Correction of Eyes and Lip Canting after Bimaxillary Orthognathic Surgery

Chae-Eun Yang¹, Jae Young Bae¹, Jina Lee², and Dae Hyun Lew¹

¹Institute for Human Tissue Restoration, Department of Plastic & Reconstructive Surgery, Severance Hospital, Yonsei University College of Medicine, Seoul;
²Lee Jina Dental Clinic, Seoul, Korea.

Patients who have a lower facial asymmetry with compensatory head posture (developmental facial asymmetry) may have minor temporomandibular (T-M) joint problems and tend to mask their asymmetry by tilting the head for camouflage of their chin deviation. However, this compensatory head posture can give the impression of orbital dystopia and c spine deviation. When these patients undergo bimaxillary orthognathic orthognathic surgery, orbital canting and head tilting improves gradually without the need for camouflage, and bleary eyes become clearer. We evaluated 13 patients who underwent LeFort I osteotomy combined with bilateral sagittal split osteotomy of the mandible for developmental facial asymmetry to quantitatively observe whole facial postural changes after surgery. Pre-operative and post-operative 1:1 full-face photographs of the patients were analyzed to compare the degrees of head tilting and orbital canting and the sizes of the eye opening. After bimaxillary orthognathic surgery, eye canting decreased from 2.6° to 1.5°, eye and lip lines came closer to parallel, and the degree of head tilting decreased from 3.4° to 1.3°. The eyes also appeared to open wider. Correction of lower facial skeletal asymmetry through bimaxillary orthognathic surgery improved head tilting and orbital canting gradually by eliminating the need of compensatory head posture. Facial expressions also changed as the size of the eyes increased due to the reduction of facial muscle tension caused by T-M joint dysfunction.

Key Words: Facial asymmetry, maxillofacial orthognathic surgery, treatment outcome
A mandibular incision was made approximately 10 mm from the mental foramen, and anesthetic agent was infiltrated into the surgical field. The tooth was then removed with a surgical handpiece. The premolar was extracted with a straight forceps. The maxilla was placed into its new position using an intermediate splint. The maxilla was fixed with three lag screws. Gingivobuccal incisions were repaired with Vicryl sutures.

After rotation of the maxillomandibular complex, the maxilla was plated into the correct position, and the intermediate splint was removed. Mandibular splitting was performed with serial osteotomies until the distal segment was placed into the desired occlusion plane using the final splint. The forwardly displaced lateral portion of the ramus was resected with a reciprocating saw, and the condylar head was manually pushed in a clockwise direction (upward and anterior). The lateral portion was fixed with three lag screws. Gingivobuccal incisions were repaired with Vicryl sutures.

On regular follow-up after surgery, postoperative photographs were taken in the same manner as the preoperative photographs. Preoperative and postoperative orbital canting, head tilting, and opening of the eyes were compared, and the results were expressed as percent change. Orbital canting was evaluated as the angle between true horizontal and the line connecting the centers of the pupils (interpupillary line). Head tilting was evaluated as the angle between true vertical and the line perpendicular to the interpupillary line. The eye was outlined on the full-face photographs, and the opening of the eye was evaluated using the ImageJ program (National Institutes of Health, Bethesda, MD, USA) (Fig. 2).

Photographs taken before surgery and a year after surgery showed marked differences in the patients’ overall appearance. Before surgery, average orbital canting was $2.6\pm1.8^\circ$ from true horizontal. After surgery, average orbital canting was $1.5\pm0.6^\circ$ from true horizontal, which was a 42.8% decrease. Opening of the eye increased from $157\pm4.8\text{ mm}^2$ to $159.1\pm8.1\text{ mm}^2$ wide, although this increase was not significant. Before surgery, average head tilt was $3.4\pm1.9^\circ$ from true vertical. After surgery, the average head tilt was $1.3\pm0.7^\circ$ from true vertical, which was a 60.6% decrease (Fig. 3).

As a result, the interpupillary line and the line connecting bilateral oral commissure came closer to parallel and to true horizontal. Interestingly, these changes did not appear immediately after surgery. Instead, the patients’ appearances changed gradually over the 12-month postopera-
Symmetry is an important factor in determining facial attractiveness; however, no human face is perfectly symmetrical.

Facial asymmetry is a relative distortion of multiple anatomical parts including the eyes, nose, lips, and mandible, and the degree of asymmetry determines whether it is perceptible. Song, et al. reported that the mouth is the most asymmetrical facial structure, followed by the ears, and the orbits exhibit the lowest degree and incidence of asymmetry. Lee and Yu reported that asymmetry of the lower third of the face tends to be perceived more than asymmetry of the upper or middle third of the face. Although position of the mandibular body, gonial angle, and lip canting are all involved in asymmetry of the lower third of the face, chin deviation exerts the greatest influence.

Although there are no standard criteria for the quantitative assessment of facial asymmetry, some studies have reported quantitative data. An occlusal cant of 0° to 3° is observed in normal, healthy individuals. Padwa, et al. reported that more than half of both untrained and trained observers can notice an asymmetry of 3°, and if the cant is greater than 4°, 90% of untrained observers and 98% of trained observers can detect the asymmetry. Keulen, et al. reported that most observers were able to identify a chin deviation of 4 mm or greater.

Most individuals with facial asymmetry experience T-M joint...
problems. Some may have clinical signs and symptoms related to the masticatory system, such as muscle contraction headache, malocclusion, or bruxism, which can be diagnostic. Previous studies have reported abnormal forward head posture in patients with T-M disorders, and Munhoz, et al. reported that individuals with more severe T-M joint disorder tend to exhibit cervical spine hyperlordosis. These adaptations in lateral position are thought to be the result of compensatory head posture. According to Bjork and Marcotte, in individuals with prognathic profiles, the protrusive mandible tends to be masked by forward positioning of the forehead.

Conversely, a convex facial profile is masked somewhat by upward positioning of the chin. In the anteroposterior view, individuals with distinct facial asymmetry often tilt the head to bring the chin point to midline. This head posture leads to the false impression of orbital dystopia due to rotating an untilted orbital plane. In addition, most of these individuals have tired appearing eyes.

Patients with facial asymmetry may desire surgery for aesthetic reasons, even without functional problems with mastication or occlusal position. Facial asymmetry can involve not only the skeleton, but may also have dental and soft tissue components, requiring a combination of orthodontic treatment and orthognathic surgery. Surgical management of facial asymmetry generally requires bimaxillary surgery involving a LeFort I osteotomy and bilateral sagittal split osteotomy. In this study, we found that bimaxillary orthognathic surgery to correct skeletal asymmetry in the lower face can improve head tilting and orbital canting. These changes are presumed to be the result of head posture correction. After surgery, postural compensation by head tilting is unnecessary, and the impression of orbital dystopia disappears. Changes in head and neck posture are presumed to reflect the gradual readjustment of head and neck muscles, such as the sternocleidomastoid muscle.

Results of electromyographic evaluations reveal neuromuscular imbalance in candidates for orthognathic surgery, reflecting asymmetrical development of the temporals and masseter muscles. Goto, et al. reported differences in bilateral masseter muscle size in patients with facial asymmetry, and Kiliaridis and Katsaros reported that children with untreated unilateral cross bite have a thinner masseter muscle on the affected side. The masticatory muscles are innervated by the trigeminal nerve, which commingles with the nerves of the neck. Therefore, masticatory system dysfunction often leads to problems within cervical structures and vice versa. When the auriculotemporal nerve is constantly stimulated, possibly by internal derangement of the T-M joint, the aberrant signal may cause the head and neck to turn to the ipsilateral side of the stimulation. Forward head and neck posture in patients with facial asymmetry can be explained by this neuromuscular relationship. Muscle orientation becomes symmetrical as skeletal components achieve symmetry, and the neural stimulation is relieved by surgery. Kiliaridis and Katsaros also reported that bilateral differences in muscle size in patients with unilateral cross bite were eliminated after treatment of the malocclusion. A number of studies have reported that orthognathic surgery, in combination with orthodontic treatment, corrects the dento-facial deformity and improves occlusal contacts, masticatory efficiency, bite force, and electromyography activity. The gradual redistribution of jaw muscle activity alters facial alignment and head posture.

Head and neck posture are also connected to the extraocular muscles. Monaco, et al. reported that ocular convergence defects are more common in patients with functional mandibular deviation. In this study, we observed that surgical correction of lower face asymmetry improves the appearance of tired eyes, which is presumed to be due to muscle readaptation and pain relief. These changes occur gradually because muscle stress is not relieved immediately, and time is necessary to allow the head and neck muscles to readjust. Patients may feel discomfort early after surgery as this realignment takes place.

Although not evaluated in this study, changes in lip cant after bimaxillary surgery have been reported. Lip cant is caused by differences in height of the bilateral oral commissures, determined by the upward pull of the zygomaticus major and levator anguli oris muscles and the downward pull of the depressor anguli oris muscle. During orthognathic surgery, the depressor anguli oris muscle attachment is displaced to correct lip cant.

One limitation of this study is the lack of precise method to measure head and cervical posture. A device to help patients maintain stillness during the full-face photographs is needed for reproducibility. In addition, magnetic resonance imaging or computed tomography scans could provide more precise estimates of hard and soft tissue changes.

ACKNOWLEDGEMENTS

The authors thank Mr. Dong-Su Jang, Research Assistant, Department of Anatomy, Yonsei University College of Medicine, Seoul, Korea, for his help with the figures.

ORCID

Chae-Eun Yang https://orcid.org/0000-0001-8128-791X
Dae Hyun Lew https://orcid.org/0000-0002-2625-5664

REFERENCES

1. Kim YH, Jeon J, Rhee JT, Hong J. Change of lip cant after bimaxillary orthognathic surgery. J Oral Maxillofac Surg 2010;68:1106-11.
2. Padva BL, Kaiser MO, Kaban LB. Occlusal cant in the frontal plane as a reflection of facial asymmetry. J Oral Maxillofac Surg 1997;55:811-6.
3. Capurso U, Garino GB, Rotolo L, Verna C. [Radiographic screening of asymmetry and postural changes in orthodontic patients]. Mondo Ortod 1990;15:313-20.
4. van Keulen C, Martens G, Dermaut L. Unilateral posterior cross-bite and chin deviation: is there a correlation? Eur J Orthod 2004; 26:283-8.
5. Song WC, Koh KS, Kim SH, Hu KS, Kim HJ, Park JC, et al. Horizontal angular asymmetry of the face in korean young adults with reference to the eye and mouth. J Oral Maxillofac Surg 2007;65: 2164-8.
6. Lee DH, Yu HS. Masseter muscle changes following orthognathic surgery: a long-term three-dimensional computed tomography follow-up. Angle Orthod 2012;82:792-8.
7. Isacsson G, Linde C, Isberg A. Subjective symptoms in patients with temporomandibular joint disk displacement versus patients with myogenic craniomandibular disorders. J Prosthet Dent 1989; 61:70-7.
8. D’Attilio M, Epifania E, Ciuffolo F, Salini V, Filippi MR, Dolci M, et al. Cervical lordosis angle measured on lateral cephalograms; findings in skeletal class II female subjects with and without TMD: a cross sectional study. Cranio 2004;22:27-44.
9. Gremillion HA. The prevalence and etiology of temporomandibular disorders and orofacial pain. Tex Dent J 2000;117:30-9.
10. Lee WY, Okeson JP, Lindroth J. The relationship between forward head posture and temporomandibular disorders. J Orofac Pain 1995;9:161-7.
11. Munhoz WC, Marques AP, Siqueira JT. Radiographic evaluation of cervical spine of subjects with temporomandibular joint inter- nal disorder. Braz Oral Res 2004;18:283-9.
12. Bjork A. Some biological aspects of prognathism and occlusion of the teeth. Acta Odontol Scand 1950;9:1-40.
13. Marcotte MR. Head posture and dentofacial proportions. Angle Orthod 1981;51:208-13.
14. Di Palma E, Gasparini G, Pelo S, Tartaglia GM, Sforza C. Activities of masticatory muscles in patients before orthognathic surgery. J Craniomaxfac Surg 2010;21:724-6.
15. Goto TK, Nishida S, Yahagi M, Langenbach GE, Nakamura Y, Tokumori K, et al. Size and orientation of masticatory muscles in patients with mandibular laterognathism. J Dent Res 2006;85:552-6.
16. Kiliaridis S, Katsaros C. The effects of myotonic dystrophy and Duchenne muscular dystrophy on the orofacial muscles and dentofacial morphology. Acta Odontol Scand 1998;56:369-74.
17. Sims AB, Stack BC, Demerjian GG. Spasmodic torticollis: the dental connection. Cranio 2012;30:188-93.
18. Monaco A, Streni O, Marci MC, Sabetti L, Marzo G, Giannoni M. Relationship between mandibular deviation and ocular convergence. J Clin Pediatr Dent 2004;28:135-8.
19. Shapiro II. Relation between vertical facial asymmetry and postural changes of the spine and ancillary muscles. Optom Vis Sci 1994;71:529-38.
20. Marinetti CJ. The lower muscular balance of the face used to lift labial commissures. Plast Reconstr Surg 1999;104:1153-62.