

Interdisciplinary management of Class III malocclusion with cleft lip and palate

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ABSTRACT

Background: A cleft lip and palate (CLP) is one of the most common birth defects of the face. Individuals with CLP often have a significant growth disturbance of the maxilla along three dimensions, resulting in skeletal Class III malocclusion and cross bite. Oral rehabilitation can be complicated. **Purpose:** The purpose of this case study was to highlight the necessity of sequential interdisciplinary management to improve facial esthetics and correct functional disturbances for a patient with CLP. **Case:** The patient was a 20-year-old woman complaining of the unpleasant appearance of her upper front teeth. She had a concave profile with Class III skeletal patterns (SNA: 78°; SNB: 82°; ANB: -4°), cleft lip and palate, and an anterior and posterior crossbite. **Case Management:** A combined orthodontic, endodontic, conservative, periodontic, and prosthetic approach was proposed to achieve normal occlusion, function, and a harmonious profile. The combination of rapid maxillary expansion and fixed orthodontics (standard edgewise appliance) established good general alignment and a Class I relationship. After 15 months of treatment, both the posterior and anterior crossbite had been completely corrected. In order to address the gingival margin differences, the patient was instructed to make another appointment with the periodontist and was referred to the restorative dentist for veneer restorations and the prosthodontist for fabrication of a removable retainer with obturator. **Conclusion:** This interdisciplinary approach greatly improved both esthetics and function. The patient was satisfied with the results achieved.

Keywords: Class III skeletal malocclusion; cleft lip and palate; orthodontics

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INTRODUCTION

Cleft lip and palate (CLP) is a common type of congenital orofacial malformation which is characterized by varying degrees of deficient and displaced orofacial tissues, including soft tissue, musculature, bone, and cartilage.¹ According to the World Health Organization (WHO), the prevalence of cleft lip and palate depends on the country, ranging anywhere between 3.4 and 22.9 out of every 10,000 births. It has been found that the rate of occurrence varies by ethnicity and geographical location, with the highest incidence seen in Asian populations (0.84–4.04 per 1,000 live births), medium incidence in Caucasians (0.9–2.69 per 1,000 live births), and the lowest incidence in African

populations (0.18–1.67 per 1,000 live births).² In Indonesia, of all orofacial cleft types, cleft lip and palate is the most frequent (50.5%), followed by cleft lip (24.4%), and cleft palate (25.1%).³ There are multiple genes contributing to the etiology of CLP. Conte et al. reported 45 genes for deletions and 27 for duplications, including several known causative genes for orofacial clefts in humans, such as special AT-rich sequence-binding protein 2 and meis homeobox 2, as well as 12 other genes that are associated with clefts. Further, they identified a number of deletions and duplications in genes not previously reported. However, knowledge on the genetic background is still limited.⁴

Individuals with CLP are born with dentofacial deformity and may experience functional issues such as

feeding difficulties, speech problems, respiration pattern alterations, and recurrent middle ear infections that affect their quality of life.⁵ A variety of professions are involved in the treatment. Speech therapy is frequently needed to treat cleft-related muscle abnormalities at the time of speech development. Disturbed facial growth and dental development leading to malocclusion necessitate dental and occasionally surgical care as the individual grows and matures.⁶ Dental and cosmetic impairments such as midfacial deficiencies, crossbites, abnormalities, asymmetries of the soft tissues, and extraoral and intraoral soft-tissue scarring, as well as eating and communication difficulties are common in patients with these conditions. In many cases, lip and palate repair procedures have a deleterious impact on maxillary growth and development, resulting in a narrow maxillary arch and maxillary sagittal insufficiency. Consequently, anterior and posterior crossbites and a reduction in the maxillary arch's perimeter are usually noticed, and maxillary expansion is frequently necessary.⁷ Comprehensive orthodontic treatment is needed for patients with CLP to provide the best possible results in terms of dental occlusion and facial esthetics. It has also been noted that patients with cleft conditions are not only at a high risk of caries, but they also have a higher prevalence of caries than people who do not have cleft conditions.⁸ Thus, the final treatment outcome for a CLP patient is highly dependent on a multidisciplinary team approach.⁹ This case report highlights the importance of such an approach for

the effective treatment of a Class III malocclusion in a CLP patient in order to improve the patient's overall functional, structural, and esthetic outcomes.

CASE

An Indonesian female (aged 20 years 2 months) came to Prof. Soedomo at Universitas Gadjah Mada Dental Hospital for orthodontic purposes. Her chief complaint was her anterior crossbite which gives her face an unesthetic appearance. She was born with a nonsyndromic complete bilateral cleft lip, alveolus, and palate (CBCLAP). Primary cheiloplasty and palatoplasty were performed when she was one year old. She did not undergo any additional orthodontic therapy or alveolar bone grafting procedure after this. Both alveolar clefts were still open, the soft palate was partly closed, and there was an anterior palatal fistula present. The patient's profile was concave, and her upper lip was retracted and lower lip everted. She had a mesocephalic head type and a hypereuriprosopic facial type. She showed an imbalance among the facial thirds (Figure 1), and functional analysis revealed that the free-way space was normal (2.4 mm) with no evidence of temporomandibular disorder.

Intraoral examination revealed an Angle Class III relationship bilaterally with a negative overjet up to -2 mm. Due to a combination of factors, including the initial cleft and the previous surgical scarring in the palate, the



Figure 1. Pre-treatment (A, B) and post-treatment (C, D) extraoral photographs. Frontal photographs of spontaneous smile (upper) and profile view (lower).



Figure 2. Intraoral photographs: pre-treatment (A), during orthodontic treatment with fixed appliances (B), and after orthodontic treatment and prosthetic rehabilitation (C).

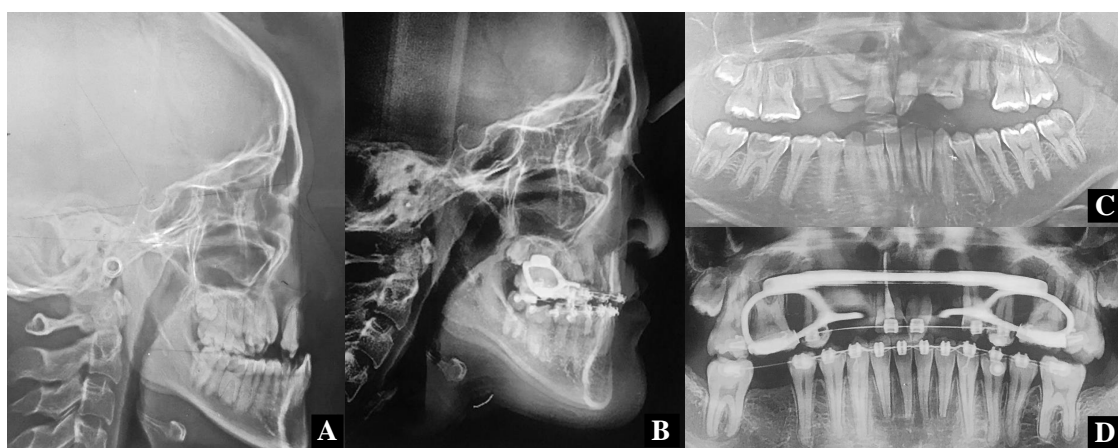


Figure 3. Pre-treatment lateral cephalogram (A), post-treatment lateral cephalogram (B), pre-treatment panoramic radiograph (C), post-treatment panoramic radiograph (D).

Table 1. Lateral cephalometric measurements

Parameters	Normal (mean ± SD)	Pre-treatment	Post-treatment
Horizontal skeletal			
SNA (°)	82 ± 2	78	78
SNB (°)	80 ± 2	82	82
ANB (°)	2 ± 2	-4	-4
Wits appraisal (mm)	1 ± 1	-2.35	-2.25
Angle of convexity (°)	0 ± 5	-7	-4
Vertical skeletal			
Y-axis (°)	60 ± 4	58	59
SN-mandibular plane (°)	32 ± 3	29	29
MMPA (°)	27 ± 5	26	28
LAFH (%)	55 ± 2	52	55
Dental			
Interincisal angle (°)	135 ± 10	128	133
U1-palatal plane (°)	109 ± 6	106	112
U1-NA (mm)	4 ± 2	1	4
L1-mandibular plane (°)	90 ± 4	91	88
L1-NB (mm)	4 ± 2	6	4
Soft tissue			
Upper lip to E-Line (mm)	1 ± 2	-6	-1
Lower lip to E-Line (mm)	0 ± 2	3	0

maxillary arch was unable to maintain its normal shape and had collapsed and narrowed. Moderate crowding in the maxillary arch (arch length discrepancy -3.96 mm) was noted, whereas the mandibular arch showed slight anterior crowding (arch length discrepancy -0.92 mm). Poor oral hygiene was present, as evidenced by bleeding in brushing, particularly in the posterior region (Figure 2).

The cephalometric findings revealed a skeletal Class III malocclusion (ANB, -4° ; Wits appraisal, -2.35 mm) with a normal vertical facial growth pattern (SN-MP, 32°). The maxillary incisors were extremely retroclined (U1-palatal plane, 106° ; U1-NA, 1 mm), whilst the mandibular incisors were slightly proclined but still within the normal range (L1-MP, 91° ; L1-NB, 6 mm). The interincisal angle was 128° . Rickett's lip analysis indicated a retrusive upper lip and protrusive lower lip (Table 1; Figure 3). The panoramic radiograph indicated an absence of the maxillary left and right lateral incisors, an absence of the germ of teeth #38 and #48, radix second premolars (teeth #15 and #25), radix upper right canine (#13), gangrene in #37 and #46, and pulp necrosis in #11. All other permanent teeth were present (Figure 3).

CASE MANAGEMENT

The treatment's objectives were to harmonize the facial profile through the expansion of the maxillary arch, which would correct the anterior and posterior crossbite as well as the maxillary transverse deficiency, levelling and aligning the dental arches and establishing a good interdigitation with enhanced intercuspation. A treatment plan was suggested as follows: (1) extraction of radix second premolars (teeth #15 and #25) and gangrenous teeth #37 and #46; (2) root canal treatment (RCT) for #11; (3) restoration of all caries; (4) alignment of the upper and lower teeth with edgewise appliance, 0.022" slot; (5) retention using upper and lower

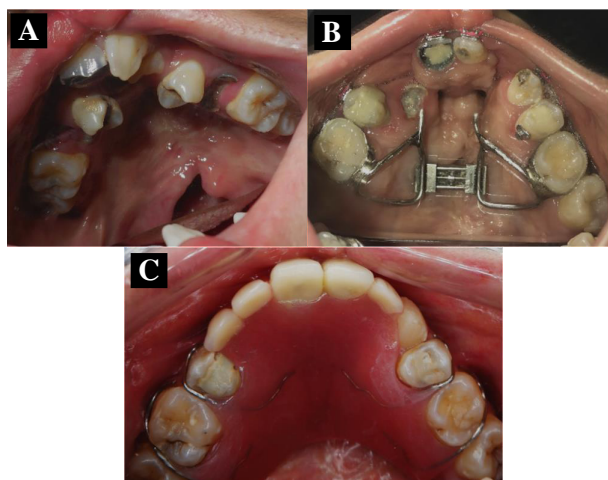


Figure 4. Occlusal view of the maxilla pre-treatment (A), during orthodontic treatment (B), and after orthodontic treatment and prosthetic rehabilitation (C).

removable retainers followed by prosthetic rehabilitation. The periodontist, general dentist, endodontist, restorative dentist, and prosthodontist were also involved in the planning. Due to financial limitations, no additional surgical interventions were planned.

After extraction of the upper radix premolars and gangrenous teeth, RCT, and restoration, orthodontic treatment began with a slow maxillary expander. Because rapid, heavy, intermittent forces created by a screw-type rapid palatal expansion device have the potential to cause tissue damage, a slow maxillary expansion was conducted to generate slow, suitable, continuous stresses. During the process of expansion, the maxilla, palatal mucosa, and dentition were tightly controlled for any difficulties that might arise, such as the enlargement of the palatal fistula or tipping of teeth. After a period of four months, an expansion of four millimeters was achieved.

Following expansion, a fixed standard edgewise appliance with a 0.022-inch slot (Marquise, Orthotech, USA) was bonded to the maxillary and mandibular teeth in order to begin the process of aligning the dental arches, while keeping the expansion appliance in place to maintain the width of the maxillary arch. The first step was processing alignment and leveling with 0.012", 0.014", 0.016" and 0.016 x 0.016-in stainless steel arch wires. The second stage, using a stainless steel 0.016 x 0.22-in arch wire, involved clockwise backward and downward rotation of the mandible while employing Class III intermaxillary elastics. This was done in order to enhance the maxillomandibular skeletal relationship in the sagittal dimension and to increase the lower anterior

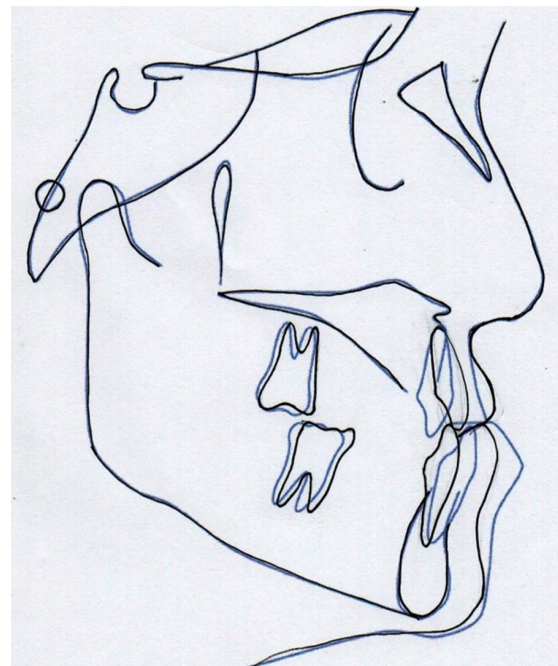


Figure 5. Superimposition of the pre- (blue) and post-treatment (black) cephalometric tracings. Note there were changes in maxillary and mandibular incisor inclination, and also in the lip position.

face height. This rotation contributes significantly toward the development of an improved anterior overjet position. After 11 months of treatment, both the posterior and anterior crossbite had completely disappeared. The final step was finishing and settling of the occlusion using a 0.017 x 0.025-in stainless steel arch wire. Subsequently, the patient was instructed to return to the periodontist in order to have the gingival margin inconsistencies corrected, to the conservative dentistry specialist for veneer restorations, and to the prosthodontist for fabrication of a removable maxillary denture.

After 24 months of orthodontic treatment in total, the appliances were debonded. In the maxillary arch, a Hawley retainer with two lateral incisors was used for esthetic reasons and to maintain tooth position and arch width. In the lower arch, a removable retainer was used to stabilize the position of the teeth and to replace tooth #46 (Figure 4). Soft tissue analysis indicated the position of the upper lip was more forward and upward while the lower lip was more backward by the end of treatment (Figure 5). An improved profile, an ideal overjet and overbite, and Class I relationship were established, a clockwise mandibular rotation was noted, and the inclination of the upper and lower incisors was within normal limits (Figures 1C, 1D, 2C, and 5).

DISCUSSION

Orthodontic management of CLP patients requires a multidisciplinary approach. In the presented case, a multidisciplinary treatment involving orthodontic, endodontic, and prosthetic management was proposed to achieve a normal function, occlusion, and balanced profile. To enhance the patient's quality of life, the treatment's primary objective was to achieve a more functional and esthetically pleasing facial profile and dentition.

The patient had a complex CLP problem list. The width of the maxillary basal arch was exceptionally restricted. A deep curve of Spee could be seen in the mandibular arch, and a Class III relationship was observed. The oral hygiene of the patient was poor, assessed by the presence of debris and calculus on the teeth, bleeding on probing of the gingiva, radix relictia, deep carious lesions, and pulp necrosis.

The role of orthodontic treatment is important for the management of patients with dental arch discrepancy in CLP conditions.⁴ There are several stages in this treatment that must be carried out. Firstly, people with an orofacial cleft are more likely to have gingivitis and calculus than non-cleft patients. These issues may be caused by a lack of physical ability, which makes brushing teeth difficult, as well as a lack of knowledge of the necessity of oral health management, communication difficulties, and fear of oral health procedures.¹⁰ Therefore, patients with an orofacial cleft need to take responsibility for maintaining proper dental hygiene and the long-term health of their teeth.¹¹ At the beginning of treatment, the specialist must

provide dental health education on the CLP condition using motivational techniques as well as explain how the treatment plan will be carried out and how to deal with poor oral hygiene. The patient's motivation and cooperation is essential in attaining these goals, and the patient must sign an informed consent acknowledging receipt of good information and agreeing to the course of treatment,

In this case, the endodontist then performed treatment of tooth #11, and orthodontic treatment started using slow maxillary expansion (SME), which was performed until the interpremolar and intermolar width were acceptable. Severe constriction in the posterior and anterior segments of the maxillary arch associated with the cleft lip and palate requires transverse expansion to achieve a better interocclusal relationship. The use of SME as a potential therapy modality for transverse deficiency in patients with clefts seems encouraging. Here, a fixed palatal expander was used since there is a possibility that expansion would cause damage to the tissues in the mouth. This was also done in order to generate appropriate and continuous stresses.¹² Although there is little doubt that an expander appliance is effective in cleft patients, the question remains as to whether expansion is stable in the long term. Patients with CLP at a mean age of 30 years exhibited satisfactory stability in upper inter-canine and upper/lower inter-molar widths after expansion with an expander appliance for a period of 10 years.¹³ Another study following 75 patients with a complete unilateral CLP until five years posttreatment showed that the transverse relationship deteriorated further if maxillary expansion was performed during treatment than in patients without expansion.¹⁴ However, more long-term studies are needed to assess the stability of this approach.

After the use of SME to achieve the ideal arch within four months, definitive orthodontic treatment can be initiated with fixed appliances. The aim of this phase is correction of the malrelationship and malposition of individual teeth and to align the dental arch to achieve good occlusion. The duration of definitive orthodontic treatment varies depending on the severity of the case and the degree of patient cooperation. In this case, the treatment was completed within 15 months, the posterior and anterior crossbite having been completely resolved. Definitive orthodontic treatment should be carried out until all teeth have good interdigitation contact to improve stabilization, there is sufficient space for preparation of prosthetic placement, and a satisfactory patient profile has been achieved.^{15,16}

In the final phase of treatment, in order to obtain optimal treatment results, patients are referred to various dental professionals such as a conservative dentistry specialist, periodontist, and prosthodontist. In this instance, the conservative dentistry specialist carried out dental veneer restoration of tooth #11 to achieve a more esthetic and stable result. The periodontist had performed a gingivectomy and gingivoplasty to correct the gingival margin discrepancies, and the prosthodontist had fabricated removable dentures to replace the upper lateral incisors. In this case, the

partial denture in the maxilla was also able to serve as an orthodontic retainer to maintain the transverse dimensions. The choice of retainer used may vary depending on the situation.¹⁷ A recently published, evidence-based, clinical practice guideline on CLP recommends maintaining the anterior teeth positions with a fixed retainer, and in addition, using a removable orthodontic retainer, such as a Hawley retainer, to preserve the maxillary transverse dimensions.¹⁸ Such a retainer must be worn on a nightly basis, lifelong.¹⁹ A retainer complete with denture and obturator was inserted. If the palate is severely scarred, the blood supply is often compromised, and a re-operation is not therefore advised. Moreover, due to the long-term constricting effects of palatal scar tissue, the patient must wear a retainer anyway for the transverse dimensions. In this context, a retainer and denture with an obturator have a two-fold advantage: they retain the transverse dimensions and cover the remaining palatal defects to improve speech and feeding.

Following treatment, the patient was satisfied with the results, the facial esthetics and profile had improved significantly, and had a good occlusion while keeping a balanced profile. Patient was educated to continue to use retainers regularly and to have regular check-ups with an orthodontist at least once every six months to assess the condition of the teeth so that good treatment results can be maintained.^{16,17}

Treatment for this patient with Class III malocclusion and cleft lip and palate was a challenge. The multidisciplinary approach resulted in significant improvements to facial and dental esthetics, and function was improved as well. The patient regarded the outcomes as satisfactory.

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