

Correlation between Gonial Angle and Different Variables after Bilateral Sagittal Split Ramus Osteotomy

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Abstract:

Statement of problem: The gonial angle plays an important role in ensuring a harmonious facial profile. Changes in this angle especially after surgery may be an aesthetic concern for both the patient and the surgeon.

Purpose: The aim of the present study was to evaluate gonial angle changes after mandibular setback with the BSSRO technique and to measure postsurgical relapse two years after surgery.

Material and Methods: Nineteen patients with mandibular prognathism referred to Taleghani Hospital were selected from 1999 to 2001. All subjects underwent surgery for mandibular setback with the BSSRO technique and IMF for 8 weeks. Lateral cephalograms were taken before surgery, immediately postoperatively and 2–4 years after surgery. The setback rate (relapse) and gonial angle changes were evaluated during these periods. Pearson correlation and student t tests were used for statistical analysis.

Results: The mean gonial angle decreased in all subjects, it was 135.05° (6.41) before and 128.73° (5.43) after surgery. The mean reduction of the gonial angle was 6.32° (4.08) immediately after surgery while it showed 4.89° (3.44) decrease after 2 years follow-up at the final examination. The mean of setback was 6.27 (2.28) mm which decreased to 5.82 (1.82) mm after follow-up. A significant correlation was observed between the amount of setback and reduction of the gonial angle (P=0.0001) but no correlation was found between sex and gonial angle changes or mandibular setback relapse.

Conclusion: Surgical correction of mandibular prognathism using BSSRO and IMF can cause a decrease in the gonial angle. This increase in the setback, may reduce the gonial angle and have correlation to the amount of relapse.

Key words: BSSRO; Mandibular Setback; Gonial angle; Relapse

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INTRODUCTION

Orthognathic surgeries are performed in order to enhance the patients' function and esthetics. Different methods are developed for the improvement of mandibular deformities. Sagittal osteotomy is a technique preferred by

oral and maxillofacial surgeons because of its benefits, such as its application for all types of mandibular movements [1].

The use of this method is accompanied by short- and long-term skeletal changes. Also, changes in the mandibular gonial angle that

occur in some patients play an important role in ensuring a harmonious facial profile from an esthetic point of view. The gonial angle is a representative of mandible morphology and its increase may cause the face to appear older. Xie [2] concluded that elderly and edentulous subjects had larger gonial angles than did dentate individuals. This fact suggests the employment of techniques other than bilateral sagittal split ramus osteotomy (BSSRO) in these patients. Obwegeser, developed the BSSRO technique and claimed that the gonial angle decreased during mandibular setback. Previous studies conducted to evaluate gonial angle changes and its relapse rate, it was concluded that the use of Obwegeser's setback technique caused an increase in the gonial angle [3,4].

Liou et al [5] performed mandibular setback on 27 patients using the BSSO method and observed 7.6mm setback at 6 weeks and 2.3mm relapse 1 year postoperatively. Proffit et al [6], also using the BSSO technique for mandibular setback, reported a mean setback of 8.4 mm and a relapse of 0.9 mm after a 6-month follow-up period. The increase of the gonial angle was 3.7 (3.6) degrees that increased to 4.2 (2.9) degrees after one year.

According to several investigators, mandibular prognathism could be grossly improved by bilateral sagittal splitting osteotomy for mandibular setback [1,3,6]. However, some degree of relapse, i.e. return of a disease or deformity after partial recovery, may occur within 1 year after surgery that should be a concern for both patients and physicians [7]. Gu et al [8], evaluated the process of relapse after mandibular setback surgery by an analysis of the role of craniofacial morphology, hyoid position, pharyngeal airway and head posture. They reported a reduction of 7.2 mm in mandibular length and 2.6 degrees in gonial angle. Therefore it seems critical to closely monitor and control relapse, before the full healing of fragments and new muscular

balance is established [8]. On the other hand, Lu and Liu [9] showed that the skeletal relapse following BSSRO was limited and related to the period of presurgical operations and mandibular rotation after surgery.

Gonial angle increase after mandibular setback has been reported by Johnson et al [10], Ja'farian et al [11] and Choi et al [12]; while Politi et al [13], Scheuer et al [14] and Mobarak et al [15] reported 55%, 20% and 72% relapse, respectively.

The main purpose of this study was to evaluate the correlation between the gonial angle with other relevant variants, after mandibular setback with the BSSRO technique and to measure skeletal relapse, two years after surgery.

MATERIALS AND METHODS

Thirty patients with mandibular prognathism referred to Taleghani Hospital, Shahid Beheshti University of Medical Sciences, from 1999 to 2001, were selected for this investigation. All subjects had undergone BSSRO for mandibular setback surgery as described by Obwegeser. None of them had received simultaneous surgery of the maxilla or any other procedure like genioplasty. Eleven patients were excluded from the study population: 6 had undergone surgery using the rigid fixation technique and 5 were not available for the recall visits. Lateral cephalograms were obtained from the remaining 19 patients who received mandibular setback with the Obwegeser technique and 8 weeks IMF followed by elastic therapy for 2 weeks. Changes in the occlusal plane were measured according to the changes occurring in the gonial angle. As a result, the confounding factors were eliminated from the investigation. The vertical distance between B point from the NA line was measured before surgery in order to estimate the related setback rate. The first and final setback was considered to be the distance between B point and NA line after the

surgery and follow up period respectively. The present investigation also evaluated the effect of sex on gonial angle changes and relapse rate. Pearson correlation and student *t*-tests used for statistical analysis.

RESULT

The study group consisted of 13 females and 6 males. The mean gonial angle prior to surgery was 135.05° (6.41) which decreased to 128.73° (5.43) after the operation. This reduction was observed in all subjects and ranged from one to 14 degrees with a mean of 6.32 (4.08) degrees. The gonial angle returned to its presurgical rate in two patients at the end of the follow-up period while it was less than the value obtained before the operation, in the remaining 17 patients.

The mean decrease of the gonial angle, measured before surgery and at the final follow-up visit was 4.89 (3.44) degree. Comparison between postsurgical and follow-up values of the gonial angle revealed a significant negative correlation (P=0.02, r = -0.546), which is larger presurgical gonial angles caused greater changes.

The gonial angle decreased further during the follow-up period in four patients, while it remained unchanged in four, and increased in the other 11 subjects. A 0.92 (1.06) mm relapse related to the setback operation was observed at follow-up, that ranged from zero (no relapse) to 3mm (Table I).

A positive and significant correlation was found between the gonial angle and occlusal plane changes (r=0.878). This finding not only demonstrates the correlation of these variables,

Table I: Descriptive statistics of relapse

Setback	N	Max.	Min.	Mean	SD
Initial	19	11.00	3.00	6.7368	2.57859
Follow up	19	8.50	3.00	5.8158	1.85000
Relapse	19	3.00	0	0.9211	1.05755

Table II: Gonial angle changes in female and male patients

	Max.	Min.	Mean	SD
Male	11.8701	2.7013	7.2857	4.9570
Female	8.0348	3.4652	7.2857	3.5961

but also shows a normal distribution of data. A significant negative correlation was found between the final setback and gonial angle changes as compared to the preoperative stage (P<0.001, r=-0.74), which means a larger quantity of setback caused higher amounts of decrease in the gonial angle after surgery.

The mean value of the setback was 6.74(2) mm after surgery which decreased to 5.82 (1.58) mm during the follow up period showing an average relapse of 0.92 (1.06) mm after the mandibular setback operation.

In order to investigate the effect of sex on gonial angle changes and relapse values, the differences were subjected to student *t*-test which did not show a statistically significant difference between males and females (gonial angle changes; P=0.55, relapse; P=0.84) (Table II).

DISCUSSION

Gonial angle decrease was observed in the present study following mandibular setback using the method described by Obwegeser. After a follow up period of more than 2 years, 2 patients showed no changes however by comparing pre- and post surgical values, 4.89 degrees decrease was found in the rest of the 17 subjects. Also, postsurgical relapse was found to be 0.92 mm at the final examination.

Gu et al [8] performed sagittal split ramus osteotomies (SSRO) on 62 patients and showed a 2.6 degrees reduction in the gonial angle which was less than that achieved in the current investigation. The operation methods are similar in both studies but the follow-up period and sample size was smaller in the

present study [8].

In a similar investigation conducted by Jonsson et al [10], an increase in gonial angle was seen after mandibular setback with the BSSRO technique. As a result, they proposed the use of the IVRO method for mandibular setback. Contrary to these findings, the present study showed decrease in the gonial angle. Considering that the authors had not provided detailed information, the discrepancy may be because of the difference in fixation time and the use of elastics between the jaws after IMF opening. Other possible reasons are the application of the BSSRO technique (described by Obwegeser and modified by Dal Ponte) in the present study, the sample size and possible deformities such as internal derangement of the TMJ. According another study such abnormalities can cause relapse during time or reduction in the gonial angle due to muscular striping [10].

Choi, et al [11] performed BSSRO surgery on 42 patients and showed an increase in the intergonial width from T1 (preoperative) to T2 (early postoperative). From T2 to T3 (late postoperative), most patients had a decrease in their intergonial width. Overall, the intergonial width and the proximal segment angulations increased significantly from T1 to T3 [11].

Ja'farian and Rouhi [12] in their investigation demonstrated a -5.9° (3.4) decrease in the gonial angle after surgery which is comparable with the -4.89° (3.44) obtained in the present study, however, the angle has been increased at the end of follow up period. Larger amounts of decrease after surgery caused greater relapse ($P=0.014$). A significant correlation was observed between the initial amount of the gonial angle and the changes that occurred after follow-up ($P=0.016$, $r=-0.55$). This indicates that greater changes could be expected from cases that have larger gonial angles before surgery.

Using BSSRO along with IMF for mandibular setback, Proffit et al [6] reported 24% relapse

after surgery, which was higher than the 13.65% observed in the present study, employing the same technique. Politi et al [13] reported a relapse rate of 55% at initial setback. In an analysis of soft and hard tissue changes after BSSO in a group of Taiwanese patients, the hard tissue relapse at Pog was 21%, 1 year after surgery [7]. A 20% relapse rate was reported by Scheuer et al [14] after 3 years follow up.

Mobarak et al [15] studied skeletal stability and postoperative changes in consecutive mandibular prognathism patients operated with BSSO and rigid fixation. It was concluded that most of the relapse (72%) took place during the first 6 months after surgery [15]. This could explain the smaller amount of relapse obtained in the current investigation which had a shorter follow-up period as compared to previous reports.

In this study, larger gonial angles in female patients before surgery have been observed which is in contrast to the results obtained by Van Spronsen et al [3]. This may be related to differences in the sample size and the fact that female patients are more concerned with facial appearances and therefore, more willingly submit to aesthetic surgery. Our results indicated that the gonial angle and SN-Occp did not change significantly after surgery. SN-Occp has not been previously investigated, but a significant correlation was found between the changes occurring in the gonial angle and the occlusal plane in the current study.

CONCLUSION

A decrease in the gonial angle was observed in the present study following mandibular setback using the Obwegeser technique. Comparing pre- and post surgical values, a decrease was found after a follow up period of more than 2 years.

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