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# Severe Scissor Bite Management in a Cleft Lip and Palate Patient Following an Unsuccessful Distraction Osteogenesis

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## ABSTRACT

**Aim:** The current report presents the clinical and orthosurgical management of a median complete dentoalveolar cleft patient with bilateral severe skeletal and dental scissor bite with functional and aesthetic difficulties caused by an unsuccessful distraction osteogenesis (DO) without any primary or secondary graft history.

**Methods and materials:** The patient was managed by segmental osteotomy, augmentation of the missing tissues, upper (midpalatal) and lower arches TADs (Temporary Anchorage Devices) and fixed orthodontic treatment to correct the iatrogenic scissor bite. Finally, the treatment process followed by implant and prosthetic rehabilitation of the upper anterior teeth.

**Results:** The final results revealed a functional and aesthetic skeletal and occlusal full cusp class II first molars and class I canines relationship with a normal overjet and overbite and a coincident upper and lower dental midline. The patient's gingival show at smile and smile arch improved significantly at the end of the treatment.

**Conclusions:** Although DO is indicated as one of the most popular treatment options for cleft lip and palate patients, but a precise diagnosis and adopting the right kind of DO and predicting the potential side effects and the need for subsequent grafting is essential in treatment planning. Uncontrolled DO in patients with wide cleft lip and palate may cause some iatrogenic side effects that compromises the stability and function of the final occlusion and imposes a more complicated and long-term future treatment to the patient.

**Keywords:** Distraction osteogenesis; Cleft lip and palate; Orthodontic mini-implant; Craniofacial anomaly

## INTRODUCTION

Different DO methods have been introduced to manage different types of deformities in patients with clef lip and palate. Different DO methods with various treatment goals have been introduced so far. For example,

alveolar distraction osteogenesis (ADO) could be utilized for augmentation and reduction of the cleft size in patients with wide alveolar bone cleft before dental implantation.[1]

Another practical type of DO is Lo Fort I distraction osteogenesis. Le Fort I distraction osteogenesis in patients with cleft lip and palate associated maxillary and midface deficiencies is one of the well-known methods in management of these patients.[2,3] Although, this method is not always the best therapeutic option for every cleft lip and palate patient and require some considerations and prerequisites. Therefore, delicate care must be taken to choose the right patients to be qualified for this type of therapeutic treatment.

Among the distraction methods, the intraoral distractor osteogenesis compared to the external one, suggests advantages such as reduced emotional tensions and shorter hospitalization period and less patient's cooperation in the following retention phase. Also it has the privilege of no scar formation caused by fixation screws on the contrary to the extraoral DO.[4]

On the other hand, some noticeable disadvantages have been mentioned for internal DO as follows: challenging of the appliance positioning, additional surgical session for the distractor removal, uncontrolled and unchangeable distraction force vector throughout the distraction phase and challenges associated with the placement of the paired segments of the distractors parallel to each other.[5] Therefore, the internal DO as the treatment plan in cleft lip and palate patients needs to be adopted intelligently in order to avoid unwanted iatrogenic side effects and imposing further sophisticated treatments to the patient.

In this report the management of a patient with a large median lip and palate cleft undergone an unsuccessful internal DO treatment is discussed. The internal DO with the aim of maxillary advancement yielded some complicated skeletal and occlusal iatrogenic side effects which had compromised the patient's function and aesthetics. The patient was managed by the combination of surgical and fixed and TAD-based orthodontic treatments.

## CASE PRESENTATION

### Diagnosis

A twenty-year-old patient was referred with median complete cleft lip and palate with a chief complaint of functional, aesthetic and speech difficulty and bilateral buccal dental and skeletal severe scissor bite and anterior impinging overbite. The patient's cleft was complete including deficiencies in the premaxilla, subnasal and nasal septum areas and congenitally missing upper lateral incisors.[6] In the previous history, the patient had undergone internal bilateral distraction osteogenesis with the aim of maxillary downward and forward movement without any history of primary and secondary bone grafting. The unsuccessful DO had resulted in buccal cross bite which was aggravated by biting malfunction leading to exaggerated buccal and labial teeth inclination and associated gingiva and bone recessions.

The maxilla had no deficiency, but due to the absence of the premaxilla and maxillary anterior collapse, the patient was previously misdiagnosed as class III with maxillary deficiency. This misdiagnosis led to the incorrect treatment plan of applying internal bilateral DO appliance for maxillary anterior traction. And this was even worse when the DO treatment option for this patient was followed without considering subsequent grafting and augmentation for stability. As the maxilla has a pyramid structure with lateral slopes, when activating the DO advice, an uncontrolled lateral movement of separated, bony palatal bones had occurred concurrent with forward and downward maxillary movement which led to bilateral buccal crossbite. Following the patient's

biting, the bilateral palatal tissues which were not sticked by a necessary graft, were thoroughly separated and the resultant occlusion was severe bilateral scissor bite. The upper anterior and posterior teeth demonstrated a severely proclined position with lower posterior teeth occlusal surfaces contacting the upper posterior teeth lingual sides. She demonstrated class I skeletal and canine relationships, premaxillary deficiency and a concave profile. The lower lip was inverted and protruded according to E-line. The lower dental arch had a noticeable cant in compensation of congenitally missing upper anterior teeth (Figure 1, 2 and Table 1).


**Figure 1:** Initial images of the patient: Extraoral views: frontal at rest (a), frontal at smile (b), left profile(c), right profile(d) intraoral views: upper arch(e), frontal(f), lower arch(g), right occlusion(h), right overjet(i), left overjet(j), left occlusion(k)

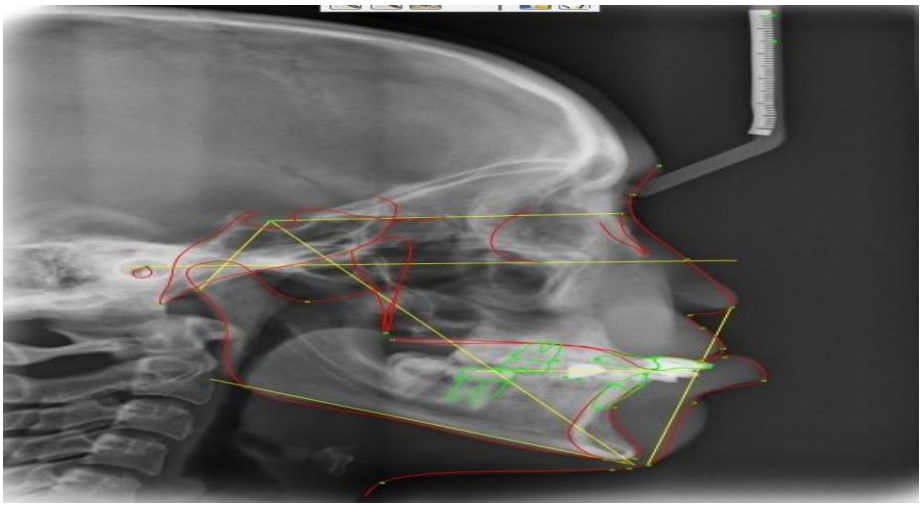

**Figure 2:** Initial lateral cephalogram

**Figure 3:** Initial Panoramic view

**Table 1:** Pre-treatment values of cephalometric analysis. *not identifiable to be measured due to the severity of the craniofacial abnormality.

| Cephalopetric variable | Pre Treatment (degrees) |
|---|---|
| **U1-SN** | 173 |
| **L1-MeGo** | 88 |
| **U1 to N-Pog** | 11 |
| **L1 to N-Pog** | 2 |
| **Interincisal A.** | 73 |
| **U1-Palatal P.** | 176 |
| **S-Go: N-Me×100** | 69 |
| **Pal-Go-Me(Basal A.)** | 24 |
| **SN-MeGo** | 31 |
| **SNA** | * |
| **SNB** | 86 |
| **ANB** | * |
| **SN-Pog** | 88 |
| **Wits** | * |
| **Upper lip to E_line** | 1.8 |
| **Lower lip to E_line** | 9.9 |
| **Nasolabial angle** | 76 |

Treatment objectives:

The treatment objectives consisted of the followings:

- Relocation of the separated bony segments into the right position,
- Correction of the bilateral skeletal and dental scissor bite
- Rehabilitation of the functional occlusion,
- Augmentation of the absent midpalatal tissues,

- Correction of the lower dental arch canting,
- Correction of the lower dental arch accentuated curve of spee,
- Decrowding the lower dental arch,
- Improvement of the incisors and gingival show at smile,
- Correction of the nonconsonant smile arch
- Achieving normal overbite and overjet,
- Achieving a stable molar and canine relationship.
- Substitution of the upper anterior teeth
-

**Treatment progress**

Due to the resultant malocclusion caused by the prior DO history, the patient was referred to Oral and maxillofacial surgeon to operate bilateral maxillary osteotomy to put the separated bony parts in the right position. The horizontal surgical cuts were made 5 millimeters gingival to the maxillary teeth root apices. The missing midpalatal tissues were augmented during the surgery.

The osteotomy resulted in a relatively correct buccolingual posterior relationship in the left side and an improved but still remained buccal relationship in the right side. The upper incisors with poor periodontal prognosis were extracted during the osteotomy procedure (Figure 4).

**Figure 4.** Images of the patient after surgical osteotomy and before initiation of the fixed orthodontic treatment: Extraoral views: frontal at rest (a), frontal at smile (b), left profile(c), right profile(d) intraoral views: upper arch(e), frontal(f), lower arch(g), right occlusion(h), right overjet(i), left overjet(j), left occlusion(k)

Two weeks following the osteotomy, pre-adjusted MBT metallic brackets (Master Series, American Orthodontics Ltd, Sheboygan, Wis, USA) with 0.022 slot size were bonded on the buccal surfaces of the upper and lower teeth.[7]

0.0155" coaxial wire (3M Unitek Corporation) was employed for initial alignment and leveling. At subsequent visits, archwire was changed to 0.16" NiTi, .018" NiTi and then .018" stainless steel. To correct the right buccaly inclined posterior teeth, a mini-screw (1.6 × 8 mm, G2, Dual Top Anchor System; Jeil Medical, Seoul, Korea) was inserted on the posterior left palatal area. Lingual button was bonded on the lingual surfaces of the upper right first premolars and molars using Transbond XT bonding material (3M Unitek, Monrovia, CA, USA) 8. Grey closed-spaced elastomeric chain was utilized from the buttons to the miniscrew to correct the buccal inclined posterior teeth in the right side (Figure 5).

**Figure 5.** Images of the patient after initiation of the fixed orthodontic treatment and miniscrews insertion: Extraoral views: frontal at rest (a), frontal at smile (b), left profile(c), right profile(d) intraoral views: upper arch(e), frontal(f), lower arch(g), right occlusion(h), right overjet(i), left overjet(j), left occlusion(k).

The upper left canine was distoangulated and it was anticipated that during the correction of the canine angulation, undesirable buccal force may be exerted on the upper left posterior teeth. So, as demonstrated in figure 5, two lingual buttons were also bonded on the palatal side of the left first premolar and molar. These buttons were also ligated to the miniscrew to prevent any unwanted buccal force direction from distoangulated left upper canine during angulation correction.

In the following step, it was decided to correct the lower arch deep curve of spee by the aid of TADs which are beneficial in facilitating some complicated cases.[9,10] Due to the close intimacy of the anterior teeth roots, it was impossible to insert the miniscrew anteriorly. So, a mini-screw (1.6 × 8 mm, G2, Dual Top Anchor System; Jeil Medical, Seoul, Korea ) was inserted in the right side of the lower arch between the first and second premolars on the labial side to correct the occlusal deep bite and lower dental arch canting (Figure 5).

After correction of the scissor bite in the posterior right side, the elastomeric chain was replaced by a ligation from the lingual button to miniscrew to stabilize the corrected posterior teeth inclination (Figure 6).

**Figure 6:** Images of the patient after stabilization of the resultant occlusion: Extraoral views: frontal at rest (a), frontal at smile (b), left profile(c), right profile(d) intraoral views: upper arch(e), frontal(f), lower arch(g), right occlusion(h), right overjet(i), left overjet(j), left occlusion(k).

The treatment was followed by 019×.025" rectangular (NiTi) until we could place 19 × 25" stainless steel as the working archwire. The treatment continued with impression taking from the upper arch to record the labial and buccal vestibules by alginate impression material (IRALGIN, Golchai Co., Tehran, Iran). This was performed to fabricate a removable plate in order to mold the flabby tissues caused by osteotomy cut scars. The removable plate was regularly utilized by the patient for 24 hours a day for 6 months.

The final step was to refer the patient for upper incisors implant insertion and prosthetic rehabilitation. Hawley type retainer for the upper arch and fixed retainer for the lower arch was considered for the retention phase.

**Treatment results**

The treatment accomplished in a 28- month time period. The patient showed excellent cooperation during the entire treatment duration. The treatment objectives were accomplished at the end of the treatment as follows (Figures 7, 8 and 9 and Table 2):


**Figure 7:** Images of the patient after finishing the fixed orthodontic treatment. Extraoral views: frontal at rest (a), frontal at smile (b), left profile(c), right profile(d) intraoral views: upper arch(e), frontal(f), lower arch(g), right occlusion(h), right overjet(i), left overjet(j), left occlusion(k).

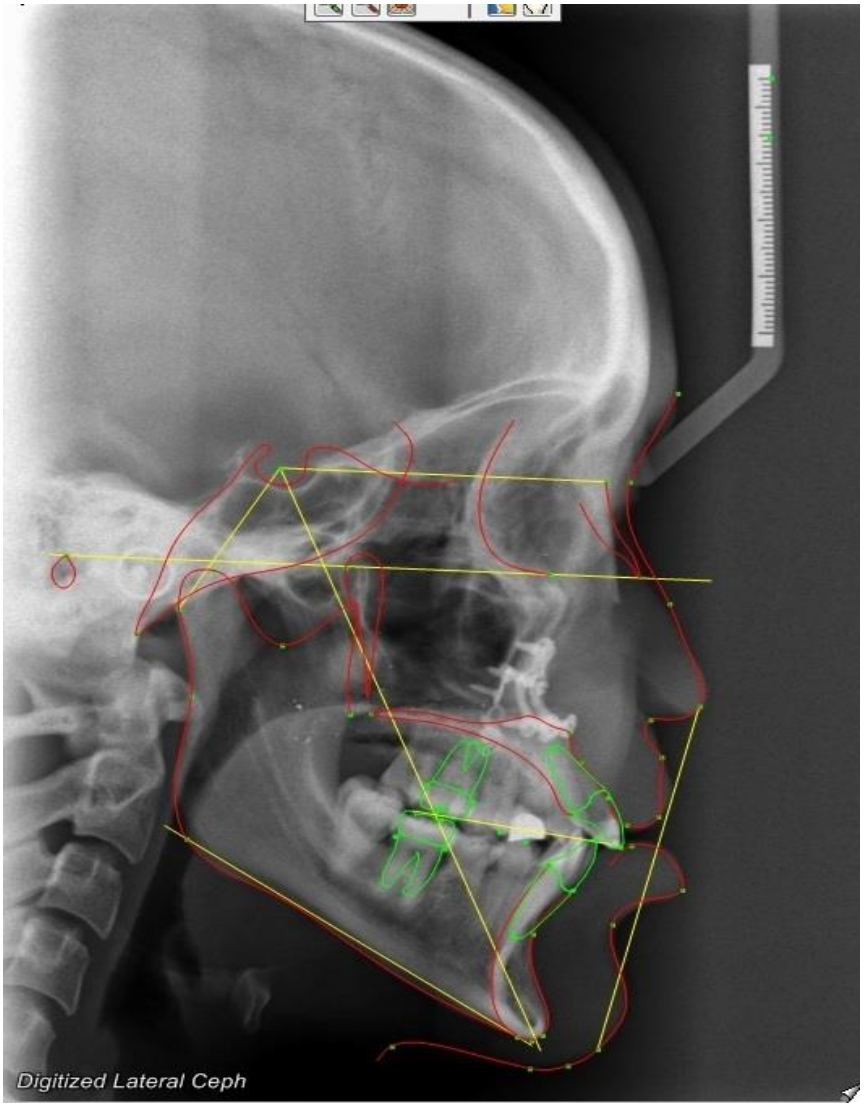


**Figure 8:** Final lateral cephalogram

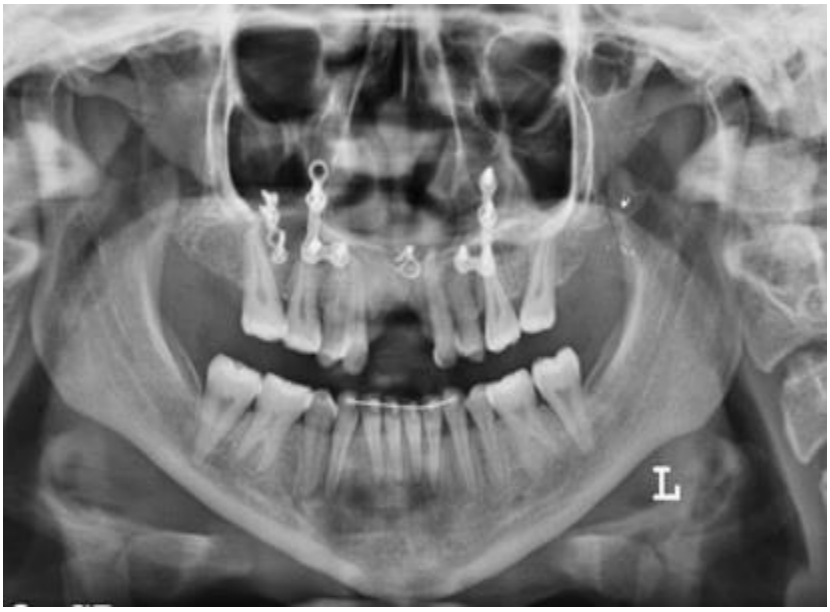


**Figure 9:** Final Panoramic view

**Table 2:** Post-treatment values of cephalometric analysis. *not identifiable to be measured due to the severity of the craniofacial abnormality.

| Cephalopetric variable | Post-Treatment (degrees) |
|---|---|
| **U1-SN** | * |
| **L1-MeGo** | 91.5 |
| **U1 to N-Pog** | * |
| **L1 to N-Pog** | 4.4 |
| **Interincisal A.** | * |
| **U1-Palatal P.** | * |
| **S-Go: N-Me×100** | 69 |
| **Pal-Go-Me(Basal A.)** | 24 |
| **SN-MeGo** | 31 |
| **SNA** | * |
| **SNB** | 86 |
| **ANB** | * |
| **SN-Pog** | 88 |
| **Wits** | * |
| **Upper lip to E_line** | -2 |
| **Lower lip to E_line** | 5 |
| **Nasolabial angle** | 76 |

- The absent midpalatal tissues were augmented
- The separated palatal bones were successfully approximated by surgical osteotomy and following midpalatal bone graft.
- Dental and skeletal scissor bite was corrected by means of surgical interventions and TADs application.
- The lower dental arch canting is corrected.
- The excessive curve of spee is corrected,
- A final stable and functional occlusion is established.
- Lower dental is decrowded.
- Labial and buccal vestibules are modeled.
- Consonant smile arc and acceptable gingival show at smile are achieved.

The two year follow-up demonstrated stable dental, skeletal, functional and aesthetic results (Figure 10).

**Figure 10.** Images of the patient after the upper incisors implant insertion and prosthetic rehabilitation. Extraoral views: frontal at rest (a), frontal at smile (b), left profile(c), right profile(d) intraoral views: upper arch(e), frontal(f), lower arch(g), right occlusion(h), right overjet(i), left overjet(j), left occlusion(k).

## DISCUSSION

In this case report a cleft lip and palate patient with the history of previous internal DO with iatrogenic complications was successfully managed by surgical and orthodontic treatments.

There are case reports of successfully treated patients with cleft lip and palate using distraction osteogenesis in the literature.[11] In a report by Seda Gürsoy et al. on adolescents with cleft lip and palate, the long term follow-up demonstrated successful outcomes on skeletal and dental structures following treatment by rigid external distractor devices. They concluded that according to cephalometric variables, the maxillary horizontal and vertical position showed slight relapse indicating a class I relationship after 5 years of follow-up.[12] while, some studies declare that the drawback of DO technique is the lack of vector control and development of an anterior open bite.[13]

Patient selection is of vital significance in choosing DO as the treatment option. In our case report the incorrect treatment plan of DO was firstly chosen for the patient who yielded unsuccessful aesthetic and functional results. The type of the DO appliance previously utilized for this patient was also incorrect because it yielded more lateral expansion than anteroposterior advancement. Furthermore, after the distraction no rigid fixation was followed to stabilize the separated bony segments. The instability of the posterior left and right buccal bony segments followed by tissue deficiency in the midpalatal and maxillary anterior region caused iatrogenic effects which had compromised the ideal final occlusal results.[14]

In a systematic review several advantages have been indicated for the management of severe maxillary hypoplasia in cleft lip and palate patients by DO including: a more reproducible, reliable and precise alternative compared to facemask. Also, it involves maxillary correction in the vital age of mixed dentition and causes acceptable improvements in aesthetics and velopharyngeal function.[15] While in our patient, the maxillary advancement following DO has no beneficial effects on the patient's speech and hypernasality. The primary drawback of the aforementioned technique is the unattainable final stable class I occlusion following distraction period15. This is in line with the distraction results obtained in the current case patient, which uncontrolled traction vectors a serious demand for further more complicated orthodontic and surgical treatments3.

In a recent case report, successful treatment of an adolescent with a wide unilateral cleft lip and palate was accomplished by a two-phased interdental distraction osteogenesis. This technique was adopted since the patient had rejected the grafting procedure and also because the prognosis of the secondary bone grafting was estimated low due the large width of the alveolar cleft. In such cases, interdental distraction osteogenesis allows for fistulae closure of alveolar cleft size reduction. Partial segmental osteotomy and extension of the segment from the impaired bone fragment to the other sound bony segment make the basis of this technique based on bone transport concept.[16] In our case, with the same concept, osteotomy executed by the surgeon and miniscrews were inserted to intimate the aparted bony fragments following external distraction osteogenesis which ended up with successful skeletal and dental results.

In a recent case report, with wide alveolar cleft, among different distraction methods, the tooth-borne archwise distraction technique was adopted which utilized Cr-Co custom-made crowns with double heavy arch wires and palatal bar to provide more rigidity.[17] In this technique following the maxillary expansion via quad helix, interarch distractor was activated to bring the anchored teeth containing bonny segments to a close contact. The primary advantage of this technique is the new bone regeneration concurrent with the arch shaping and the cleft size reduction. The other privilege of this method is having more controlled teeth movement compared to DO with the conventional fixed orthodontic appliance due to the rigidity of the heavy metal framework and teeth crowns. The right type of DO method utilized in this patient yielded with successful results on the contrary to the present case report with unsuccessful internal DO results.

Our patient was a candidate for alveolar DO because according to the literature the large cleft size challenges the full coverage capacity and the prognosis of the graft and the alveolar DO is a more predictable alternative to reduce the cleft size.[18] But in this case the patient had the history of internal DO for maxillary advancement with no preparation for the large median cleft. As the primary goal for the current case DO was not cleft size reduction but it was maxillary downward and forward movement, it ended up with unpredictable unsuccessful results. The outcome side effects on the teeth inclination can also be justified by incomplete osteotomy cuts prior to force application by DO, which led to excessive force exertion on teeth leading to exaggerated buccal inclination and buccal gingival and bone recessions.

By choosing the right patient for DO, this method could meet desirable treatment goals. As the results of a recent study revealed that bone grafting and rigid fixation following DO improves the skeletal stability and decreases the relapse risk in susceptible cleft lip and palate patients.[19] In this case the patient was unsuccessfully undergone internal DO. As DO in this patient was not with the goal of approximating the separated cleft parts to reduce the cleft size but to advance the maxilla, the large midpalatal gap compromised the osteotomised segments three-dimentionally control and stability. Incorrect treatment plan and not

considering the gap augmentation with graft and following the patient biting activity, the buccal cross bite was ended up with an extremely dental and skeletal scissor bite.

The common treatment approach for correcting scissor bite is to use inter-arch elastics and a transpalatal arch, but inter-arch elastics may cause an unintentional extrusion of the second molars, due to a vertical force vector. TADs and orthodontic mini-implants can be a beneficial alternative for different tooth movements and can be used as anchorage to effectively correct scissor bite without complications 20-22. As the unwanted severe scissor bite caused by an uncontrolled DO in this case was managed by surgical osteotomy and fixed orthodontic treatment in combination with TADs.

## CONCLUSIONS

- DO is not always the best treatment option for all cleft lip and palate patients.
- Improper patient selection for DO may end up with some irreversible iatrogenic side effects.
- Accurate diagnosis and adopting the most suitable treatment approach for alveolar cleft patients with large cleft size could prevent unintentional side effects and the demand for more future complicated treatments.

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