Original Article

Skeletal Relapse after Correction of Mandibular Prognathism by Bilateral Sagittal Split Ramus Osteotomy

H. Mohajerani [1], M. Mehdizadeh [2], A. Khalighi Sigaroodi [3]

[1] Assistant Professor, Department of Oral and Maxillofacial Surgery, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2] Oral & Maxillofacial Surgeon, Private Practice
[3] Postgraduate Student, Department of Oral and Maxillofacial Surgery, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Abstract:

Objective: The aim of this study was to assess skeletal relapse in patients who underwent mandibular setback by bilateral sagittal split ramus osteotomy (BSSRO) and osteosynthesis wiring techniques.
Materials and Methods: In this semi-experimental study, 10 patients (8 women, 2 men) with 3-8 millimeters overjet underwent mandibular setback with BSSRO, osteosynthesis wiring and inter maxillary fixation (IMF) techniques for 6-8 weeks. They were studied before (T0), immediately after (T1), and 6 months after surgery (T2) using clinical and cephalometric indices. Then, the maximum changes occurred in sagittal, rotational and vertical planes were evaluated in three time intervals (T1-T0), (T2-T0), and (T2-T1). Wilcoxon paired test was used as a statistical approach for data analysis.
Results: The highest degree of relapse occurred in the sagittal plane in mandibular setback surgery with BSSRO and osteosynthesis wiring and IMF techniques. The degree of relapse was irrelevant of setback. In addition, no patient showed the amount of relapse warranting another surgery after six months.
Conclusion: BSSRO surgery with osteosynthesis wiring and IMF provides acceptable stability in mandibular setback.

Key Words: Prognathism; Jaw Fixation Techniques; Osteotomy

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Corresponding author:
Author's name, Department of Oral and Maxillofacial Surgery, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran
shmohajerani@hotmail.com

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INTRODUCTION

Different techniques are developed to perform mandibular setback surgeries. The technique that is widely used is bilateral sagittal split ramus osteotomy (BSSRO), which was introduced by Schuchard and modified by Dal Pont, Trauner and Obwegeser [1-3]. This technique is carried out intra orally for the correction of all mandibular deformities together with all fixation systems [4-6].

These important properties have made BSSRO technique a treatment modality for mandibular orthognathic surgeries. Although different surgical techniques are developed and applied for mandibular setback, no published study exists with respect to the skeletal relapse and stability in patients treated with these techniques in the literature. By definition relapse is any unexpected change in skeletal or dental planes after the surgery, which is caused by improper or incorrect surgical techniques. This change occurs initially (i.e. immediately after surgery), or gradually after the surgery. The causes of relapse comprises relocation of condyle, orthodontic treatment before and after the operation, muscular forces, growth factors,

tongue size and hypo-pharyngeal space, and distal teeth (root paralleling, interdigitation)
Various methods such as osteosynthesis wiring, rigid fixation with screw, or plate and maxillomandibular fixation are used in BSSRO technique for the placement of osteotomized pieces [1-5,7-14].
The degree of relapse in different methods of fixation is assessed by different studies in the field and contradictory results are reported [4-7,12-13,15-19]. Therefore, the present study was conducted to assess the skeletal relapse after mandibular setback by BSSRO, osteosynthesis wiring, and IMF techniques.

MATERIALS AND METHODS

In this quasi-experimental study, 10 patients (8 women and 2 men) with the mean age of 23.3 years (SD=6.9, range18-38 years) were studied over a period of one year. They were studied by clinical and cephalometric analyses before (T0), immediately after the surgery, which was not delayed for longer than seven days (T1), and six months after surgery (T2). All of the used cephalometric radiographs were taken by a single radiologist using the same equipment and existing radiology standards in order to establish similar situations for all cases. The changes during the surgery were measured by cephalometric indices. An expert of the field with no knowledge of either the nature of the study or succession of cephalometric data analyzed the cephalometric data. Rotational changes of mandible were measured by SN-Pog, SNB, and SN-Symph angles. All the measurements were performed twice and in two consecutive days to avoid errors due to small differences, although these small differences were not significant.
The changes that occurred in the sagittal axis of the mandible after the surgery were assessed by reflecting points from B, symphysis and pogonion (B', Symp' and Pog') on the palatal plane and measuring their distances from the image of nasion (N') on this line (Fig 1).
For the assessment of vertical position of the mandible, the distances of menton, symphysis, and B from the palatal plane were measured.
Dental landmarks were used only to measure the reverse overjet before the surgery and overjet after the surgery due to the changes occurred during the orthodontic procedure or adaptation during the surgery.
All patients underwent the mandibular setback surgery by the same surgeon and using BSSRO, wiring osteosynthesis (a straight wire on the proximal edge of ramus between the proximal and distal parts), and IMF techniques for a period of 6 to 8 weeks. The data related to the changes were analyzed with Wilcoxon paired test.

Table 1. Mean and standard deviation (SD) of different indicators changes.

Indicators	TimeVariables	T2-T1		T2-T0		T1-T0	
		Mean	SD	Mean	SD	Mean	SD
Angular	SNB	0.1	1.6	-4.2 *	2.8	-4.3 *	2.7
	SN-Pog	0	1.5	-2.6 *	3.5	-2.6 *	3.5
	SN-Symp	0.1	1.4	-4.3 *	2.4	-4.4 *	2.4
Vertical	B-B'	0.45	1.7	-0.75	3.6	1.2	3.9
	Me-Me'	0.2	2.9	-0.4	2.4	-0.6	3.6
	Symp-Symp'	0.5	1.4	-0.4	3.3	-0.9	3.5
Sagittal	B'-N'	-0.8	3.7	5.5 *	3.8	6.4 *	5.7
	Pog'-N'	-0.7	2.9	4.8 *	4.4	5.5 *	5.1
	Symp'-N'	-1.8 *	3.9	4.9 *	4.9	6.8 *	6.3

*P-Value<0.05, T0: Before surgery, T1: Immediate after surgery, T2: Six months after surgery

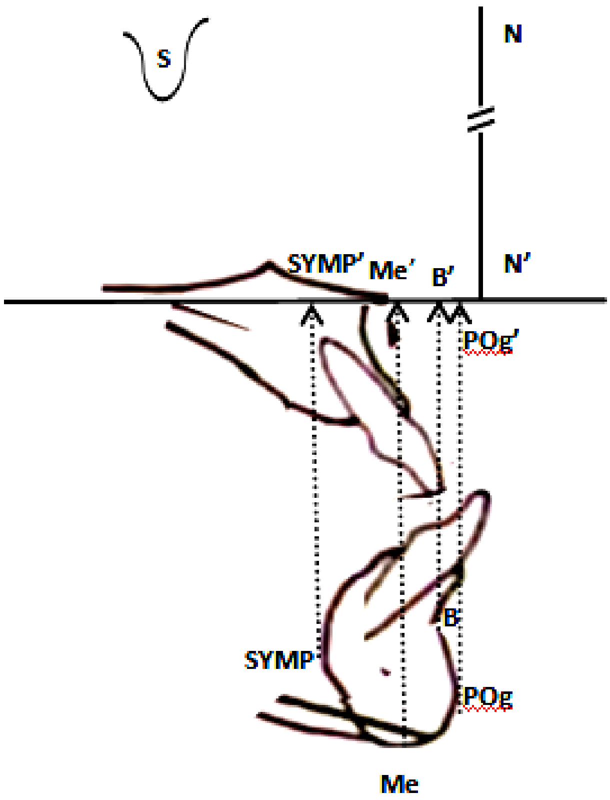

Fig 1. Measurement of changes of the mandible's sagittal axis.

RESULTS

All clinical and paraclinical results before (T0), immediately after (T1), and six months after the surgery (T2) were analyzed in three time intervals (T1-T0), (T2-T0), and (T2-T1). Statistical analysis showed that the changes of overjet during T0-T1, T0-T2, and T1-T2 were all significant. Based on the clinical findings related to the patients, none of the cases showed any lateral shift six months after the surgery.

The degree of distal-proximal differences of the patients was between 3-8 mm. Among angular indicators showing rotational changes of the mandible, the three indicators of SNB, SN-Symph, and SN-Pog were statistically significant in T0-T1 and T0-T2 intervals (Table 1). However, the changes occurred in these indicators during T1-T2 period were not statistically significant. The small increase in these indicators points to the relative stability of the mandible with respect to rotational change after six months.

Among vertical indicators, i.e. ME-ME', B-B' and Symp-Symp', changes found between before and immediately after the surgery were not statistically significant in spite of a minor reduction (Table 1). In addition, the changes occurred in these indicators between pretreatment and six months after the surgery were not significant. A slight increase of the indicators was observed between six months and immediately after the surgery with no significant results. The finding suggests that the sagittal mandibular surgery does not lead to significant changes in the vertical plane during and after the surgery.

Considering the sagittal mandible changes, i.e. B'-N', Pog'-N', and Symp'-N', the changes before and immediately after the surgery in all three indicators were statistically significant (Table 1). In addition, the changes before, and six months after the surgery were significant. The indicators of B'-N' and Pog'-N' did not show significant changes between T1 and T2 which suggests an acceptable stability in spite of small reduction. The Symp'-N' indicator showed a significant change between T1 and T2 suggesting a small relapse in the sagittal plane.

DISCUSSION

The present study shows that changes of overjet were statistically significant before and immediately after the surgery, before and six months after the surgery, and immediately and six months after surgery. Although no patient experienced reverse overjet, significant change of overjet in T2-T1 phase is an indication of a reduction in the degree of overjet over six months after treatment. The causes were adaptive movement and changes of the teeth during the period of IMF, as well as forward movement and relocation of the mandible.

According to a study by Proffit et al [15] on patients who underwent mandibular setback surgery with the methods of VRO, BSSRO + osteosynthesis wiring and BSSRO + rigid fixation, overjet reduced slightly between immediately and six months after the surgery. However, the change of overjet between before and six months after the surgery was significant [15].
Considering the angular and rotational indicators, the changes between before and immediately after the surgery were statistically significant, but no indicator showed significant changes between immediately and six months after the surgery. All of these are indications of mandibular stability in terms of rotational changes in BSSRO and osteosynthesis wiring.
The vertical changes of the mandible in phases T1-T0, T2-T0 and T2-T1 were not significant that indicates lack of any relation among these changes during BSSRO and osteosynthesis wiring surgery before and after the treatment. These results explain why none of the patients experienced open bite six months after the treatment. This finding is also reported by others [7,5,13,18]. They observed no relation among vertical changes of the mandible during sagittal surgery and considered the relapse in the vertical plane to be very uncommon.
In the sagittal plane, the changes of B'-N' and Pog'-N' indicators in the phases of T1-T0 and T2-T0 were statistically significant. In the T2-T1 phase, a small and non-significant reduction was observed in the indicators of forward movement of the mandible. Significant change of Symp'-N' indicator was observed in T0-T1, T0-T2 and T1-T2 phases but the patients experienced a small forward movement. This finding coincides with other findings which reported great degrees of relapse in the sagittal plane [5,6,15,18].
None of the patients experienced a lateral shift after six months in the present study contradicting the results achieved by Kobayashi et al [5]. The reason may be due to good occlusion achieved after the surgery in the present study and the presence of a smaller lateral shift (maximum 3 mm) in three patients before the operation.
Minimum and maximum setback amounts were 3 and 8 mm respectively and little differences existed in the degree of stability among patients with varying degrees of setback, as determined by clinical and cephalometric examinations. The same results were obtained by others [12,18,14], who denied existence of any relation between the degree of relapse and mandibular setback. However, this finding contradicts with the studies of Kobayashi et al [5] and Rodríguez et al [16] who concluded that the greater increase of setback the greater increase in relapse.
This difference may be due to the wide range of mandibular setback (1-12 mm) in the studies mentioned. This finding also suggests the multi-factorial nature of the relapse phenomenon. In other words, the extent of mandibular setback in addition to other factors such as effects of various methods of fixation, muscular forces, quality of occlusion, etc. can affect the degree of relapse. It seems that no linear relation exists between the degree of setback and relapse [12,20].
The results suggest that BSSRO surgery with osteosynthesis wiring and IMF provides a relatively good stability in the mandibular setback. In spite of a minor relapse that occurred in the sagittal plane and overjet, no patient showed any obvious change after six months compared to immediately after the surgery from a clinical perspective. Moreover, there was no need for a second operation for any of the patients studied.
Only in two patients, a small amount of forward movement was observed after removal of IMF. Therefore, elastics were applied for two weeks after which the problem was resolved with the removal of the elastics. This is one of the benefits of the osteosynthesis wiring technique.

As shown in this study, the amount of setback does not have a great effect on the amount of post-operative relapse. In addition, it can be concluded that the skeletal relapse, as mentioned, is a multi-factorial phenomenon in general. Factors such as the amount of setback and the techniques used for stabilizing the osteotomized segments can play a role in the relapse quantity, though no factor can be considered as the main cause in its reduction or increase.

CONCLUSION

Considering the results, it can be concluded that the BSSRO surgery with osteosynthesis wiring and IMF provides a relatively good stability in the mandibular setback. This technique appears to be more appropriate than other techniques considering the acceptable stability, ease of use, few complications, and the lower associated costs.

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