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Original Article

Factors related to skeletal relapse in the two-jaw surgery treatment of mandibular prognathism

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ABSTRACT

This study identified factors contributing to skeletal relapse in the two-jaw surgery treatment of mandibular prognathism. A set of three standardized lateral cephalograms (T1: before surgery, T2: immediately after surgery, T3: final follow-up after surgery) were obtained from 35 patients. The surgical changes were defined as follows: postsurgical immediate change (T2–T1), postoperative stability (T3–T2) and the final surgical change (T3–T1). The occlusal plane and gonial angles were also measured. Relapse was defined as the reverse movements of the menton point (Me) and point A, with the null hypothesis stating that Me and point A do not significantly change at the postoperative stability (T3–T2). A paired t test and Pearson's correlation were used for statistical analysis. The immediate postoperative changes (T2–T1) in Me and point A were significant, and were measured to be 8.5 mm backward and 3.0 mm forward, respectively. Additionally, the occlusal plane and gonial angles significantly increased by 2° and decreased by 2°, respectively. The final postoperative changes (T3–T1) in Me and point A were also significant, and were measured to be 5.2 mm backward and 2.5 forward, respectively; the occlusal plane and gonial angles also increased nonsignificantly by 0.6° and 0.7°, respectively. Upon investigating postoperative stability (T3–T2), Me was measured to be significantly 3.3 mm forward and 1.4 mm upward, whereas point A was measured to be nonsignificantly 0.5 mm backward and 0.9 mm upward. Therefore, the null hypothesis was rejected. Pearson's correlation showed that horizontal Me (T3–T2) and point A (T3–T2) were significantly correlated with the amounts of setback Me (T2–T1) and advancement A (T2–T1), respectively. In conclusion, skeletal relapses are significantly correlated with the amounts of mandibular setback and maxillary advancement.

1. Introduction

Mandibular prognathism is caused by the excessive growth of the lower jaw, which results in a longer mandible. Mandibular prognathism is further characterized by the forward protrusion of the patient's submental area and lower lip. Such facial indentation and damage cause facial disharmony and can affect the patient's mental status. Excessive mandibular growth, coupled with abnormal occlusion, Class III molar relationship, and a reverse overjet in the incisor area, are the main characteristics of mandibular prognathism. The National Institute of Health found that malocclusion is prevalent in children aged 6–11 years. Specifically, the results showed that 75% of the students had symptoms of occlusal disharmony, 37% of these students had symptoms of malalignment of the teeth, and 5% of these students had symptoms of malocclusion of Angle Class III [1].

Mandibular prognathism can be treated using numerous procedures, including subcondylar osteotomy, horizontal osteotomy of the ramus, or mandibular body osteotomy. Among these techniques, intraoral vertical ramus osteotomy (IVRO) and sagittal split ramus osteotomy (SSRO) have been widely utilized to address mandibular prognathism. Recently, two-jaw surgeries have been used to treat patients with mandibular prognathism. The present

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study investigated the postoperative stability of SSRO and Le Fort I operations performed to treat mandibular prognathism. The null hypothesis stated that jaw bone positions are not different between the immediate postoperative phase and final follow-up. We also hypothesized that no difference exists in the jaw positions between the immediate postoperative phase and final follow-up for the SSRO setback combined with Le Fort I advancement, which was applied as a therapeutic modality for the management of mandibular prognathism.

2. Methods

This study included 35 patients (19 men and 16 women; mean age: 26.2 ± 5.6) who needed surgical correction for mandibular prognathism and were treated at the Oral and Maxillofacial Surgery Department of China Medical University Hospital. The operation was performed using SSRO setback (miniplate fixation) and Le Fort I advancement (miniplate fixation) techniques. The indications for the two-jaw surgery of the patients were as follows: presence of skeletal Class III malocclusions and absence of craniofacial anomalies; however, those with a history of trauma or recognized syndromes were excluded. Three cephalograms were obtained preoperatively (T1), immediately postoperatively (T2), and at least 6 months postoperatively (i.e., at the final postoperative follow-up) (T3). The immediate postoperative change (T2–T1), postoperative stability (T3–T2) and the final surgical change (T3–T1) were calculated and analyzed, during which the following points were identified: sella (S), nasion (N), menton (Me), and point A. For analysis, an x–y coordinate system was constructed, wherein the origin was at point N, the x-axis was the horizontal axis or reference line (NS) at an angle of 7° (upward) [2], and the y-axis was the vertical line through S that was perpendicular to the x-axis (Fig. 1).

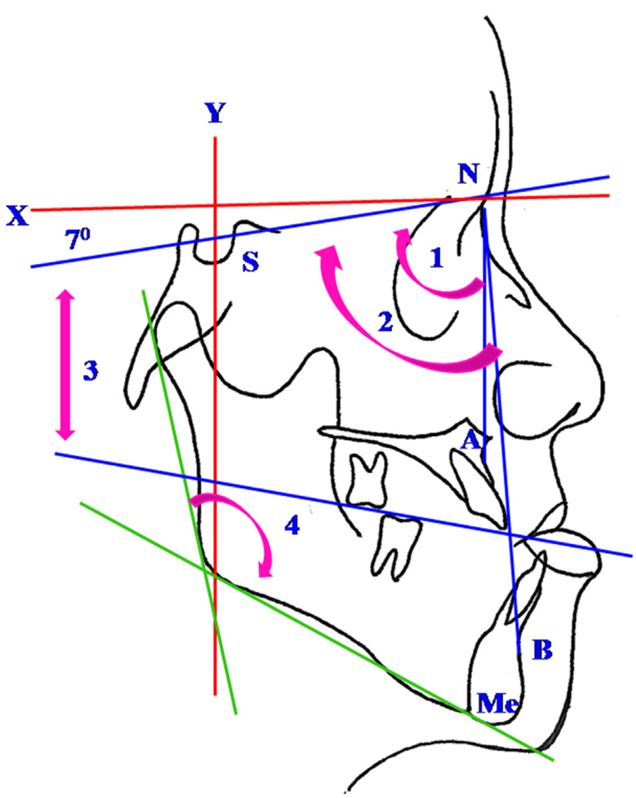

Fig. 1. N: nasion; S: sella; A: point A; B: point B; Me: menton. Red lines: x-axis (horizontal line: 7° to NS line); y-axis (vertical line through S); blue lines: (1) SNA angle (2) SNB angle (3) occlusal plane angle; green line: (4) gonial angle.

The parameters related to angular cephalometric measurements were identified to evaluate the maxillary and mandibular positions. The parameters are as follows:

- SNA angle: the angle between the SN line and the NA line;
- SNB angle: the angle between the SN line and the NB line, and;
- occlusal plane angle: the angle between the SN line and the occlusal plane. The gonial angle was defined as the intersection of the ramal plane and the mandibular plane.

Relapse was defined as the reverse movements of Me and point A. A Student t test was used to estimate the mean changes in the variables at different stages, and Pearson's correlation was calculated to determine the correlation among the final postoperative changes in the related variables. Statistical significance was set at $P < 0.05$. The null hypothesis stated that jaw bone positions (Me and point A) are not different between the immediate postoperative phase and the final follow-up in both directions (horizontal and vertical). This retrospective study was approved by the Human Ethics Review Committee of China Medical University Hospital (CMUH105-REC2-146).

3. Results

The immediate postoperative changes (T2–T1) in Me and point A were statistically significant, and were measured to be 8.5 mm backward and 3 mm forward, respectively. Vertically, Me and point A also moved 0.9 and 0.6 mm downward, respectively (Table 1). The SNA and SNB angles significantly increased by 2.8° and decreased by 4.1°, respectively, and the occlusal plane and gonial angles significantly increased and decreased, respectively, by 2° (Table 2). The final postoperative changes (T3–T1) in Me and point A were also significant, and were measured to be 5.2 mm backward and 2.5 mm forward, respectively. Vertically, Me and point A moved 0.5 mm upward and 0.1 mm downward, respectively. Moreover, the SNA and SNB angles significantly increased by 2.4° and decreased by 3.5°, respectively, and the occlusal plane and gonial angles increased by 0.6° and 0.7°, respectively.

Upon investigating the postoperative stability (T3–T2), Me was measured to be significantly 3.3 mm forward and 1.4 mm upward. Additionally, point A was measured to be 0.5 mm backward and 0.5 mm upward, although these changes were not significant. Therefore, the null hypothesis was rejected. This finding is indicative of significant relapses in Me movement at T3–T2 in the horizontal and vertical directions. The occlusal plane and

Table 1
Cephalometric landmarks of immediate postoperative change (T2–T1), postoperative stability (T3–T2), and final change (T3–T1).

Variable	Mean	SD	*P* value
Horizontal (mm)			
Me-T2–T1	−8.5	5.36	< 0.001*
Me-T3–T2	3.3	2.74	< 0.001*
Me-T3–T1	−5.2	4.98	< 0.001*
A-T2–T1	3.0	2.58	< 0.001*
A-T3–T2	−0.5	2.04	0.151
A-T3–T1	2.5	2.44	< 0.001*
Vertical (mm)			
Me-T2–T1	0.9	3.92	0.190
Me-T3–T2	−1.4	1.76	< 0.001*
Me-T3–T1	−0.5	3.81	0.424
A-T2–T1	0.6	3.38	0.276
A-T3–T2	−0.5	1.78	0.111
A-T3–T1	0.1	3.01	0.784

Me: menton point; A: point A; T2–T1: immediate surgical changes; T3–T2: postoperative stability; T3–T1: final changes.
* $P < 0.05$.