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Condylar Changes Following Mandibular Setback Using Manual Guidance

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Abstract: The purpose of this retrospective study was to analyze changes in the position of the condyles following mandibular setback surgery with manual guidance. The study included 28 patients with mandibular prognathism who underwent mandibular setback surgery using manual guidance with a bioabsorbable mesh for mandibular fixation, and changes in the position of the center of the condylar head were compared at three time points: before surgery (T0), within 1 week after surgery (T1), and 6 months after surgery (T2). The results showed significant lateral, anterior, and inferior movements of the condyle at T1 compared to T0, with an average movement of 0.66 ± 0.84 mm along the *x*-axis, −1.27 ± 0.82 mm along the *y*-axis, and −0.20 ± 0.69 mm along the *z*-axis, with a 1.77 ± 0.87 mm linear distance ($p < 0.05$). At T2, the condylar position had mainly changed inferiorly along the *y*-axis (−0.17 ± 0.48 mm) ($p < 0.05$) compared to that at T0. The change in the position along the *x*-axis (−0.14 ± 0.57 mm), *z*-axis (−0.05 ± 0.68 mm), and linear distance (0.85 ± 0.57 mm) at T2 was not significantly different from that in the condylar position at T0 ($p > 0.05$). The study suggests that significant anterior–lateral–inferior condylar movement occurs within 1 week after mandibular setback surgery using manual guidance, but the condyle returns to its original position over time, which is clinically acceptable.

Keywords: orthognathic surgery; condylar position; accuracy; sagittal split ramus osteotomy; con-beam computed tomography

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1. Introduction

Sagittal split ramus osteotomy (SSRO) is a commonly utilized technique for orthognathic surgery of the mandible. This technique offers several advantages including rapid bone healing and excellent postoperative mandibular positional stability due to the large contact area of the cutting surface, particularly the cancellous bone surface [1]. However, after SSRO, changes in the position of the mandibular condyle can lead to post-surgical problems such as bite instability and idiopathic condylar resorption [2–4].

Therefore, maintaining a physiologic range of condylar position is crucial for enhancing stability, masticatory function, and preventing temporomandibular joint complications. Various techniques have been proposed to maintain the desired condylar position during orthognathic surgery, such as maintaining a centric relation bite [5–7] or utilizing a condylar positioning device [2,8,9] or surgical wafer produced by computer-aided design/computer-aided manufacturing in computer-assisted simulation surgery [10–12].

The precision of any condylar positioning method relies on various factors, including the surgeon's expertise and experience, the patient's specific circumstances, and the chosen surgical approach. While using specialized techniques to maintain the desired condylar position can contribute to accurately repositioning the mandible, the condyle's position may still change postoperatively [7,9,11,12]. Regardless of the condyle positioning technique used, the fixation method can influence postoperative relapse and subsequent condylar position [13,14]. In addition, the physiologic range of condylar position after SSRO has been controversial. The permissible movement of the condyle right after surgery should be defined as the ability to return to its pre-surgery position during the follow-up period. Any technique showing the physiologic range of condylar position may be acceptable. Manual guidance involves the surgeon manually guiding and holding the jaw in the desired position during surgery using their hands. Although this approach can be effective in some cases, it may not consistently offer the same degree of accuracy and stability as a condyle repositioning device can [12,15,16]. To evaluate the manual guidance technique, precise analysis of postoperative condylar change is required.

Assessing condylar position changes after orthognathic surgery can be achieved by analyzing lines and angles between anatomical landmarks on lateral, frontal, and submental–vertical cephalograms and computed tomography (CT) scans [17–20]. However, different observers may identify variations in these landmarks' localization on the scans [21,22]. Recently, a novel automatic superimposition method using two CT images has been introduced, proving more accurate than manual landmark setting [12,15]. Employing this method allows for more precise analysis of condylar positional changes following orthognathic surgery.

The aim of this study was to investigate changes in condylar position after mandibular setback surgery using manual guidance in patients with mandibular prognathism. The null hypothesis stated that there would be no significant alterations in condylar position after the surgery. As a result, the preoperative condylar position served as the control. Moreover, the study analyzed variations in condylar position influenced by factors such as patient age, sex, the type of orthognathic surgery, the extent of mandibular setback, and the degree of asymmetry.

2. Materials and Methods

This retrospective study was conducted with the approval of the Institutional Review Board of Gangneung-Wonju National University Dental Hospital (GWNUDH-IRB2022-A001). The study involved 28 patients (11 men and 17 women) with mandibular prognathism, with a mean age of 22 years (age range: 17–28 years), and 56 condyles in total were analyzed (Table 1). All patients underwent mandibular setback surgery by a single surgeon between 2014 and 2021. All patients did not have any specific TMJ symptoms. Of the 28 patients, 5 underwent mandibular surgery only, while 23 underwent bimaxillary surgery. The average mandibular setback was 8.21 mm.

Table 1. Information of the included patients.

Patient (No.)	Age (Years)/ Sex	Surgery Type	Right Mandibular Setback (mm)	Left Mandibular Setback (mm)
1	21/F	Bimaxillary surgery	8.5	7.5
2	24/F	Bimaxillary surgery	9	13
3	23/M	Bimaxillary surgery	6	7
4	23/M	Bimaxillary surgery	8	4
5	18/F	Bimaxillary surgery	2	6
6	28/F	Bimaxillary surgery	8	10
7	28/M	Bimaxillary surgery	12	9
8	21/F	Bimaxillary surgery	7	7
9	19/F	Mandibular surgery	5	10
10	23/F	Bimaxillary surgery	1	9
11	21/M	Mandibular surgery	8	5
12	19/M	Mandibular surgery	11	11
13	25/M	Bimaxillary surgery	6	12
14	22/F	Bimaxillary surgery	7	11
15	28/M	Bimaxillary surgery	4.5	7.5
16	23/F	Bimaxillary surgery	6	4
17	19/F	Bimaxillary surgery	10	8
18	27/M	Bimaxillary surgery	9	12

Table 1. *Cont.*

Patient (No.)	Age (Years)/ Sex	Surgery Type	Right Mandibular Setback (mm)	Left Mandibular Setback (mm)
19	20/F	Mandibular surgery	9	4
20	23/F	Bimaxillary surgery	3	4
21	21/F	Bimaxillary surgery	2	8
22	20/M	Bimaxillary surgery	8	12
23	20/F	Bimaxillary surgery	12	12
24	20/F	Bimaxillary surgery	9	7
25	23/M	Bimaxillary surgery	10	12
26	17/F	Bimaxillary surgery	9	11
27	17/F	Mandibular surgery	10	9
28	23/M	Bimaxillary surgery	14	14

The patients had undergone conventional bilateral SSRO with the placement of a bioabsorbable mesh (OsteotransMX® Tairon, Osaka, Japan) and 3 to 5 mm long bioabsorbable screws in each segment for mandibular fixation. LeFort I osteotomy of the maxilla was additionally performed in patients requiring bimaxillary surgery. Intraoperatively, the mandibular condyle was manually positioned using the conventional methods; the condyle was elevated to its highest point, pressure was released to identify the stable condyle position, and these steps were repeated until a consistent, reproducible position was achieved, before the proximal segment was slightly advanced within 2 mm. Postoperatively, intermaxillary fixation was implemented for a duration of 3 to 5 days based on the patient's occlusion. Subsequently, it was transitioned to a rubber guiding, in accordance with our protocol, which was followed by mouth opening exercises.

As described in a previous report [12], the nasion was set to point (0,0,0), with three axes passing through this point: the line parallel to the Frankfurt horizontal plane (FH plane) was the x-axis, perpendicular to the FH plane was the y-axis, and parallel to the FH plane and perpendicular to the x-axis was the z-axis (Figure 1a). In this three-dimensional coordinate system, the coordinate point of the center of the mandibular condyle head was set as follows (Figure 1b).

1. Frontal (medial to lateral) plane: As initially described, the center of the condylar head was identified as the point placed in the middle of the lateral and medial poles of the condyle.
2. Sagittal (anterior to posterior) plane: The center of the condylar head was determined by identifying the midpoint between the most anterior and most posterior aspects of the condylar head on sagittal sections.
3. Axial (superior to inferior) plane: In the axial plane, the center of the condylar head was identified by locating the midpoint between the most superior and most inferior aspects of the condylar head based on the axial sections.

Comparative studies of the changes in the condylar position were performed by superimposing CT data through voxel-based registration (Invivo5; Anatomage Inc., Santa Clara, CA, USA) at three time points: T0 (before surgery), T1 (within 1 week after surgery), and T2 (6 months after surgery). A comparative analysis was performed according to patient age, sex, the type of orthognathic surgery, the extent of mandibular setback, and the degree of asymmetry.

Originally, a negative value on the x-axis indicated rightward movement and a positive value indicated leftward movement. Therefore, the sign of the x-coordinate values was reversed in the left and right condyles, leading to the mean of change in both condylar positions on the x-axis being offset. To overcome this issue, the sign of the x-coordinate values for the right condyle was reversed such that a negative value indicated medial movement and a positive value indicated lateral movement. This allowed consistency in that the same sign indicated movement in the same direction for both condyles. In contrast, on the y-axis, a negative value represented downward movement, while a positive value represented upward movement; on the z-axis, a negative value indicated advance, while a positive value indicated setback.

(**a**) (**b**) (**c**)

Figure 1. (**a**) A model drawing depicting each measurement axis in 3D analysis. The nasion serves as the central point for all axes, with the Frankfort horizontal plane (FH plane) as the reference plane. The x-axis is a straight line that runs parallel to the line connecting the FH planes and Orbitale. The y-axis is a straight line that passes through the nasion and is perpendicular to the FH plane. The z-axis is an anteroposterior line with a straight line passing through the nasion, parallel to the FH plane, and perpendicular to the x-axis; (**b**) The three-dimensional center point of the condylar head (red point), which was the point in the middle of the lateral and medial poles; (**c**) the amount of condylar positional change calculated using the x-, y-, z-coordinate value in each observation.

Coordinate values were compared not only to the extent of movement along the x, y, and z axes but also to the linear distances in the coordinate space using the following formula, which helps calculate the distance between two points, A (x1, y1, and z1) and B (x2, y2, and z2) in the coordinate space (Figure 1c).

$$\overline{AB} = \sqrt{(x_2 - x_1)^2 + (y_2 - x_1)^2 + (z_2 - z_1)^2}$$

After testing for normality using the Kolmogorov–Smirnov test, the change of condylar position between observational points was analyzed with a one-sample test (SPSS Inc., Chicago, IL, USA). In the one-sample t-test, it was assumed that there were no changes in the observational period and that the standard deviation in the mother group was the same as that in the observed samples. The change in condylar position before and after a specific surgical protocol was assessed using a dependent samples t-test to analyze within-subject effects. For comparisons between two different surgical protocols, an independent samples t-test was employed to evaluate differences in condylar positional changes. To analyze the effects of varying setback amounts on condylar positional changes, an independent samples t-test was utilized. Similarly, to compare the condylar positional changes associated with different levels of asymmetry, an independent samples t-test was conducted. The significance level was set at $p < 0.05$.

3. Results

According to Table 2, the average movement of the condyle between T0 and T1 was 0.66 ± 0.84 mm along the x-axis, -1.27 ± 0.82 mm along the y-axis, and -0.20 ± 0.69 mm along the z-axis. The linear distance covered was 1.77 ± 0.87 mm. These changes were found to be statistically significant ($p < 0.05$). Comparing the condylar position at T1 with that at T0, there was a tendency for lateral, anterior, and inferior movement. The average movement of the condyle between T1 and T2 was -0.79 ± 0.69 mm along the x-axis, 1.10 ± 0.89 mm along the y-axis, and 0.16 ± 0.71 mm along the z-axis, with a linear distance of 1.69 ± 0.88 mm. At T2, the condyle showed a tendency to move in a direction opposite to that between T0 and T1. These changes were statistically significant ($p < 0.05$), except along the z-axis. On comparing the overall movement of the condyle between T0 and T2, there was no statistically significant difference, except along the y-axis ($p < 0.05$), but on average, the condyle moved medially, anteriorly, and inferiorly.

Table 2. Changes in condylar position after mandibular setback surgery with bioabsorbable mesh for mandibular fixation.

	Surgical Change [T1–T0] (mm)	Postoperative Change [T2–T1] (mm)	Total Change [T2–T0] (mm)
Δx	0.66 ± 0.84 *	-0.79 ± 0.69 *	-0.14 ± 0.57
Δy	-1.27 ± 0.82 *	1.10 ± 0.89 *	-0.17 ± 0.48 *
Δz	-0.20 ± 0.69 *	0.16 ± 0.71	-0.05 ± 0.68
Δd	1.77 ± 0.87 *	1.69 ± 0.88 *	0.85 ± 0.57

* $p < 0.05$, statistically significant. T0, before surgery; T1, within 1 week after surgery; T2, 6 months after surgery. Δd, a calculated value based on a formula that determines the distance between two points in spatial coordinates.

There was no statistically significant difference in the extent of setback based on patient age, sex, the type of orthognathic surgery, and the degree of asymmetry ($p > 0.05$). Similarly, there was no statistically significant difference in the degree of asymmetry based on patient age, sex, and the type of orthognathic surgery ($p > 0.05$). Moreover, there was no significant change in the condylar position in any period or direction based on patient age and sex, as shown in Table 3.

When comparing the movement between T1 and T2 according to the type of orthognathic surgery, statistically significant differences in condylar movement were observed (Table 3). Specifically, the condyle moved anteriorly in the bimaxillary surgery group and posteriorly in the mandibular surgery group during follow-up ($p = 0.037$: Table 3). Additionally, a statistically significant inferior movement of the condyle was observed in the mandibular surgery group compared to that in the bimaxillary surgery group between T0 and T2 ($p = 0.003$: Table 3). However, no statistically significant changes were found in other directions or periods ($p > 0.05$).

When analyzing the extent of mandibular setback, patients with a mandibular setback of >8 mm showed a statistically significant inferior movement of the condyle only between T0 and T2 compared to that of those with a mandibular setback of $\leq$8 mm ($p = 0.021$: Table 3). No significant changes were observed in other directions or periods ($p > 0.05$).

The degree of asymmetry was determined by the difference in mandibular setback between the left and right sides. Patients with a >3 mm difference showed a statistically significant anterior movement of the condyle between T0 and T1 compared to those with $\leq$3 mm difference ($p = 0.003$: Table 3). However, no significant changes were found in other directions or periods ($p > 0.05$).

Table 3. Associations between the changes in the coordinate values of the condylar position and clinical variables. (N = 56).

Variables	N	Surgical Change [T1–T0] (mm)				Postoperative Change [T2–T1] (mm)				Total Change [T2–T0] (mm)			
		Δx	Δy	Δz	Δd	Δx	Δy	Δz	Δd	Δx	Δy	Δz	Δd
Age													
≤22 years	30	0.66 ± 0.98	−1.22 ± 0.71	−0.22 ± 0.68	1.73 ± 0.92	−0.82 ± 0.81	0.95 ± 0.71	0.03 ± 0.47	1.59 ± 0.65	−0.17 ± 0.67	−0.27 ± 0.43	−0.18 ± 0.54	0.90 ± 0.47
>22 years	26	0.66 ± 0.64	−1.33 ± 0.94	−0.19 ± 0.71	1.82 ± 0.81	−0.76 ± 0.53	1.28 ± 1.04	0.30 ± 0.90	1.80 ± 1.08	−0.10 ± 0.45	−0.05 ± 0.50	0.11 ± 0.79	0.80 ± 0.67
p-value		0.999	0.621	0.898	0.719	0.730	0.182	0.158	0.379	0.671	0.084	0.111	0.526
Sex													
Male	22	0.72 ± 0.71	−1.04 ± 0.73	−0.16 ± 0.36	1.57 ± 0.53	−0.88 ± 0.59	0.88 ± 0.92	0.20 ± 0.76	1.58 ± 0.89	−0.16 ± 0.58	−0.16 ± 0.56	0.05 ± 0.74	0.89 ± 0.66
Female	34	0.62 ± 0.92	−1.41 ± 0.85	−0.24 ± 0.84	1.91 ± 1.01	−0.74 ± 0.75	1.25 ± 0.85	0.13 ± 0.68	1.76 ± 0.87	−0.12 ± 0.58	−0.17 ± 0.42	−0.11 ± 0.64	0.83 ± 0.51
p-value		0.652	0.093	0.623	0.107	0.447	0.128	0.697	0.475	0.805	0.972	0.408	0.716
Surgery type													
Mandibular surgery	10	1.04 ± 1.09	−1.33 ± 0.85	0.07 ± 0.60	1.94 ± 1.13	−0.99 ± 0.79	0.77 ± 0.89	−0.26 ± 0.54	1.59 ± 0.86	0.05 ± 0.57	−0.56 ± 0.46	−0.19 ± 0.39	0.90 ± 0.42
Bimaxillary surgery	46	0.57 ± 0.76	−1.25 ± 0.82	−0.26 ± 0.69	1.74 ± 0.81	−0.75 ± 0.67	1.17 ± 0.88	0.25 ± 0.71	1.71 ± 0.89	−0.18 ± 0.57	−0.08 ± 0.44	−0.02 ± 0.73	0.84 ± 0.60
p-value		0.106	0.794	0.160	0.508	0.313	0.197	0.037 *	0.709	0.260	0.003 *	0.472	0.778
Mandibular setback													
≤8 mm	28	0.68 ± 0.88	−1.27 ± 0.77	−0.25 ± 0.71	1.59± 0.90	−0.79 ± 0.68	1.24 ± 0.80	0.12 ± 0.34	1.56 ± 0.77	−0.10 ± 0.59	−0.02 ± 0.49	−0.14 ± 0.60	0.84 ± 0.53
>8 mm	28	0.63 ± 0.80	−1.27 ± 0.87	−0.16 ± 0.67	1.96 ± 0.81	−0.80 ± 0.71	0.96 ± 0.96	0.20 ± 0.95	1.82 ± 0.97	−0.17 ± 0.57	−0.31 ± 0.42	0.04 ± 0.75	0.87 ± 0.61
p-value		0.802	0.996	0.603	0.109	0.956	0.234	0.674	0.264	0.659	0.021*	0.372	0.885
Asymmetry (Difference between right and left mandibular setbacks)													
≤3 mm	36	0.64 ± 0.83	−1.25 ± 0.77	−0.01 ± 0.55	1.72 ± 0.76	−0.78 ± 0.71	1.14 ± 0.85	0.08 ± 0.68	1.68 ± 0.86	−0.14 ± 0.50	−0.11 ± 0.53	0.07 ± 0.69	0.82 ± 0.60
>3 mm	20	0.68 ± 0.86	−1.29 ± 0.92	−0.56 ± 0.77	1.86 ± 1.05	−0.81 ± 0.67	1.03 ± 0.98	0.30 ± 0.75	1.70 ± 0.92	−0.14 ± 0.70	−0.26 ± 0.36	−0.25 ± 0.62	0.92 ± 0.51
p-value		0.889	0.866	0.003*	0.567	0.879	0.672	0.253	0.952	0.998	0.285	0.090	0.504

* $p < 0.05$, statistically significant. '–' value on the *x*-axis indicates medial movement; '+' value on the *x*-axis indicates lateral movement; '–' value on the *y*-axis indicates downward movement; '+' value on the *y*-axis indicates upward movement; '–' value on the *z*-axis indicates advance; '+' value on the *z*-axis indicates setback. T0, before surgery; T1, within 1 week after surgery; T2, 6 months after surgery.

4. Discussion

This study's objective was to examine condylar position alterations after mandibular setback surgery using manual guidance in patients with mandibular prognathism and to assess the impact of patient age, sex, the type of orthognathic surgery, the extent of mandibular setback, and the degree of asymmetry on these changes. Our results revealed that the condyle moved significantly in an anterior–lateral–inferior direction between T0 and T1 and in a posterior–medial–superior direction between T1 and T2, indicating a tendency to return to its original position ($p < 0.05$, Table 2). There were no significant changes in the anterior–posterior and medial–lateral directions between T0 and T2, but a statistically significant inferior displacement was observed until 6 months postoperatively ($p < 0.05$, Table 2). Furthermore, there were statistically significant differences in positional changes between T0 and T1, but no significant differences between T0 and T2 (Table 2). The average changes in the condyle position between T0 and T1 and T0 and T2 were comparable to or smaller than those observed in a previous study [19] that used manual guidance with metal plates for mandibular fixation. The difference from that study to our current study was the use of bioabsorbable plates for mandibular fixation in SSRO.

Orthognathic surgery typically employs metal plates and screws. Despite the conventional perception that bioabsorbable plates are weaker than metal plates, there is a growing trend towards using bioabsorbable plates, which is primarily driven by the patient's preferences. Multiple studies have confirmed the usefulness and skeletal stability of bioabsorbable plates [20,23,24]. Bioabsorbable plates offer benefits such as not requiring secondary surgery for removal, eliminating the risk of metal corrosion, reducing stress shielding, and radiolucency [25,26].

Condylar displacement following orthognathic surgery is influenced by several factors, including the type of surgery (single- or two-jaw), the extent of mandibular setback, the degree of mandibular asymmetry, and the fixation method [13–15,17,20,27–33]. However, the direction of condylar displacement is not consistent across these factors. A previous study [27] has reported posterior–lateral–superior displacement of the condyle during single-jaw surgery and posterior–medial–inferior displacement during two-jaw surgery. However, another study [28] has reported similar condylar movement regardless of the type of surgery. Additionally, many papers have noted anterior–lateral–inferior displacement of the condyle in patients who underwent SSRO for mandibular prognathism [15,17]. In our study, we found that the anterior–posterior direction of condylar positional changes showed opposite movement between T0 and T1 depending on the type of surgery, but the difference was not statistically significant ($p > 0.05$). However, statistically significant differences in condylar movement were observed in the anterior–posterior direction between T1 and T2 according to the type of surgery. ($p = 0.037$: Table 3).

The extent of mandibular setback is an important factor that can affect condylar displacement after surgery [15,31–33]. However, a previous study [29] found that changes in condylar position are not significantly influenced by the extent of mandibular setback. Similarly, in our study, we found that the amount of setback did not have a significant impact on postoperative or follow-up condylar position ($p > 0.05$: Table 3). Interestingly, when comparing condylar position between T0 and T2, we observed that patients who underwent mandibular setbacks of >8 mm showed a significant downward condylar position at T2 compared to that at T0 ($p = 0.021$: Table 3).

Lee et al. [30] reported a significant increase in intercondylar distance due to lateral condylar movement in patients with asymmetry and mandibular prognathism. Similarly, our study found that patients with mandibular asymmetry (more than a 3 mm difference between the right and left setback amount) showed significant anterior movement between T0 and T1 ($p = 0.003$: Table 3). However, there was no significant difference during follow-up ($p > 0.05$: Table 3). Interestingly, when comparing the preoperative condylar position, mandibular asymmetry did not appear to have an impact on the condylar position at 6 months postoperatively ($p > 0.05$: Table 3). In contrast, Park et al. [33] observed a posterior–lateral–inferior displacement of the condyle after SSRO in patients with asymmetry and mandibular prognathism. They reported significant differences in the condylar position along all three axes when comparing results preoperatively and one week postoperatively, as well as one week and seven months postoperatively.

The duration of time required for recovery to the preoperative condylar position after orthognathic surgery has varied in previous studies, ranging from 6 months [15,17] to 3 years [34]. Lee et al. [30] reported a trend of condyles returning to their preoperative position over time, which was consistent with the findings of this study (Table 2), demonstrating a common pattern of condylar displacement after surgery. The present study revealed significant positional changes between T0 and T2 only in the y-axis ($p < 0.05$: Table 2). The condyles generally move in a certain direction after surgery and gradually recover towards the preoperative position, but the extent and duration of recovery may vary depending on the surgical approach and patient-specific factors.

In this study, the voxel-based registration method, a comparatively new technique, was utilized. This method involves aligning CT images acquired at two different time points through a mathematical algorithm that relies on the grayscale variation of voxels [35,36]. It offers superior accuracy and reduces the likelihood of human error compared to that with landmark-based registration, since the superimposition of CT scans is automated and does not necessitate the repeated selection of reference points [21,36,37].

The current study acknowledges several limitations. Firstly, the follow-up period in this investigation was confined to 6 months. Although significant recovery towards the original condylar position was observed in our study, this period may have been inadequate for the full recovery of condylar position in the y-axis, as shown in Table 2. Future studies with extended follow-up durations are needed to observe the long-term changes in condylar position after surgery. Secondly, the present study did not evaluate the effects of different fixation materials on postoperative condylar position and soft tissue changes. All patients in this study received a bioabsorbable mesh for mandibular fixation in SSRO. For a comprehensive comparison, future research should consider including an additional group that receives a traditional metal plate or screw fixation. Thirdly, our sample predominantly consisted of bimaxillary surgeries, with a relatively small number of single-jaw cases. Incorporating a larger number of single-jaw surgeries would enhance our understanding of the potential differences in condylar position changes between single-jaw and bimaxillary surgeries. Lastly, while this study was retrospective in nature, a prospective study design, potentially with a pre-determined sample size based on power calculations, would permit a more controlled and robust analysis of condylar position changes following mandibular setback surgery. We strongly advocate for such future studies to validate and expand upon our findings.

5. Conclusions

This study's results demonstrate significant anterior–lateral–inferior displacement of the condyles within one week following mandibular setback surgery utilizing manual guidance and a bioabsorbable mesh. Nevertheless, the condyles progressively reverted to their initial position, displaying near-complete recovery six months post-surgery, which is in line with findings from a study employing metal plates. In conclusion, the observed alterations in condylar position after implementing manual guidance and a bioabsorbable mesh in mandibular setback surgery were considered clinically satisfactory.

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