

Evaluation of Soft Tissue Change after Segmental Osteotomy in Korean

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Our Goal of modified segmental osteotomy on maxilla accompanied by mandibular anterior subapical osteotomy was to get the best results from patients of bi-alveolar or bi-maxillary protrusion. In this study, cephalometric and photo (en face, profile) analysis have been compared to define the soft tissue change after surgery. Lip protrusion was efficiently reduced and nasolabial angle was much obtused. Although nose was a little widened, it was quite acceptable. Blood circulation on osteotomized segment was well maintained. This relatively simple methods could be successfully applied to many patients.

Key Words : Soft tissue change, Segmental Osteotomy, Korean

Since maxillary segmental osteotomy was introduced by Kole(1959), Murphey(1963) and Mohnac(1966) et al, it was mainly used for the correction of occlusal abnormality. Modified Wassmund(1935) and Wunderer(1963) method was applied to the maxilla. Maxillary segmental osteotomy itself has special indication(Bell, 1977).

In most bimaxillary cases combined therapy with orthodontic treatment and anterior subapical osteotomy is required. But this surgical method was not so popularized as for example sagittal split ramus osteotomy and Le Fort osteotomy because of poor surgical results ; when it is used for the correction of the vertical jaw dysplasia as before, it results in inadvertent effects such as gummy smile and high relapse rate. Because the main factor for the vertical jaw dysplasia is located in the posterior part of the jaw.

Modified segmental osteotomy on maxilla showed in this study(Figure 1, 2) is a relatively simple one, which minimizes retraction of paranasal area by doing osteotomy between apertura piriformis and canine root apex

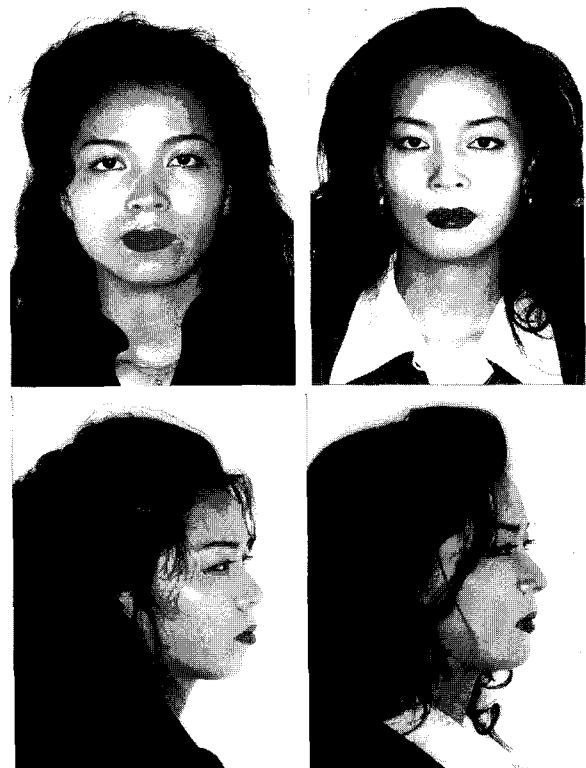


Figure 1. Frontal and lateral profile change of a female patient before and after modified segmental osteotomy.

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Figure 2. Frontal and lateral profile change of a male patient before and after modified segmental osteotomy.

with only vestibular incision. It can also maintain palatal mucosa intact, reduce bleeding and has the advantage of maintaining the nasal form because it minimizes the retraction of paranasal soft tissue.

The goal of this study is to define the soft tissue change after modified segmental osteotomy on maxilla and anterior subapical osteotomy on mandible, using cephalometrics and photo(en face and profile) analysis, to evaluate intended and unintended facial changes.

MATERIALS AND METHODS

The samples included in this study were 9 female patients(age 22-50) who were diagnosed as bi-alveolar, or bi-maxillary protrusion and received modified segmental osteotomy on maxilla and anterior subapical osteotomy mandibular and they had slight condition like vertical skeletal discrepancy but had no symptoms of

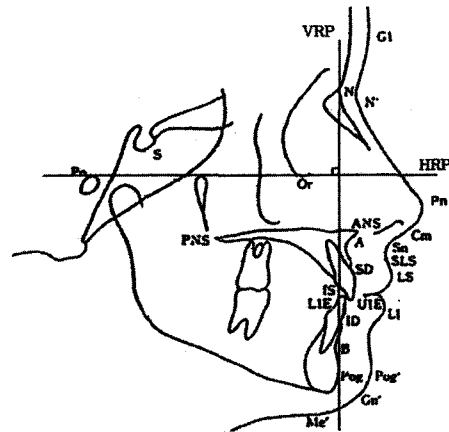


Figure 3. Landmarks and reference planes used in lateral aspect. Frankfort horizontal plane as a horizontal reference plane and Nasion(Na) perpendicular line as a vertical reference plane.

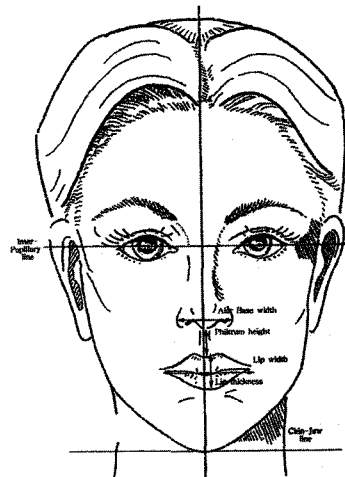


Figure 4. Measurement items in frontol photo.

cleft lip and palate and facial asymmetry was not severe.

The facial photos and lateral cephalometric radiographs before and after surgery these patients' of these its were analyzed. The frankfort horizontal plane(FH plane) was chosen for the horizontal reference plane, and Nasion perpendicular line which gets through Nasion(Na) and is perpendicular to the FH plane was chosen for vertical reference plane. (Figure 3, 4)

Table 1. Soft tissue change in frontal aspects.

| measurements | pre-treatment (percent mean \pm SD) | post-treatment (percent mean \pm SD) | t-value |
|-----------------------|--|---|-----------|
| alar base width ratio | 62.0 \pm 2.8 | 66.0 \pm 3.0 | -5.781*** |
| lip thickness ratio | 17.5 \pm 2.1 | 16.1 \pm 2.4 | 2.031* |
| lip width ratio | 82.4 \pm 4.9 | 82.7 \pm 6.6 | -0.195 |
| philtrum height ratio | 15.8 \pm 2.5 | 16.0 \pm 2.3 | -0.933 |

significance value *P<0.1 **<0.05 ***P<0.01

Table 2. Soft tissue change in lateral aspects : angular measurements in degree.

| measurements | pre-treatment (percent mean \pm SD) | post-treatment (percent mean \pm SD) | t-value |
|-------------------|--|---|-----------|
| profile angel | 166.3 \pm 7.7 | 167.9 \pm 7.3 | -2.019* |
| naso-labial angle | 87.0 \pm 13.7 | 99.6 \pm 15.9 | -4.461*** |
| labiomental fold | 137.8 \pm 16.2 | 133.4 \pm 22.8 | 0.661 |

significance value *P<0.1 **<0.05 ***P<0.01

In frontal(en face) aspect, the changes of alar base width, lip width, philtrum height, and lip thickness were sought. Alar base width and lip width were compared by calibrating the percentage of inter-pupillary width. Philtrum height and lip thickness were compared by the revised percentage of the vertical distance between inter-pupillary line and chin-jaw line.

In lateral(profile) aspect, profile angle(Powell, 1994), naso-labial angle, labio-mental fold value for angular measurements and lip projection, Ricketts' aesthetic line value and the distance from the vertical reference plane to anterior nasal spine(ANS), A point, supra-dentale, upper incisal edge, lower incisal edge, infradentale, B point, and Pogonion(Pog) was sought. For anterior-posterior movement of soft tissue, distances from vertical reference plane to subnasion(Sn), superior labial sulcus(Sls), labium superioris(Ls), labium inferioris(Li), inferior labial sulcus(Ils), and soft tissue Pogonion (Pog') were measured and compared.

The measurement items described above were extracted from the study of Arnett(1993) and Athanasios (1995).

All statistical analyses were performed by SPSS win ver. 7.5 program. Paired-t-test was used to compare the mean values.

RESULTS

After examining the changes in measurements of frontal aspect,(Table 1) it showed statistically insignificant change in lip width ratio and philtrum height ratio. Lip thickness ratio showed a slight decrease from 17.5% \pm 2.1(SD) to 16.1% \pm 2.4(SD) and alar base width ratio was increased from 62.0% \pm 2.8(SD) before surgery to 66.0% \pm 3.0(SD) after surgery showing statistically significant change. Naso-labial angle showed attenuation.

From watching the changes in measurements of lateral aspect(Table 2, 3) a slight increase (from 166.3 $^{\circ}$ \pm 7.7(SD) to 167.9 $^{\circ}$ \pm 7.3(SD)) of profile angle was shown and the naso-labial angle(from 87.0 $^{\circ}$ \pm 13.7(SD) to 99.6 $^{\circ}$ \pm 15.9(SD)) increase showed there were statistically significant changes. On the other hand, the inclination of the labio-mental fold that shows the angle of the lower lip and chin showed severe increase depending on the patients or the decreased aspect contrary to this.(Table 2)

The lip projection that shows lip procumbency and the numerical value of Ricketts' aesthetic line was decreased vastly so the decrease of lip protrusion was prominent.(Table 3) On the other hand, the change of

Table 3. Soft tissue change in lateral aspects : linear measurements in millimeter.

| measurements | pre-treatment (percent mean \pm SD) | post-treatment (percent mean \pm SD) | t-value |
|--------------------------|--|---|-----------|
| lip projection | | | |
| upper lip | 11.1 \pm 2.2 | 7.4 \pm 1.8 | 7.137*** |
| lower lip | 11.2 \pm 2.9 | 5.6 \pm 2.6 | 10.631*** |
| Ricketts' aesthetic line | | | |
| upper lip | 3.1 \pm 2.8 | -0.3 \pm 2.4 | 6.424*** |
| lower lip | 6.0 \pm 3.3 | 0.9 \pm 2.1 | 8.859*** |
| nasal projection | 14.8 \pm 2.1 | 14.9 \pm 2.5 | -0.275 |
| subnasion | 14.0 \pm 4.8 | 14.2 \pm 5.6 | -0.530 |
| superior labial sulcus | 15.9 \pm 4.2 | 14.2 \pm 5.8 | 2.189* |
| labium superioris | 21.2 \pm 5.1 | 18.7 \pm 6.0 | 4.246*** |
| labium inferioris | 18.5 \pm 6.0 | 14.1 \pm 5.6 | 5.595*** |
| inferior labial sulcus | 6.8 \pm 7.0 | 5.4 \pm 7.3 | 1.487 |
| soft tissue Pogonion | 3.2 \pm 8.9 | 4.5 \pm 8.1 | -1.387 |

significance value *P<0.1 **<0.05 ***P<0.01

nasal projection was statistically not significant but the shape got a little dull. The decrease of lip protrusion was notable but protrusion of SIs or IIs was not severely decreased.

DISCUSSION

Modified segmental osteotomy on maxilla is used for anterior-posterior problem of maxilla, that is to correct sagittal discrepancy especially by using posterior movement. The indication of this method for bi-alveolar or bi-maxillary protrusion are frequently seen on Asian face but it isn't seen much in Caucasians. Orthognathic surgery not only affects the function by improving the improvement of skeletal and dental relationship but also the facial aesthetics. So the soft tissue change should be considered during the treatment planning. Generally the report on soft tissue change in maxillary surgery especially using the segmental osteotomy was very rare compared to orthognathic surgery of mandible. Segmental osteotomy on maxilla was not a popular method because the danger of impairment of blood circulation to the osteotomized upper anterior part was notified along with tedious operation itself and because of the unintended nasal change and possibility of profuse

bleeding. A lot of efforts were put into this study (modified segmental osteotomy technique) to solve these problems. In order to reduce the possibility of segmental necrosis, it is quite important to keep the blood circulation. By modified segmental osteotomy on maxilla, palatal circulation is preserved and facial circulation is also partly preserved because of only vestibular incision of mucosa and nasal approach of the osteotomy.

By segmental osteotomy on maxilla the shortcomings like the nose getting round and the alar base width getting broad occurred, but in this modified segmental osteotomy, although nose was little widened, it was quite acceptable. Anterior-posterior position of pronasion(nose tip) and subnasion was not significantly changed but gross configuration has changed which have become dull. It is thought that this results the fact from soft tissue attachment of alar base was somewhat released. And compared to the classical method nasal change was negligible. On the other hand naso-labial angle was much obtused, depending on the degree of the posterior movement of the upper segment.

Frontal lip thickness was also decreased because of decreased lip tension according to decreased lip protrusion. Lateral lip protrusion was also significantly decreased so that this technique is very efficient for

treatment of bi-alveolar or bi-maxillary protrusion.

Unlike the previous study of soft tissue changes after surgery for skeletal Class III malocclusion(Cho and Yang, 1996 ; Choi and Suhr, 1993) the change of inferior labial sulcus and soft tissue Pogonion was not significant, when surgery was done for treatment of bi-alveolar or bi-maxillary patients as in this study. It is considered that when thinner part of the soft tissue got thicker and contracted mentalis muscle was relaxed, variety of responses occurred during the process of harmonizing facial skeleton and soft tissue especially by the reduction of mentalis activity.

CONCLUSION

The modified segmental osteotomy on maxilla presented so far had outstanding safety and improved the soft tissue greatly the immense reduction on unexpected response of the nose was shown. Therefore modified segmental osteotomy on maxilla and mandibular anterior subapical osteotomy can be applied to many Koreans with satisfactory results.

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국문초록

한국인에서의 분절골 절단술 후 연조직 변화의 평가

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하악 전치부 근침하 골절단술을 동반한 상악 변형 분절골 절단술 목적은 양치조성 혹은 양악 전돌 환자로 부터 가장 좋은 치료 결과를 얻는 것이다. 본 연구에서는 두부방사선 계측 분석과 정면 사진을 비교 분석해 술 후 연조직 변화를 조사하였다. 구순 전돌이 효과적으로 감소되었으며 비순각은 증가하였다. 코가 약간 넓어졌으나 결과는 비교적 양호하였다. 절단된 골분 절의 혈액공급은 잘 유지되었다. 이것은 많은 환자에게 적용할 수 있는 비교적 간단한 수술법이다.

주요 단어 : 연조직 변화, 분절골 절단술, 한국인