maxillofacial and orthodontic treatment. This approach would facilitate the identification of mucogingival issues at an early stage and the implementation of appropriate treatment.

Keywords Cleft lip palate · Mucogingival surgery · Regenerative periodontal therapy · Periodontics · Regenerative treatment of periimplantitis

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Published online: 23 July 2024

Case presentation

A 47-year-old male patient presented at the Department of Periodontology and Operative Dentistry, Johannes Gutenberg University, Mainz. The patient reported gum discomfort and repeated bleeding of the gums in the anterior region of the upper jaw.

In the general medical anamnesis, he reported a cleft of the hard and soft palate with bilateral cleft lip (ICD code Q37.4 ; LAHSHAL) [1], which was treated in the Clinic and Polyclinics for Dental, Oral and Maxillofacial Diseases, Johannes Gutenberg University, Mainz, Germany: Approximately seven years prior, the alveolar cleft defects on both sides were corrected using cancellous bone grafts from the iliac crest. A maxillary repositioning osteotomy (segmental Le-Fort I osteotomy) was performed to treat a class III malocclusion. Implant-supported crowns were placed to replace missing teeth 12 and 22. A palatal expander was used as part of the orthodontic treatment regimen in conjunction with a multi-bracket appliance. Clinical (Fig. 1) and radiographic (Fig. 2) examinations confirmed the presence of dental implant restorations in regions 12 (Straumann BL; Ø 3.3×10 mm NC) and 22 (Straumann BL; Ø 3.3×8 mm NC). Several direct composite restorations were also noted. At this point, the implants had been in situ for six years.In the labial vestibule of the upper jaw, the patient exhibited scarred adhesions with localized mucogingival deformities, loss of attachment and peri-implantitis with suppuration in region 12.

Periodontal status was recorded (Fig. 1; ParoStatus.de GmbH, Berlin) in conjunction with bleeding on probing (BOP: 9%) and approximal plaque index (API: 0%). Medical findings and diagnoses (Table 1) indicated the presence of alveolar ridge defects in the right cleft region, which were considered to be a systemic disease or condition affecting the periodontal supporting tissues of the adjacent teeth. This resulted in mucogingival deformities and conditions that were localized in the cleft area of the premaxilla (region 12 – 11): Firstly, a one-wall intrabony defect on tooth

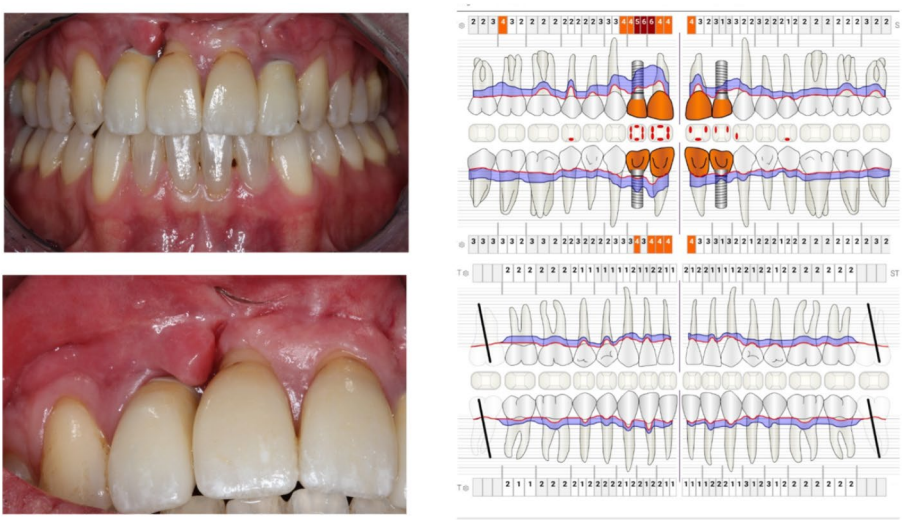

Fig. 1 Initial situation

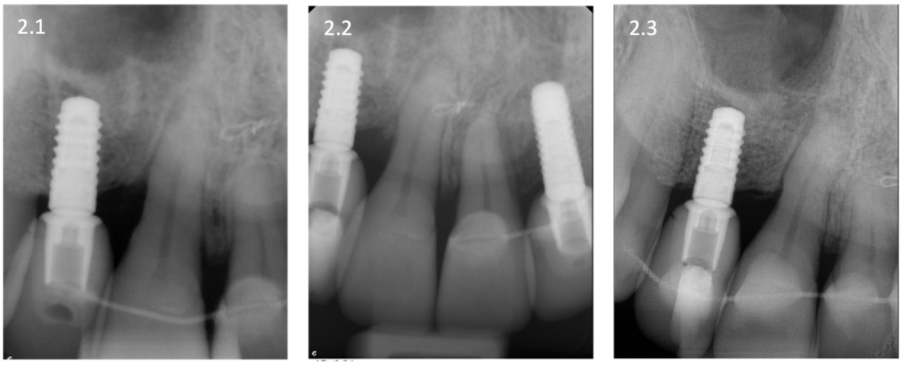

Fig. 2 X-rays (2.1: Baseline X-ray; 2.2: X-ray after surgery; 2.3: X-ray 36 months after surgery)

Table 1 Medical findings and diagnoses

Medical findings and *diagnoses*	Time	Origin
Q37.4 Cleft hard and soft palate with bilateral cleft lip • Localized alveolar ridge defect in the area of the cleft on the right as a *systemic disease or condition affecting the periodontal supporting tissues* of the adjacent teeth	Congenital	Multifactorial congenital malformation
Status after transplantation of cancellous bone grafts from the iliac crest into the alveolar clefts on both sides (region 12 and 22)	Seven years before	Previous medical interventions
Status after segmental Le-Fort I osteotomy for the treatment of a Class III malocclusion	Six years before	
Status after implantation in region 12 and 22 with simultaneous bone grafting using autogenous bone chips	Six years before	
Status after orthodontic treatment with expansion of the maxilla	Five years before	
Mucogingival deformities and conditions localized in the area of the cleft in the second sextant (Region 12 – 11) • One-wall intrabony defect on tooth 11 with gingival recession (recession Type 3 [RT3]) • *hard- and soft-tissue deficiencies* at dental implant in region 12 leading to a *periimplantitis*	At baseline	Unfavorable anatomical situation due to the bone deficit caused by the cleft and status after bone grafting in regions 12 and 22

11 with gingival recession (recession Type 3 [2]) and secondly, hard and soft tissue defects on the dental implant in region 12 leading to a periimplantitis [3]. The patient was informed of the therapeutic objectives. To control acute inflammation, it is necessary to remove the supra- and subgingival biofilm and calculus with sys-

tematic anti-infective periodontal therapy. Subsequently, the mucogingival deformities of the premaxilla should be corrected by periodontal plastic surgery, and the intrabony defect should be addressed by regenerative periodontal surgery. The periodontal treatment was conducted under local anesthesia without the use of adjuvant antibiotics. [4].

Three months later, a periodontal re-evaluation was conducted (Fig. 3). The periodontal and peri-implant inflammation had decreased to a subacute state. Tooth 11 exhibited a probing depth of 6 mm on the distal side, accompanied by a radiological bone loss of approximately 50% and a vertical bone defect in this area (Fig. 2). In the individual tooth prognosis, the classification was "questionable." [5]. Furthermore, the implant in region 12 exhibited radiographic evidence of bone loss on the mesial side. The scarred retraction with the pronounced soft tissue deficit persisted in the interdental space. For further periodontal surgical treatment, a regenerative periodontitis therapy was planned for tooth 11 (with Straumann® Emdogain and Geistlich Bio-Oss® Collagen) [4] and an open flap debridement for implant 12 [6]. Additionally, the soft tissue deficit should be addressed through the use of a connective tissue graft. It was postulated that the cleft area, which had undergone numerous previous operations, was at an increased risk of infection. After careful consideration, the decision was made to administer perioperative antibiotics (amoxicillin 500 mg and metronidazole 400 mg, each 3 times per day for seven days) [7]). The cleft represents a connection between the oral and nasal cavities, which increases the risk of contamination.

Prior to surgical intervention, the implant crown 12 was unscrewed in order to facilitate optimal access to the surgical site. The implant was temporarily sealed with a healing abutment. The surgical approach in region 13–21 was minimally invasive, employing the modified minimally invasive surgical technique (M-MIST) [8]. In the region of the scarred mucosa, the soft tissue was de-epithelialized. Following open flap debridement, the root surface of tooth 11 was conditioned with 24% EDTA gel (ethylenediaminetetraacetic acid; PrefGel®; Straumann GmbH) for a period of two

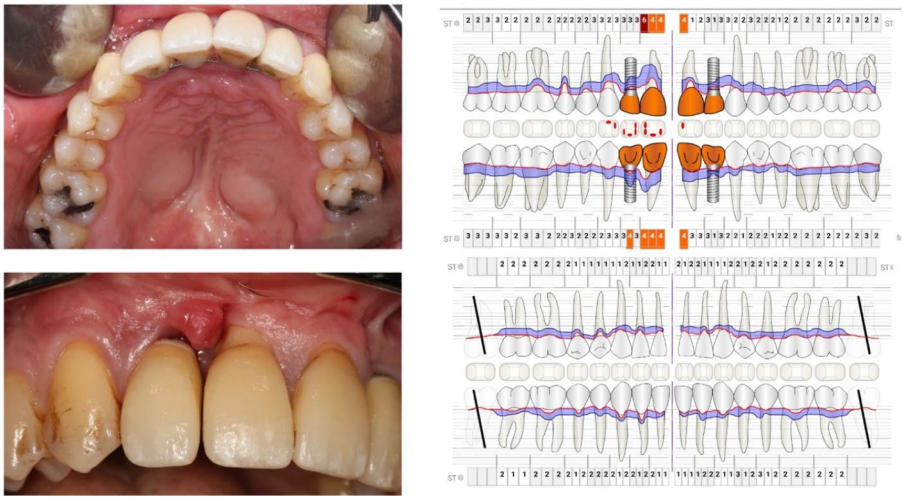

Fig. 3 Clinical situation three months after anti-infective periodontal therapy

minutes. The one-wall intrabony osseous defect was completely filled with a combination of enamel matrix derivatives (Emdogain®; Straumann GmbH) and bone grafts (Bio-Oss Collagen®; Geistlich Biomaterials) using the sandwich technique [9]. Following the application of Emdogain®, the periodontal defect was filled with Bio-Oss Collagen®; subsequently, Emdogain® was applied once more. A free gingival graft was harvested from the left side of the patient's palate and de-epithelialized extraoral (de-epithelialized gingival graft) [10] and then fixed with absorbable sutures at 12 and 11 (Vicryl® 6/0; Ethicon, Johnson & Johnson Medical GmbH).

In order to prevent contamination, a watertight wound closure was performed with Optilene® 6/0 (B. Braun Medical AG) following the reinsertion of the implant crown 12. Figure 4 depicts the individual operation steps. A postoperative X-ray revealed the presence of radiological bone filling with particulate bone graft materials in the region of the vertical bone defect 11 on the distal side (Fig. 2).

No severe adverse events were observed in the postoperative period. The patient reported only minor postoperative complaints and was closely monitored (weekly visits). This was necessary due to the limited oral hygiene, which required the use of an antiseptic mouthwash for 2 weeks [11] (rinse twice daily with 10 ml chlorhexidine digluconate solution 0.2% for 60 s) until the sutures were removed. The soft tissue was found to be free of inflammation. The initial supportive periodontitis therapy (SPT) was initiated eight weeks following the surgical procedure.

Oral hygiene instructions were provided and adherent dental biofilms were removed by supragingival cleaning of all teeth using the air-powder-water jet tech-

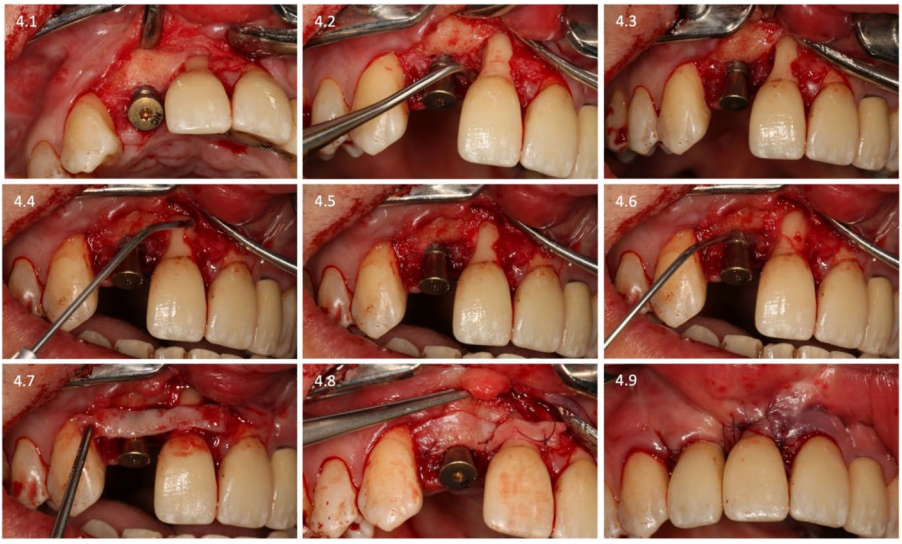

Fig. 4 Intraoperative situation (4.1: Surgical site after incision, flap preparation and internal gingivectomy in the area of the scarred invagination; 4.2: Open flap debridement; 4.3: Visualization of the bone defect after complete degranulation; 4.4: Application of Straumann Prefgel® for a period of two minutes and subsequent application of Straumann Emdogain®; 4.5: Filling of bone defect with Geistlich Bio-Oss® Collagen; 4.6: Reapplication of Straumann Emdogain®; 4.7: Fitting of Deepithelialized Free Gingival Graft [D-FGG]; 4.8: Fixation of D-FGG with Vicryl® 6/0; 4.9: Wound closure with Optilene® 6/0)

nique with erythritol powder [12]. A further eight weeks later, a re-evaluation was conducted. In terms of clinical outcomes, there was a reduction in probing depth at 12 and 11, accompanied by a notable decline in BOP (from 9 to 2%). In light of the recommendations made by our colleagues responsible for the patient's orthodontic treatment, namely that long-term retention be employed to prevent relapse [13], we proceeded to fabricate a new orthodontic retainer and bond it to all six anterior teeth (13–23). In the initial 12-month period, an SPT interval of four months was employed, which was subsequently extended to six months during the second year, given that the patient's oral hygiene remained consistently satisfactory [14]. A radiographic examination of the tooth at the 12-month follow-up visit revealed a completely filled bone defect at 11 with no evidence of particulate bone substitute material. (Fig. 2). The treatment outcome has remained consistent for a period exceeding 36 months. (Fig. 5). Figure 6 presents the individual treatment steps in a clear timeline.

Discussion

This case report serves to illustrate the potential challenges that may be encountered when treating a patient with cleft lip and palate. Following prolonged maxillofacial surgery and orthodontic treatment, a localized alveolar ridge defect with mucogingival deformities and conditions was identified in the right cleft region. This finding is consistent with the results of studies on dental implant therapy in alveolar cleft patients regarding clinical [15] and aesthetic [16] outcomes. Tooth 11 exhibited a one-wall intrabony defect with gingival recession type 3 (RT3), while the dental implant in region 12 demonstrated both hard and soft tissue deficiencies, which had resulted in peri-implantitis with suppuration Figs. 5, 6.

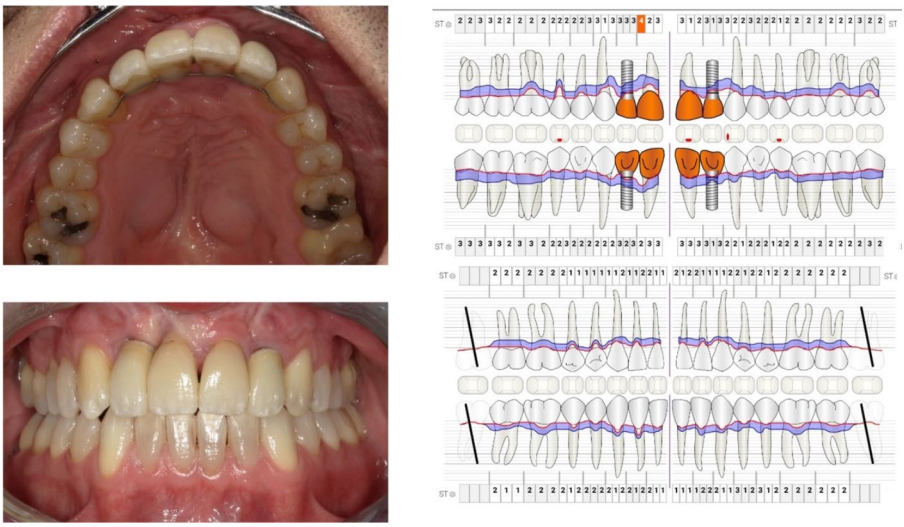

Fig. 5 Clinical situation 36 months after surgery

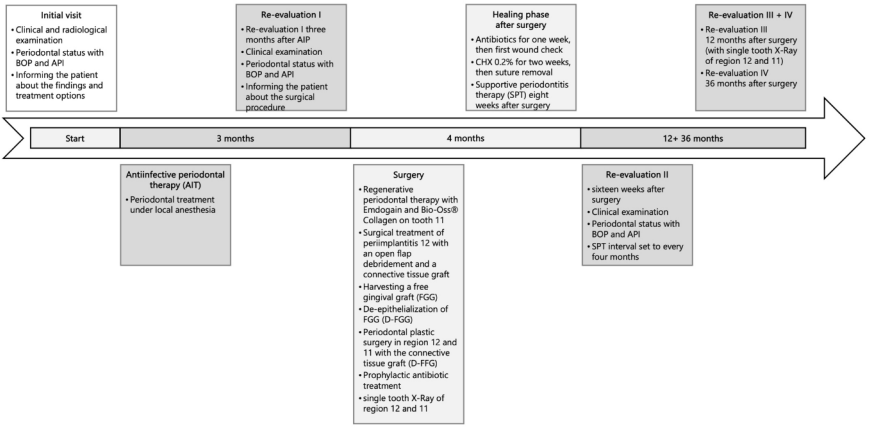

Fig. 6 Treatment steps

The objective of the treatment was to eliminate the acute inflammation and optimize oral homecare as a preliminary step. The subsequent phase of treatment involved regenerative therapy to address the bone defects and improve the soft tissue situation in the cleft area over the long term. At the commencement of the treatment, the patient exhibited satisfactory oral hygiene practices, with an API of 0% and a BOP of 9%. In region 12 – 11, however, dental care was significantly compromised due to the aforementioned issues. The acute inflammation was treated with a systematic anti-infective periodontal therapy. The one-wall intrabony defect was treated by regenerative periodontal surgery, and the mucogingival deformities of the premaxilla were treated by periodontal plastic surgery. Despite the unfavorable initial situation with bilateral cleft lip and palate, the bone defect on tooth 11 was successfully treated using regenerative periodontal surgery with Emdogain® and Bio-Oss Collagen®. The periodontal plastic surgery resulted in a notable improvement in the condition of the gingival tissues. This enhanced oral homecare (BOP from 9 to 2%) and, at the same time, improved the prognosis for tooth 11 and implant 12. The gingival conditions remained stable and healthy for a follow-up period exceeding 36 months. The periimplant condition was free of inflammation and exhibited no further bone loss. The result is not optimal from an aesthetic perspective, as there is persistent recession at tooth 11. However, the patient is satisfied with the result and demonstrates a high level of adherence, which is beneficial for the medium- and long-term prognosis. He continues to undergo SPT twice a year.

Conclusion

A localized alveolar ridge defect of the premaxilla on the right side was identified as a systemic disease or condition affecting the periodontal supporting tissue of the adjacent teeth. Additionally, a single-wall intrabony defect on tooth 11 with gingival recession (RT3) and a hard and soft tissue defect on the dental implant in region

12, which led to peri-implantitis, were observed. Regenerative periodontal therapy, periodontal plastic surgery, and surgical regenerative treatment of peri-implantitis were employed as treatment modalities, and successful outcomes were achieved. This resulted in the establishment of stable osseous and mucogingival conditions in the compromised area.

The regenerative treatment of patients with palato-alveolar clefts represents a significant challenge due to the poor condition of the mucosa and gingiva adjacent to the defect and the insufficient bone dimensions [17]. A multitude of treatment options exist, yet their efficacy has yet to be empirically validated in this patient population.

A number of studies have demonstrated that stable mucogingival conditions and the control of bacterial biofilms are essential for the achievement of favorable clinical outcomes in regenerative procedures [18]. This has been demonstrated in the case presented here.

It is conceivable that more favorable mucogingival outcomes might have been attained with a two-stage surgical procedure preceded by vestibuloplasty. This would have resulted in less traction of the labial frenulum during mucogingival surgery. Nevertheless, complete coverage of the recession would likely not have been achieved due to the level of interproximal clinical attachment loss in recession type 3 (RT3).

The author posits that it would be beneficial for the periodontist to be an integral member of the interdisciplinary treatment team for patients with cleft lip and palate from the outset. Their core responsibilities should include providing support to the patient throughout the entirety of the treatment phase with dental prophylaxis measures and delivering individualized oral hygiene instructions. This approach could potentially prevent the onset of inflammation and related bone and tissue loss. In the event that periodontal surgery is deemed necessary, it can be performed after maxillofacial surgery and before orthodontic treatment. This ensures the creation of a bony ridge with continuous mucogingival tissue, free from inflammation, at the site of the cleft. Following orthodontic treatment, it is necessary to assess whether a periodontal re-surgery is required or whether the patient can be included in an individualized supportive periodontal therapy. In the case of a patient presenting with palato-alveolar cleft defects, the general dentist may implement an individualized oral healthcare plan and professional supragingival mechanical plaque reduction. In the event that mucogingival issues persist and cannot be resolved by non-surgical periodontal treatment, the patient should be referred to a periodontist for surgical treatment.

Author contributions David Kiramira wrote the main manuscript text and prepared all figures and tables.

Funding Open Access funding enabled and organized by Projekt DEAL.

Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

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