Skeletal Stability after Bilateral Sagittal Split Advancement and Setback Osteotomy of the Mandible with Miniplate Fixation

Srinivasan Hanumantha Rao, BDS, MDS¹ Loganathan Selvaraj, MDS, MOMSRCPS²
Arathy S. Lankupalli, BDS, MDS³

¹ Department of Oral and Maxillofacial Surgery, Priyadarshini Dental College and Hospital

² Department of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospital

³ Department of Oral Medicine and Maxillofacial Radiology, Saveetha Dental College and Hospital

Address for correspondence Loganathan Selvaraj, MDS, MOMSRCPS, Department of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospital, 162, Poonamallee High Road, Thiruverkadu, Chennai, Tamil Nadu 600077 (e-mail: drloganathans@gmail.com).

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Abstract

The purpose of this study was to evaluate intraorally placed mini plates and monocortical screws in terms of postoperative skeletal stability after bilateral sagittal split advancement and setback osteotomy of the mandible. Ten patients were included in this study with five requiring advancement (group I) and five requiring setback of the mandible (group II). Bell and Epker modified surgical technique was followed for all the patients. All the patients underwent pre- and postsurgical orthodontics. Cephalometric radiographs were taken preoperatively, immediate, 3, 6, and 12 months postoperatively. Cephalometric tracings were performed by one individual examiner using a modified burstone analysis. Statistical analysis was performed using the student paired *t*-test. In advancement patients, SNB (sella, Nasion, B point) angle showed relapse at 12th month postoperative period which was statistically significant (2.4 degrees). No changes were observed in anterior facial height, posterior facial height, Frankfort-mandibular incisor angle (FmiA), and overjet during the follow-up period. In setback patients, posterior facial height ($p < 0.05$), angles between the lower incisors and mandibular plane and pogonion had a statistically significant change position of 1.4 mm (paired *t*-test, $p = 0.03$). The SNB angle, anterior facial height, interincisal angle, and FmiA remained constant (0.8–1.2 degrees) during the follow-up period. In advancement cases, the relapse was seen from the third month postoperative period but in setback cases, the relapse was noted from the sixth month onward and the skeletal relapse in these cases were noticed cephalometrically.

Keywords

- BSSO
- mandible osteotomy
- orthognathic surgery
- skeletal stability

The bilateral sagittal split osteotomy (BSSO) of mandible has been used extensively for the correction of skeletal deformities of the mandible since it was first described by Trauner and Obwegeser.¹ Over the past 40 years, it has undergone numerous modifications and improvements.^{2–4} There are several studies on skeletal stability after BSSO of mandible with wire fixation, fixation either using bicortical screws or miniplates and monocortical screws, although not even one technique has yet been demonstrated to

eliminate relapse completely.⁵ This study assesses the postoperative stability of bilateral sagittal split advancement and setback osteotomy using miniplates and monocortical screws.

Material and Methods

A total of 10 patients underwent BSSO depending upon the deformity present with or without additional osteotomies.

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Out of these 10 patients, 5 required advancement and 5 required setback of the mandible. They were divided into:

- Group I: hypoplastic mandible and those who required advancement of the mandible.
- Group II: hyperplastic mandible and those who required setback of the mandible.

Patients with condylar hyperplasia, hypoplasia, facial asymmetry, and traumatic deformities were excluded from this study.

Surgical Technique

A bilateral sagittal split advancement osteotomy was performed in group I patients and a bilateral sagittal split setback osteotomy was performed on group II patients according to Bell and Epker modification of the original Trauner and Obwegeser technique.

After advancement or setback, the bone fragments were fixed with stainless steel miniplates (four or five holes) and four monocortical 8 mm screws on each side of the osteotomy.

Cephalometric Analysis

Standardized lateral cephalograms were obtained at five stages in all patients, that is, preoperatively, immediate postoperative period (2–4 d) and at 3, 6, and 12 months postoperatively. The cephalograms were analyzed by one independent examiner using Burstone cephalometric analysis (►Table 1).

The tracings were superimposed by matching unoperated areas such as skull base and two reference lines, that is, S^1N , which was constructed by using a line through nasion created 7 degrees away from the sella nasion line and its perpendicular from N. The shifts of corresponding points at different time intervals in relation to these two reference lines indicate the changes caused by surgery or the subsequent postoperative alterations (relapse).

Statistical Analysis

The surgical effect was estimated as preoperative value minus the direct postoperative value. Skeletal/dental changes over time were calculated as 3 months, 6 months, and 12 months value minus the direct postoperative value. Differences over time were studied by the student paired *t*-test using SPSS (version 17).

Table 1 Cephalometric measurements

Cephalometric Radiograph Points	Definition (unit)
Pg movement Horizontal Vertical	Pg to N⊥Fh (mm) Pg to Fh (mm)
Skeletal angular SNA SNB SN/OP SN/MP OP/MP PP/MP FMA	SN/NA (degrees) SN/NB (degrees) id. (degrees) id. (degrees) id. (degrees) id. (degrees) Fh/MA (degrees)
FH A = Anterior FH (TAFH) P = Posterior FH (TPFH)	N-Me (mm) S-Go (mm)
Facial heights ratios TPFH/TAFH = Post / Ant UAFH/TAFH = upper anterior LAFH/TAFH = lower anterior UPFH/TPFH = upper posterior LPFH / TPFH = lower posterior	P:A (%) (N-ANS):A (%) (ANS-Me):A(%) (S-Ar):P(%) (Go-Ar):P (%)
Overjet Upper part Lower part Overjet	mx1 to N⊥Fh (mm) md1 to N⊥Fh (mm) Upper – lower part (mm)
Dental angular Interincisor angle FmiA +1/ S^1N –1/ S^1N	+1/ – 1 (degrees) Fh/ – 1 (degrees) id. (degrees) id. (degrees)

Abbreviations: FmiA, Frankfort-mandibular incisor angle; SNB, sella-nasion-B point. B point, deepest point on the anterior portion of mandible below the apices of roots of incisors/canines on the cephalometric radiograph.

Results

All the patients were evaluated clinically and radiographically at 3, 6, and 12 months postoperatively. The relapse was identified by measuring the following changes:

Table 2 Mean skeletal changes horizontal and vertical after advancement of the mandible at pogonion and the relapse at 3, 6, and 12 months after surgery in group I (*n* = 5)

	Surgical effect		Backward relapse					
	Pre–post		3 mo postop		6 mo postop		12 mo postop	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Horizontal Movement – Pg (forward in mm)	12.1	7.4	2.7	1.9	2.7	1.9	3.4	2.6
<i>t</i> -test	<i>p</i> = 0.01 ^a		<i>p</i> = 0.03 ^a		<i>p</i> = 0.03 ^a		<i>p</i> = 0.04 ^a	
Vertical movement – Pg (downward in mm)	1.6	4.6	0.0	2.2	–0.4	4.2	–0.4	4.2
<i>t</i> -test	<i>p</i> = 0.79		<i>p</i> = 1.00		<i>p</i> = 0.84		<i>p</i> = 0.84	

Abbreviations: mo, month(s); Pg, pogonion; postop, postoperative; SD, standard deviation.

^a*p* < 0.05 was considered to be statistically significant.

Table 3 Mean skeletal changes horizontal and vertical after setback of the mandible at pogonion and the relapse at 3, 6, and 12 months after surgery in group II ($n = 5$)

	Surgical effect		Forward relapse					
	Pre-post		3 mo postop		6 mo postop		12 mo postop	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Horizontal movement – Pg (backward in mm)	5.2	2.5	0.6	0.9	1.4	0.9	1.4	0.9
t-test	$p = 0.01^a$		$p = 0.21$		$p = 0.03^a$		$p = 0.03^a$	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Vertical movement – Pg (downward in mm)	1.8	2.6	0.6	1.7	0.6	2.1	0.8	2.2
t-test	$p = 0.08$		$p = 0.47$		$p = 0.55$		$p = 0.46$	

Abbreviations: mo, month(s); Pg, pogonion; postop, postoperative; SD, standard deviation.

^a $p < 0.05$ was considered to be statistically significant.

- Pogonion for horizontal and vertical changes for group I (►Table 2) and group II (►Table 3).
- Skeletal angles and facial changes for group I (►Table 4) and group II (►Table 5).
- Overjet for group I (►Table 6) and group II (►Table 7).
- The mean dental angular changes for group I (►Table 8) and group II (►Table 9).

In advancement patients, SNB (sella, Nasion, B point) angle showed relapse at 12th month postoperative period which was statistically significant (2.4 degrees). No changes were observed in anterior facial height, posterior facial height, Frankfort-mandibular incisor angle (FmiA) and overjet during the follow-up period. In setback patients, posterior facial height ($p < 0.05$), angles between the lower incisors and mandibular plane and

Table 4 Pre- and postoperative skeletal angles and facial height differences and relapse at 3, 6, and 12 months postoperatively in group I ($n = 5$)

Skeletal Angles and Facial Height	Surgical effect		Relapse					
	Pre-post		3 mo postop		6 mo postop		12 mo postop	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SNA	0.4	2.8	0.4	2.2	1.0	3.2	1.2	3.2
	$p = 0.77$		$p = 0.7$		$p = 0.53$		$p = 0.45$	
SNB	7.4	2.7	1.8	0.8	2.2	1.3	2.4	1.4
	$p = 0.004^a$		$p = 0.009^a$		$p = 0.02^a$		$p = 0.009^a$	
SN/OP	5.0	3.3	0.4	2.1	0.8	2.9	0.8	2.9
	$p = 0.03^a$		$p = 0.69$		$p = 0.57$		$p = 0.57$	
SN/MP	1.4	4.9	1.6	3.1	1.4	3.4	1.4	3.4
	$p = 0.56$		$p = 0.31$		$p = 0.41$		$p = 0.41$	
OP/MP	3.8	4.8	3.4	5.3	3.6	5.6	3.6	5.6
	$p = 0.15$		$p = 0.23$		$p = 0.23$		$p = 0.23$	
PP/MP	6.8	4.4	2.6	2.1	2.2	2.6	2.4	2.9
	$p = 0.03^a$		$p = 0.49$		$p = 0.13$		$p = 0.14$	
FMA	2.0	5.3	2.0	2.8	1.4	3.5	1.4	3.5
	$p = 0.45$		$p = 0.19$		$p = 0.42$		$p = 0.42$	
TAFH	0.6	5.8	0.0	2.7	0.0	3.3	0.2	3.4
	$p = 0.83$		$p = 1.00$		$p = 1.00$		$p = 0.90$	
TPFH	1.8	2.3	2.0	2.3	2.2	2.4	2.4	2.3
	$p = 0.15$		$p = 0.13$		$p = 0.11$		$p = 0.08$	

Abbreviations: mo, month(s); postop, postoperative; SD, standard deviation; SNB, sella-nasion-B point. B point, deepest point on the anterior portion of the mandible below the apices of roots of incisors/canines on the cephalometric radiograph.

^a $p < 0.05$ was considered to be statistically significant.

Table 5 Pre- and postoperative skeletal angles and facial height differences and relapse at 3, 6, and 12 months postoperatively in group II ($n = 5$)

Skeletal Angles and Facial Height	Surgical effect		Relapse					
	Pre-post		3 mo postop		6 mo postop		12 mo postop	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SNA	0.8	1.8	-0.4	0.9	-0.2	0.4	-0.4	0.5
	$p = 0.37$		$p = 0.37$		$p = 0.37$		$p = 0.18$	
SNB	5.8	9.1	0.8	1.1	1.2	1.3	1.2	1.3
	$p = 0.03^a$		$p = 0.18$		$p = 0.11$		$p = 0.11$	
SN/OP	1.6	5.5	0.4	2.9	1.0	2.1	1.0	2.1
	$p = 0.55$		$p = 0.77$		$p = 0.35$		$p = 0.35$	
SN/MP	-0.8	1.8	-0.2	0.8	1.6	1.5	1.6	1.5
	$p = 0.37$		$p = 0.62$		$p = 0.08$		$p = 0.08$	
OP/MP	0.2	1.9	-0.4	2.1	0.4	3.8	0.2	2.7
	$p = 0.83$		$p = 0.69$		$p = 0.83$		$p = 0.91$	
PP/MP	2.6	4.0	-0.2	3.7	0.0	5.1	0.0	5.1
	$p = 0.22$		$p = 0.91$		$p = 1.00$		$p = 1.00$	
FMA	-1.2	4.1	0.0	1.6	1.0	2.9	1.0	2.9
	$p = 0.55$		$p = 1.00$		$p = 0.49$		$p = 0.49$	
TAFH	3.2	1.9	0.4	0.5	1.0	1.4	0.6	1.8
	$p = 0.02^a$		$p = 0.18$		$p = 0.19$		$p = 0.50$	
TPFH	0.2	1.3	-1.4	0.9	-1.6	0.9	-1.8	0.4
	$p = 0.75$		$p = 0.025^a$		$p = 0.16^a$		$p = 0.001^a$	

Abbreviations: mo, month(s); postop, postoperative; SD, standard deviation; SNB, sella-nasion-B point. B point, deepest point on the anterior portion of mandible below the apices of roots of incisors/canines on the cephalometric radiograph.

^a $p < 0.05$ was considered to be statistically significant.

Table 6 Pre- and postoperative overjet differences and relapse at 3, 6, and 12 months postoperatively in group I ($n = 5$)

	Surgical effect		Relapse					
	Pre-post		3 mo postop		6 mo postop		12 mo postop	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Overjet	6.8	3.3	1.0	1.9	1.2	1.8	1.2	1.8
	$p = 0.01^a$		$p = 0.30$		$p = 0.21$		$p = 0.21$	

Abbreviations: mo, month(s); postop, postoperative; SD, standard deviation.

^a $p < 0.05$ was considered to be statistically significant.

Table 7 Pre- and postoperative overjet differences and relapse at 3, 6, and 12 months postoperatively in group II ($n = 5$)

	Surgical effect		Relapse					
	Pre-post		3 mo postop		6 mo postop		12 mo postop	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Overjet	5.2	3.3	0.4	1.3	0.8	1.1	1.0	1.4
	$p = 0.04^a$		$p = 0.54$		$p = 0.18$		$p = 0.19$	

Abbreviations: mo, month(s); postop, postoperative; SD, standard deviation.

^a $p < 0.05$ was considered to be statistically significant.

Table 8 Pre- and postoperative dental angular differences and relapse at 3, 6, and 12 months postoperatively group I ($n = 5$)

	Surgical effect		Relapse					
	Pre-post		3 mo postop		6 mo postop		12 mo postop	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
+1/ - 1	7.8	9.6	0.4	4.7	0.4	5.5	0.0	5.3
	$p = 0.01^a$		$p = 0.86$		$p = 0.88$		$p = 1.00$	
FmiA	8.2	6.9	1.4	4.8	0.0	6.6	0.2	6.9
	$p = 0.015^a$		$p = 0.55$		$p = 1.00$		$p = 0.95$	
+1/S ¹ N	4.2	6.7	0.4	1.1	0.2	1.9	0.0	2.1
	$p = 0.23$		$p = 0.48$		$p = 0.83$		$p = 1.00$	
-1/MP	7.4	5.5	0.4	2.1	4.0	4.4	4.2	4.6
	$p = 0.01^a$		$p = 0.69$		$p = 0.11$		$p = 0.11$	

Abbreviations: FmiA, Frankfort-mandibular incisor angle; mo, month(s); postop, postoperative; SD, standard deviation.

^a $p < 0.05$ was considered to be statistically significant.

Table 9 Pre- and postoperative dental angular differences and relapse at 3, 6, and 12 months postoperatively in group II ($n = 5$)

	Surgical effect		Relapse					
	Pre-post		3 mo postop		6 mo postop		12 mo postop	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
+1/ - 1	-0.2	4.3	1.2	4.7	2.6	2.9	2.6	2.9
	$p = 0.92$		$p = 0.60$		$p = 0.11$		$p = 0.11$	
FmiA	1.4	6.3	0.8	4.4	1.8	4.7	2.0	5.2
	$p = 0.64$		$p = 0.71$		$p = 0.44$		$p = 0.61$	
+1/S ¹ N	-0.2	0.4	1.2	2.7	1.2	2.7	1.0	2.2
	$p = 0.37$		$p = 0.37$		$p = 0.37$		$p = 0.37$	
1/MP	2.8	5.2	2.4	1.5	1.4	3.1	1.4	3.1
	$p = 0.29$		$p = 0.02^a$		$p = 0.37$		$p = 0.37$	

Abbreviations: FmiA, Frankfort-mandibular incisor angle; mo, month(s); postop, postoperative; SD, standard deviation.

^a $p < 0.05$ was considered to be statistically significant.

pogonion had a statistically significant change position of 1.4 mm. (paired t -test $p = 0.03$). The SNB angle, anterior facial height, interincisal angle, and FmiA remained constant (0.8–1.2 degrees) during the follow-up period.

Discussion

The skeletal stability changes after mandibular advancement or setback surgery and rigid fixation is a matter of concern and various authors have described a marginal relapse after 1 to 2 years.

Using plates and monocortical screws in BSSO for mandibular advancement and setback gives stable and predictable results. According to Borstlap and Stoelinga, high mandibular plane angle is more prone to relapse whereas more the horizontal advancement or setback, more the relapse is likely to be expected.^{6,7}

By advancing the mandible, the submandibular soft tissue drape is stretched with the suprahyoid and infrahyoid muscles. The hyoid fixed by these muscles is pulled forward

but will return to the original position several months postoperatively.⁷ The stretching gives a constant force opposite to the mandibular advancement.⁸ Chung et al found that the muscle complex surrounding the hyoid bone is able to adapt to changes in its environment.^{7,9} In BSSO patients with rigid skeletal fixation there was no recovery tendency seen in the hyoid bone.

Three potential areas where these forces might cause alteration in postoperative results include:

- The preoperative orthodontic treatment results in temporary extra mobility of teeth, particularly during or shortly after active orthodontic treatment. Therefore, even rigid intermaxillary fixation applied immediately postoperatively will not prevent the mandible moving backward.
- Despite the use of plates and screws to provide rigid skeletal fixation, bone remodeling takes place soon after fixation. This remodeling will allow minor movements of the fragments which results in backward movement of the distal fragment.

Table 10 Group I parameters

Parameter	Pre-Post		3 mo post op		6 mo post op		12 mo post op	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SNB	7.4	2.7	1.8	0.8	2.2	1.3	2.4	1.4
t-test	$p = 0.004^a$		$p = 0.009^a$		$p = 0.02^a$		$p = 0.009^a$	

Abbreviations: mo, month(s); postop, postoperative; SD, standard deviation; SNB, sella-nasion-B point.

^a $p < 0.05$ was considered to be statistically significant.

- Other factors are the rigidity of the osteosynthesis plates and the amount of bone contact between the fragments.

The condyle position is mainly determined by the muscle tone and rigidity of the capsule, which is hypotonic during the anesthesia. When the muscle tone returns to normal level postoperatively, the centric relation may alter giving rise to a visible malocclusion.^{7,9} The hematoma in the pterygomassetric sling may influence the postoperative mandibular position.⁹ Few factors which may play a role in the long term are condylar remodeling and resorption. The effects are visible on the radiographs by 6 months postoperatively.¹⁰

According to Borstlap and Stoelinga, review on the stability of mandibular setbacks by BSSO reveals relapse percentage from 7.1 to 47.3% using wire fixation and concerning rigid internal fixation report percentage varies from 9.8 to 51.4%.¹¹ The vertical and backward relapse at pogonion in combination with an ongoing increase of the angles with the mandibular plane corresponds with the clinically visible anterior open bite in relapse cases. The magnitude of surgical setback is the most important factor influencing the long term stability while others found a correlation between relapse and surgical clockwise rotation of the ramus segment with the altered condylar position.¹¹

The true relapse case seems to support the fact that a steep mandibular plane, a high mandibular angle, and a posterior anterior facial height ratio which approximates to 6:10 are factors related to relapse in setback surgery; however, this also appeared in advancement surgery. An essential difference with the advancement BSSO is the absence of condylar alteration in the setback group. Poulton and Ware described various methods to minimize relapse in mandibular advancement, which included overcorrection of the occlusion, opening of the posterior occlusion with a splint, performing a suprahyoid myotomy and using a sternal mandibular brace.^{8,12} According to Sorokolith and Nanda, relapse has been linked to instability at the osteotomy site, postsurgical pull of the pterygomassetric sling, and failure of the masticatory muscles to adapt to the new environment.¹³

Many methods have been recommended to minimize relapse, including overcorrection, prolonged periods of intermaxillary fixation, suprahyoid myotomy, prolonged wearing of cervical collar, skeletal suspension wiring, and rigid fixation.^{14,15} Studies by Ellis and Reynolds have shown that the combination of dental maxillomandibular fixation and skeletal fixation gives stable results but this method included 6 weeks of maxillomandibular fixation.¹⁵ Studies by William

Arnett have shown condylar sag as a major source of BSSO relapse and the other factors are large advancements, upward and forward advancements, and high mandibular plane angle.^{6,16}

In this study, 10 patients underwent BSSO of which 5 underwent advancement and 5 underwent setback of the mandible, fixed with 5-hole plates and 4-hole plates, respectively.

In group I the SNB angle showed the largest effect among all the skeletal angles (7.4 degrees). The relapse of this angle at the 12th month postoperatively was 2.4 degrees which was statistically significant. The angles with mandibular plane did not show any statistically significant change during the postoperative period. No change in the anterior facial height and the posterior facial height during the follow-up period (►Table 4). The mean overjet preoperatively was 8.6 mm (standard deviation [SD] = -4.3) and due to mandibular advancement this mean overjet was reduced to 3.4 mm postoperatively. No statistically significant change of this overjet postoperatively was observed (►Table 6). The mean interincisal angle was 108 degrees (SD = 6.2), this changed by 119.8 degrees (SD = -8.3) postoperatively. During the postoperative period there was slight change which was not statistically significant. During the whole period postoperative the FmiA remained fairly constant (55–53.6 degrees). The angles between upper incisor and S¹N and lower incisor and mandibular plane showed minimal changes during the postoperative follow-up period (►Table 8).

In group II, the pogonion was taken into consideration along with other skeletal angles and dental angles, because none of the patients had undergone genioplasty. The setback of the mandible at pogonion (horizontal surgery effect) had a mean of 5.2 mm. At 12 months a statistically significant change compared with the postsurgery position of 1.4 mm occurred (paired *t*-test $p = 0.03$). The mean movement in the vertical direction (vertical surgery effect) was 1.8 mm. There was no statistically significant change during the follow-up period (►Table 3).

The SNB angle showed the largest surgical effect among all the angles (5.8 degrees). This angle remained constant (0.8–1.2 degrees) during the follow-up period. All the other angles showed a minimal change at the 1-year follow-up period. There was a statistically significant change during in the posterior facial height ($p < 0.05$) while the anterior facial height remained constant during the postoperative follow-up period (►Table 5).

Table 11 Group II parameters

Parameters	Pre-Post		3 mo post op		6 mo post op		12 mo post op	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Horizontal movement – Pg (backward in mm)	5.2	2.5	0.6	0.9	1.4	0.9	1.4	0.9
t-test	$p = 0.01^a$		$p = 0.21$		$p = 0.03^a$		$p = 0.03^a$	

Abbreviations: mo, month(s); postop, postoperative; Pg, pogonion; SD, standard deviation.

^a $p < 0.05$ was considered to be statistically significant.

The mean reversed overjet was reduced by 5.2 mm (SD = 3.3), that is, the surgical effect. During follow-up the mean relapse was approximately 1 mm (►Table 7). The interincisal angle and FmiA did not show any statistically significant change postoperatively. The angles between upper incisor and S¹N showed a minimal change which was constant during the follow-up period. Whereas the angles between the lower incisors and mandibular plane showed a statistically significant change at the third month postoperative follow-up period (►Table 9).

In advancement cases (group I), pogonion was not considered because most of the cases had undergone genioplasty and so only the SNB angle was considered for the horizontal surgical effect. The SNB angle showed a significant change throughout the study period. No other values in the skeletal angles, facial heights, overjet, and dental angles showed a significant change in the study (►Table 10).

In setback cases (group II), pogonion and SNB angle were taken into consideration for the horizontal surgical effect. The pogonion in the horizontal direction showed a statistically significant change at the 6th month ($p = 0.03$) and the 12th month ($p = 0.03$) postoperative period (►Table 11). The SNB angle showed significant change immediate postoperatively but was stable during the 3, 6, and 12 month follow-up periods. The posterior facial height showed significant change during the follow-up period whereas the anterior facial height showed no change.

Conclusion

This study indicates that BSSO stabilized with miniplates and monocortical screws is a relatively safe procedure. In advancement cases, the relapse was seen from the third month postoperative period but in setback cases, the relapse was noted only from the sixth month onwards and the skeletal relapse in these cases were noticed cephalometrically which was statistically significant but was clinically insignificant. The studies need to be undertaken with larger samples and longer follow-up periods to substantiate the findings.

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