Presurgical and Postsurgical Orthodontics in Patients With Cleft Lip and Palate

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Abstract: Patients with cleft lip and palate (CLP) usually have skeletal Class III malocclusion with maxillary deficiency due to the cleft itself and fibrous scar tissue formation caused by the reconstructive surgery. In adult CLP patients with excessive jaw discrepancies, orthognathic surgery is often indicated to correct their functional and aesthetic problems. However, CLP patients have different inherent structures that may require a strategic approach compared with noncleft Class III patients. Main differences in skeletal and dental findings of lateral cephalograms between CLP and non-cleft Class III surgical patients are to be demonstrated. Furthermore, a strategic approach with various mechanics in the presurgical orthodontic stage will be applied to suit the distinct characteristic of the case. Successful clinical outcome was critically dependent on the close communication among the related specialists.

Key Words: Cleft lip and palate, presurgical and postsurgical orthodontic treatment, skeletal Class III

(J Craniofac Surg 2009;20: 1771–1775)

The objective of orthognathic surgery in cleft lip and palate (CLP) patients coincides to that of typical orthognathic surgery patients in that both strive for an esthetic face and normal oral function by improving facial skeletal and dental esthetics as well as achieving adequate functional occlusion. Successful presurgical orthodontics is a prerequisite for successful orthognathic surgery. To accomplish this, it is necessary to understand the skeletal and dental problems associated with CLP patients and consult related specialists such as orthodontists, oral surgeons, prosthodontists, and so on to establish a treatment plan. Presurgical orthodontics should be carried out according to the treatment plan to properly position the maxilla, mandible, and dentition during surgery.

The orthodontic dental problems in CLP patients are anterior and/or posterior crossbite; uprighting of the upper anterior teeth; missing teeth, or supernumerary teeth in the maxilla; upper anterior crowding; abnormal tooth shape or size in the upper anterior teeth; and so on. The skeletal problems usually appear in the maxilla.¹

Malocclusion in CLP Patients

Patients with CLP usually have CLP closure surgery in infancy. The fibrous scar tissue formed by the palate surgery affects normal forward and downward growth of the maxilla, usually resulting in a vertical and horizontal maxillomandibular relationship of skeletal Class III malocclusion with a deficient maxilla. When comparing the S-N-A and S-N-B angles of the Korean skeletal Class III surgical patients in a study by Baik et al.² to those of the white skeletal Class III surgical patients in a study by Ellis and McNamara,³ a majority of the white sample showed an underdeveloped maxilla, whereas most of the Korean sample showed an overdeveloped mandible. The same analysis was performed on CLP patients who had received orthognathic surgery by Baik et al.⁴ According to this research, skeletal Class III with underdeveloped maxilla and a normal mandible comprised the highest percentage (55%) of CLP patients (Fig. 1). In other words, a large number of CLP patients are skeletal Class III with underdeveloped maxilla.

Normal transverse growth of the maxilla is also affected by cleft palate closure surgery that results in constriction of the maxillary arch. The premaxilla appears to be narrower because of congenitally missing teeth in the maxillary anterior cleft area (Fig. 2). In skeletal Class III patients, dental compensation allows labial flaring of the maxillary anterior teeth, whereas in CLP patients, the maxillary anterior teeth show normal or even slight lingual crown tipping caused by tension of the fibrous scar tissue and upper lip closure (Figs. 3 and 4). The posterior teeth are also tipped palatally (Fig. 5). Anterior and posterior crossbite is usually observed due to maxillary arch constriction, palatal tipping of maxillary posterior teeth, and lingual crown tipping of maxillary anterior teeth (Fig. 4).

Missing tooth in the cleft area, peg lateral incisor or supernumerary teeth, anterior teeth rotation, crowding, and so on are observed (Fig. 6). The lower anterior teeth are tipped linguually by dental compensation.

Presurgical Orthodontic Treatment

Presurgical orthodontic treatment is a process that enables the upper and lower teeth to occlude in the most adequate and...
stable position after surgery. The treatment aligns crowded teeth, coordinates the maxillary and mandibular arch, and tips the linguually inclined upper and lower incisors labially.

Related specialists should be consulted to either maintain the space for further conventional prosthetic treatment or an implant or to bring the posterior teeth forward to close the space caused by the missing tooth or peg lateral incisor. Decisions are made according to the patient’s condition, but it is wise to make setup models to verify the occlusion when resolving tooth size discrepancies and space problems.

In typical skeletal Class III patients, presurgical orthodontic treatment lingually tips the upper incisors because the incisors are flared labially. However, in CLP patients, the upper incisors are uprighted, and labial tipping is required instead. The lower incisors of CLP patients need to be flared labially as is the case in typical skeletal Class III patients to release the dental compensation (Fig. 7).

Most cases require expansion in the constricted maxillary arch for upper and lower arch coordination. The extent of maxillary constriction should determine the method for maxillary expansion. A removable appliance with jackscrews or a quad-helix appliance (Fig. 8) is usually used to expand the maxillary arch in children, but it can also be applied to patients with little growth remaining in cases of mild constriction.

In preadolescents or children, orthopedic expansion by rapid palatal expansion (RPE) (Fig. 9) yields favorable results. However, a mini-implant reinforced RPE should be used for similar results in adults whose midpalatal suture is fused and basal bone expansion by opening of the midpalatal suture cannot be expected with a typical RPE appliance. Maxillary distraction osteogenesis may be used in adult CLP patients to actually move the maxilla anteroposteriorly with a maxillary distractor. This procedure can also be applied to distract the premaxilla anteriorly, regaining space for the permanent teeth and reestablishing normal arch form (Fig. 10).

Generally, in CLP patients, more time is needed for this presurgical orthodontic procedure compared with noncleft patients.

### POSTSURGICAL ORTHODONTIC TREATMENT

The purpose of postsurgical orthodontic treatment is to obtain stable occlusion after surgery. Generally, the splint and surgical arch wires are simultaneously removed, and round wires are engaged. Occlusal seating is achieved with light elastics.

Necessary prosthodontic treatment is performed after debonding (Fig. 11). In maxillary expansion cases, additional long-term retention appliances or prosthetic treatment is recommended.
because there is a higher tendency of relapse compared with noncleft patients.

**PATIENT**

Patient was a 21-year-old woman with left unilateral CLP and Class III malocclusion. She had a concave facial profile, short philtrum, anterior and posterior crossbite with midline discrepancy, crowding in the upper and lower dentition, and severe caries in the upper left central incisor. Her lateral incisor was missing, and upper right first premolar had been extracted. Her upper arch was omega shaped (Fig. 12).

The S-N-A angle was 73.9 degrees; A-N-B angle, was −7.3 degrees; Wits, −6.6 mm; and mandibular plane angle, 32.8 degrees, showing a hypodivergent skeletal Class III with an underdeveloped maxilla (Fig. 13).

The upper incisors were uprighted, whereas the lower incisors were compensated.

For presurgical orthodontic treatment, extraction of the upper left central incisor, relief of crowding, anterior expansion and
posterior constriction in the maxillary arch, and decompensation of the lower incisors were planned. Anterior crowding was reduced by retracting the upper right canine into the extracted first premolar space (Fig. 14). The anterior maxillary arch was expanded with quad helix, and posterior maxillary arch was constricted with a precision transpalatal arch simultaneously (Fig. 15).

For surgery, a 2-piece Le Fort I osteotomy, accompanied by bone grafting, was performed on the maxilla to widen the anterior area with forward and downward displacement. A prediction of the surgical change after maxillary 2-piece surgery was made on a model before surgery (Fig. 16). The mandible was set back via intraoral vertical ramus osteotomy.  

**FIGURE 11.** Space caused by the peg laterals was resolved with porcelain laminates for both lateral and central incisors.

**FIGURE 12.** Initial maxillary intraoral photograph. Severe caries on maxillary right central incisor, missing lateral incisor, extracted space of the left first premolar, and an omega-shaped maxillary arch are present.

**FIGURE 13.** Cephalometric analysis.

**FIGURE 14.** Quad helix is used to expand the maxillary anterior arch, and relief of anterior crowding is done simultaneously.

**FIGURE 15.** Anterior alignment is almost achieved, and the posterior teeth are constricted with a precision transpalatal arch.
In postsurgical orthodontic treatment, the upper left canine was modified into a lateral incisor, and the first premolar into a canine by prosthodontic treatment. Due to the forward downward displacement of the maxilla, the philtrum and upper lip were improved (Figs. 17–20).

For a successful orthodontic treatment, as always, accurate diagnosis, proper treatment, and good retention are important. Treatment planning for CLP patients is essential and requires special attention.

It is important to consider the dental and skeletal features of cleft patients along with the distinct characteristics of each patient. In addition, interdisciplinary cooperation and care between specialists of orthodontics, oral surgery, prosthodontics, and so on should begin from the start of treatment planning for an esthetic and functional outcome. Presurgical and postsurgical orthodontic treatment should follow this carefully planned-out blueprint.

REFERENCES


FIGURE 16. A model was used to plan the 2-piece surgery and bone grafting in the maxillary left central incisor area.

FIGURE 17. Maxillary arch after the maxillary left canine was modified into a lateral incisor by prosthetic treatment.

FIGURE 18. Before (A) and after treatment (B).

FIGURE 19. Superimpositions before and after surgery.

FIGURE 20. Before (A) and after treatment (B). Note the improved concave profile.