Prevention of relapse following intraoral vertical ramus osteotomy mandibular setback: can coronoidotomy help?

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Objective. Relapse after intraoral vertical ramus osteotomy (IVRO) is a subject of debate. The impact of the temporalis muscle on relapse has led to modifications, including liberating the temporalis muscle from the coronoid process or removing the coronoid process itself. The objective of this study was to evaluate the effect of coronoidotomy in preventing relapse after IVRO.
Study design. Fifty-six patients with mandibular prognathism, selected for IRVO, were studied within a 21-month period. These patients were randomly divided into 2 groups. The patients were matched regarding cephalometric norms. The case group underwent the IVRO plus coronoidotomy, whereas the control group underwent the simple IVRO. Relapse ratio within the first year was compared between groups. Significant relapse was defined as relapse >30% of the primary setback.
Results. Twenty-seven patients in the study group and 29 patients in the control group were followed. The mean relapse ratio 1 year after surgery in B, menton, and pogonion points were greater in control subjects. The mean relapse ratio for ANB and SNB angle 1 year after surgery compared with the primary setback ratio was more in control subjects.
Conclusion. This study suggests that IVRO along with coronoidotomy was slightly better than IVRO without coronoidotomy for treatment of mandibular prognathism. **(Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2011; 111:557-560)**

Intraoral vertical ramus osteotomy (IVRO) is one of the main techniques used in the treatment of mandibular prognathism when patients decline to consent to the greater risk of possible paresthesia associated with the sagittal split osteotomy. IRVO surgical technique is still one of the common orthognathic procedures for mandibular setback.[1-4] However, relapse is common, with an average of 12%-16%.[2,3]

Relapse and skeletal/dental changes after IVRO surgery are important issues and have attracted much attention.[1,3,5,6] Low bone contact has been blamed as a cause for relapse in vertical osteotomies.[5] Numerous factors, such as soft tissue retraction, are also factors in relapse.[1,2] Additionally, muscle adhesion is considered to play a role in postoperative relapse.[1,3] The amount of setback is also an influential factor.[2] Many surgeons have tried to reduce postoperative relapse via various techniques.[1,3] Some have recommended overcorrection of the setback by 2 mm and liberating internal pterygoid and temporalis muscles.[3,4] Coronoidotomy liberates the temporalis muscle and has been advocated.[3] The present study was done to compare relapse ratios in IVRO and IVRO plus coronoidotomy in our patients.

MATERIALS AND METHODS

Fifty-six patients with mandibular excess were randomly divided into 2 groups (IVRO plus coronoidotomy and simple IVRO) in a randomized clinical trial: 27 patients in the study group and 29 patients in the control group. Stability was evaluated and compared after 1 year. This study took 21 months (from May 2008 to December 2009) and was carried out on patients who were referred to our clinics for mandibular excess. Sample size was determined by using ratio estimation formula considering $\alpha = 0.05$ and $P = .2$. Both groups were compared after a 1-year follow-up period for relapse. Patients were blinded to the surgical technique used.

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Table I. Main findings of the study before and after surgery (mean ± SD)

Variable	*Case group (n = 29)*	*Control group (n = 27)*	*P value*
Setback ratio of B point after surgery (mm)	6.5 ± 1.3	7.0 ± 1.4	.183
Setback ratio of menton point after surgery (mm)	6.2 ± 1.3	6.5 ± 1.3	.304
Setback ratio of pogonion point after surgery (mm)	6.0 ± 1.1	6.5 ± 1.2	.134
Decrease in ANB angle after surgery (degree)	5.3 ± 1.4	5.0 ± 1.3	.446
Decrease in SNB angle after surgery (degree)	4.0 ± 1.2	3.8 ± 1.1	.369
Relapse ratio of B point 1 year after surgery	2.1 ± 0.7	2.5 ± 1.1	.087
Relapse ratio of menton point 1 year after surgery	1.9 ± 0.6	2.3 ± 0.9	.066
Relapse ratio of pogonion point 1 year after surgery	1.8 ± 0.6	2.3 ± 0.9	.02*
Relapse ratio of ANB angle 1 year after surgery	1.7 ± 0.7	1.9 ± 0.9	.281
Relapse ratio of SNB angle 1 year after surgery	1.3 ± 0.6	1.4 ± 0.7	.372
Relapse ratio to primary setback in B point 1 year after surgery (%)	32.0 ± 9.1	35.2 ± 12.3	.281
Relapse ratio to primary setback in menton point 1 year after surgery (%)	30.4 ± 8.9	34.4 ± 12.2	.170
Relapse ratio to primary setback in pogonion point 1 year after surgery (%)	28.8 ± 9.0	34.0 ± 12.1	.073
Relapse ratio to primary setback in ANB angle 1 year after surgery (%)	30.7 ± 8.3	37.2 ± 12.6	.017*
Relapse ratio to primary setback in SNB angle 1 year after surgery (%)	30.1 ± 10.3	36.7 ± 13.3	.043*

*Statistically significant.

Inclusion criteria in this study were as follows: 18-35 years of age, mandibular excess ~4-8 mm with no vertical mandibular changes needed based on cephalometric norms. Exclusion criteria in this study were as follows: history of trauma, dental or skeletal asymmetries, open bite, cross bite, and postoperative instability determined by models prior to surgery.Written consent was obtained from each participant. This study was approved by our Ethics Committee.

Surgical stents were made for both groups, and jaw fixation was used for 6 weeks and light elastic for 2 weeks after surgery. Cephalometric radiographs were taken for both groups. Each point was evaluated twice by an expert orthodontist blinded to the study. The points with distances of >0.5 mm were evaluated. Cephalometric radiographs were taken 1-2 days before surgery (T1), 1 week after surgery (T2), and 1 year after surgery (T3).[7,8] Radiographs were evaluated by X-Y–cranial base coordinate system. In this method, a horizontal reference line was drawn 7 degrees from sella-nasion line (X-axis) and a vertical reference line drawn vertically on it from sella.[2]

Changes in SNB and ANB angles were measured twice to calculate surgical change ($T_1 - T_2$) and 1-year changes ($T_2 - T_3$).[7,8] Changes in menton, pogonion, and B point distances to the vertical axis were measured twice to calculate surgical change ($T_2 - T_1$) and 1-year changes ($T_2 - T_3$).

Assessment included: age, gender, setback ratio, proportion of the relapse ratio after 1 year to primary setback ratio, and relapse 1 year after surgery. Data were presented as mean ± SD or frequency and percentage. SPSS software version 15 was used for statistics. Quantitative variables were compared using independent-samples *t* test. Qualitative variables were compared by contingency tables, chi-square test, or Fisher exact test. Correlation was studied using Pearson coefficient. Results were considered to be significant in all cases when $P \leq .05$.

RESULTS

Patients were followed for 1 year in both groups. The mean age of the patients was 21.6 ± 2.9 years (range 16-27) in the study group and 20.7 ± 3.5 years (range 17-29) in the control group. There was no statistically significant difference in this regard between the groups ($P = .283$). There were 12 (44.4%) men and 15 (55.6%) women in the study group and 13 (44.8%) men and 16 (55.2%) women in the control group. There was no statistically significant difference in this regard ($P = .977$).

The findings before and after surgery in the 2 groups are summarized and compared in Table I. Based on our findings, the mean relapse ratio for pogonion point 1 year after surgery was greater in the control group. The mean relapse ratio for ANB and SNB angles 1 year after surgery also was greater in the control group. No significant difference was seen in other cephalometric norms. Relapse status 1 year after surgery in both groups is summarized and compared in Table II.

DISCUSSION

Although the sagittal split osteotomy does not require intermaxillary fixation (always a dangerous situation in the event of aspiration, vomiting and forgotten throat packs) and is a much more stable operation in terms of bone position, dental occlusion, social restrictions, and weight loss after surgery, the IVRO tech-

Table II. Relapse status 1 year after surgery, n (%)

	Relapse	Case group (n = 29)	Control group (n = 27)	P value
B point	Low	1 (3.7%)	1 (3.4%)	.512
	Moderate	17 (25.9%)	10 (34.5%)	
	High	19 (70.4%)	18 (62.1%)	
Menton point	Low	1 (3.7%)	1 (3.4%)	.114
	Moderate	13 (48.1%)	8 (27.6%)	
	High	13 (48.1%)	20 (69%)	
Pogonion point	Low	1 (3.7%)	1 (3.4%)	.113
	Moderate	14 (51.9%)	9 (31%)	
	High	12 (44.4%)	19 (65.5%)	
SNB angle	Low	1 (3.7%)	1 (3.4%)	.112
	Moderate	12 (44.4%)	7 (24.1%)	
	High	14 (51.9%)	21 (72.4%)	
ANB angle	Low	1 (3.7%)	1 (3.4%)	.112
	Moderate	12 (44.4%)	7 (24.1%)	
	High	14 (51.9%)	21 (72.4%)	

nique for mandibular setback is still common. As in other setback techniques, relapse is an issue. According to earlier studies, relapse occurs in 12%-16% of the cases treated via IVRO.[2,3]

In the present study, 1 year after surgery, varied degrees of relapse (mild to severe) were seen in 96% of both groups. Severe relapse (>30%) in different points varied from 44.4% to 70.4% in the case group and from 62.1% to 72.7% in the control group. In this regard, de Villa et al.[4] suggested that there was a relapse of >2 mm in B and pogonion points in 60% and 65% of the cases after primary setback. In the present study, in the case group, the mean relapse ratios 1 year after surgery were 2.1, 1.9, and 1.8 mm (32%, 30.4%, 28.8%) in B, menton, and pogonion points, respectively, and 1.7 and 1.3 degrees (30.7% and 30.1% compared with primary setback ratios) in ANB and SNB, respectively. In the control group, the mean relapse ratios 1 year after surgery were 2.5, 2.3, and 2.3 mm (35.2%, 34.4%, and 34% compared to the primary setback ratios) in B, menton, and pogonion points, respectively, and 1.9 and 1.4 degrees (37.2% and 36.7% compared with the primary setback ratios) in ANB and SNB angles, respectively. Greebe and Tuinzing[9] reported an 18.5% relapse at the menton point 6 months after IVRO surgery. In another study by Phillips et al.,[10] 16% was reported 1 year after IVRO surgery. Chen et al.,[11] in a study in Taiwan, followed 25 patients after IVRO for 2 years after surgery and reported a mean relapse of 10.2%.

In a study carried by Hashemi,[12] 237 patients who had IVRO were followed 1 year after surgery. The mean setback in point B was 7.9 mm, and the mean relapse in this point was 2.16 mm. In other studies, the mean relapse ratio in point B 1 year after IVRO was reported to be 0.51-3.6 mm 1 year after surgery and 2.3 mm (28%) to 3 mm (34%) using the sagittal split technique.[4,13-17]

The results of our study were in ranges similar to those reported by other studies. Numerous factors may affect the reported results, including sample volume, follow-up period, expertise, patient care, and follow-up. Many factors may relate to relapse.[16-19] One of the factors affecting the relapse ratio in these patients is primary setback ratio. Studies suggest that an increase in primary setback ratio would lead to greater relapse.[1,9,14] We found a significant correlation between relapse and primary setback ratio in both groups. The main objective of the present study was to compare relapse ratios 1 year after IVRO surgery (control group) and IVRO plus coronoidotomy surgery (case group). In this regard, relapse ratio was greater in the control group, as were ANB and SNB angles 1 year after surgery. It has previously been indicated that temporalis muscle pull may be involved in relapse after mandibular setback.[1] Proffit et al.[17] focused on the comparison of 2 methods of intraoral vertical subcondylar osteotomy plus coronoidotomy with sagittal split ramus osteotomy. They concluded that the first method is better regarding stability. Other parameters, however, other than stability could be of importance.

CONCLUSION

The mean relapse ratio 1 year after surgery was less in the study group, which had a coronoidotomy in conjunction with the IVRO for prognathism compared with the control group, in which no coronoidotomy was performed.

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