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THE CHANGES OF MANDIBULAR ROTATION AND LOWER ANTERIOR FACIAL HEIGHT IN DENTOSKELETAL ORTHODONTIC TREATMENT WITH MALOCCLUSION CLASS II/1 ANGLE

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ABSTRACT

***Background**: Classification of malocclusion, especially in the class II division, has various biological variations and dental abnormalities with the presence of distocclusion of the first molar relation and proclination of the maxillary fourth incisor and causing the patient's profile to become convex. Aesthetic correction in class II division 1 is determined by the choice of treatment and taking into account the rotational pattern of the mandible. **Objectives**: To determine the effect of orthodontic treatment in relation to changes in mandibular rotation with lower anterior facial height and to determine the parameters of the effect of mandibular rotation on lower anterior facial height (LAFH) in Angle Class II/1 dentoskeletal malocclusion. **Methods**: Cephalometric data were obtained from lateral cephalograms presented before and after treatment. Assessed changes in Y-axis FH angle, SN - mandibular plane angle (GoMe) and NPog-FH angle facial angle. Data analysis with Pearson was used to correlate the mandibular rotation parameter (angle) with the lower anterior facial height parameter, namely ANS-Me (linear) ($p > 0.05$). **Results**: Group 1 access maxilla, normal mandible showed a significant correlation on the Y-FH Axis with ANS-Me. Group 2 with normal maxillary, retrognathic mandibles, showed a significant correlation between NPog-FH with ANS-Me and NPog-FH with extrusion of the upper/lower first molars. Group 3, the combination group which is the maxillary retrognathic access, showed a significant correlation between Sn-GoMe and ANS-Me. Group 4 is with different teeth, but normal bone (grade 1). **Conclusion**: There is a relationship between changes in mandibular rotation and changes in lower anterior facial height (LAFH) in the orthodontic treatment of class II/1 Angle dentoskeletal malocclusion.*

***Keywords:** Class II divition 1, Lower Anterior Facial Height (LAFH,)Malocclusions, Rotation Mandible*
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INTRODUCTION

In orthodontic cases, proper diagnosis of malocclusion is required to determine the correct and appropriate treatment plans. The classification of malocclusion, especially in class II division 1 malocclusion, has various biological variations. In class II malocclusion pattern, the etiology usually from the influence of soft tissue and skeletal growth. Skeletal etiology such as the antero-posterior relationship where there is a descrepancy of maxilla and mandible. Descrepancy can occur if the maxilla is more than normal and the mandible is normal, the mandible is less than normal and the maxilla is normal or the maxilla is more than normal and the mandible is less than normal. This is called a class II dentoskeletal disorder. The dental abnormalities with class II division 1 Angle malocclusion are dental abnormalities with the first molar relation distocclusion and the fourth maxillary incisors proclination and causes the patient's profile to be convex.[1]

Aesthetic correction in class II division 1 is determined by the choice of treatment. According to Proffit, there are 4 types of treatment plans for Class II Division 1 cases. First, with the principle of growth modification, namely using headgear or functional devices. The other three are use the principle of variations in tooth movement, namely the movement of the maxillary molars distally followed by the entire dental arch distally, retracting the maxillary anterior teeth distally by occupying the space where the premolars were extracted and then the combination by retracting the maxillary teeth and mandible teeth to move forward. In severe class II division 1, orthognatic surgery and camouflage treatment (compromise) are considered.[1,2]

In determining treatment options, the orthodontist must pay attention to the mandibular rotation pattern. Because in the cases of Class II division 1 malocclusion, the expected rotation pattern at the end of the treatment is forward and

upward rotation in order to correct convex face profile. On the other hand, if the mandibular rotation pattern at the end of the treatment is backward and downward, the face will be longer (long face). This is an undesirable change in mandibular rotation.[2]

According to Jacobson in Downs analysis, the vertical relationship of the face was influenced by changes in the rotation of the mandible downwards and backwards, so the height of the face will increase or vice versa. The changes in the rotation of the mandible to upward and forward direction will make facial height decrease. Downs analysis said mandibular rotation can be measured through the parameters of the Y-FH axis angle, SN-GoMe angle and facial angle, namely the NPog-FH angle which these parameters can distinguish the rotation direction of the mandible are downward and backward or upward and forward. These two directions of rotation greatly influence in increasing or decreasing the dimension of the lower anterior facial height (ANS-Me). The changes proportion of the patient's facial harmony before and after treatment can be observed from the vertical aspect.[3]

MATERIALS AND METHODS

This research is an analytical observational study and was conducted at the Orthodontic Specialist Clinic, Faculty of Dentistry, Airlangga University. The total sample was 24 samples, then the sample was divided into 4 groups, namely:

Group 1 (samples of 6 people):
- Clinical diagnosis: Class II division 1 Angle
- ∠SNA : ≥ 89° (maxilla more than normal)
- ∠SNB : 74°-89° (mandible normal)
- ∠ANB : ≥ 4° (skeletal pattern class II)

Group 2 (sample 6 people):
- Clinical diagnosis: Class II division 1 Angle
- ∠SNA : 79°-89° (maxilla normal)
- ∠SNB : ≤ 75° (mandible less than normal)
- ∠ANB : ≥ 4° (skeletal pattern class II)

Group 3 (sample 6 people):
- Clinical diagnosis: Class II division 1 Angle
- ∠SNA : ≥ 85° (maxilla more than normal)
- ∠SNB : ≤ 78° (mandible less than normal)
- ∠ANB : ≥ 7° (skeletal pattern class II)

Group 4 (samples of 6 people):
- Clinical diagnosis: Class II division 1 Angle
- Overjet ≥ 4 mm, overbite ≥ 4 mm
- ∠SNA : 79° - 89° (maxilla normal)
- ∠SNB : 74° - 89° (mandible normal)
- ∠ANB: 2° - 4° (skeletal pattern class I)

Then measurements were made on the patient's cephalometry before and after orthodontic treatment. The tracing methods are determined points, lines and cephalometric angles, measure the angle and distance variables used and perform statistical tests.

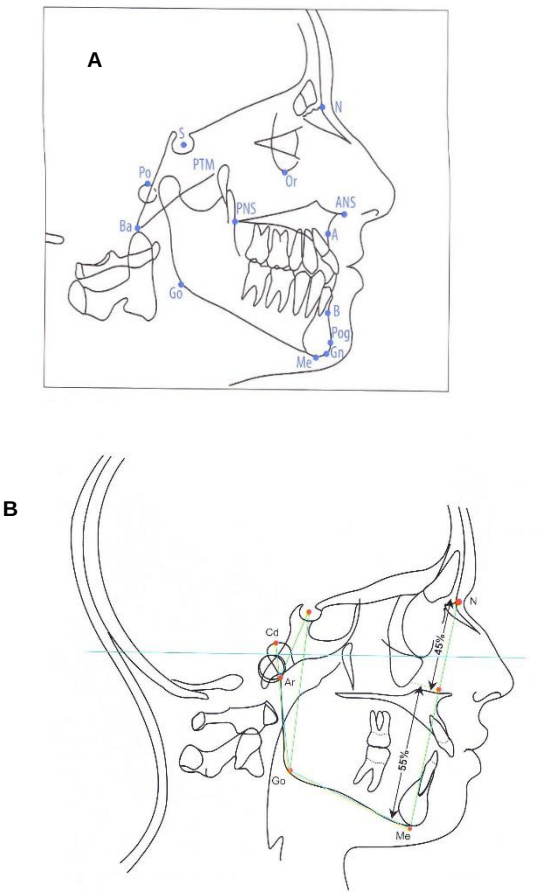

Figure 1.
A. Cephalometric reference landmark points.[3]
B. Lower face anterior height.[4]

RESULT

The cephalogram observation regarding the changes of mandibular rotation to the lower anterior facial height was measured by the parameters SN - mandibular angle (Go-Me), Y-FH axis, NPog-FH angle, ANS-Me linear distance, maxillary and mandibular M1 extrusion at Class II division 1 Angle dentoskeletal malocclusion cases before and after orthodontic treatment with a total sample of 24 people.

Table 1. Group 1 (Maxilla more than normal, mandible normal)

Parameter	∠ SN-GoMe	∠ FHGoMe	∠Sb.Y-FH	∠NPog-FH
ANS-Me (mm)	r : 0,718 p : 0,108	r : 0,194 p : 0,713	r : 0,882** p : 0,020	r : -0,395 p : 0,439
Upper and lower M1 extrusion	r : -0,951** p : 0,004	r : 0,000 p : 1,000	r : -0,859 p : 0,028	r : 0,193 p : 0,758

Description: r : pearson correlation value ; p : significance value; α = 0,05, **: meaningful difference

From the results of the Pearson test, it was concluded there was no correlation in the normal group.

Table 2. Group 2 (Maxilla normal, mandible less than normal)

Parameter	∠ SN-GoMe	∠ FHGoMe	∠Sb.Y-FH	∠NPog-FH
ANS-Me (mm)	r : 0,765 p : 0,077	r : 0,783 p : 0,766	r : 0,741 p : 0,092	r : -0,892** p : 0,017
Upper and lower M1 extrusion	r : -0,695 p : 0,126	r : 0,724 p : 0,104	r : -0,678 p : 0,139	r : 0,916** p : 0,010

Description: r : pearson correlation value ; p : significance value; α = 0,05, **: meaningful difference

From the results of the Pearson test, it was concluded there is a parameter correlation between Y-FH and ANS-Me (mm) axis angles, there is a parameter correlation between NPog-FH and ANS-Me angles (mm) and there is a parameter correlation between NPog-FH and NPog-FH angles and upper and lower M1 extrusion (mm).

Table 3. Group 3 (Maxilla more than normal, mandible more than normal)

Parameter	∠ SN-GoMe	∠ FHGoMe	∠Sb.Y-FH	∠NPog-FH
ANS-Me (mm)	r : 0,873** p : 0,023	r : -0,218 p : 0,678	r : 0,735 p : 0,096	r : -0,038 p : 0,943
Upper and lower M1 extrusion	r : 0,124 p : 0,815	r : -0,372 p : 0,468	r : 0,286 p : 0,583	r : 0,418 p : 0,409

Description: r : pearson correlation value ; p : significance value; α = 0,05, **: meaningful difference

From the results of the Pearson test, it was concluded there is a parameter correlation between SN-GoMe and ANS-Me angles (mm).

Table 4. Group 4 (class II dental abnormalities, division 1 Angle, skeletal class 1)

Parameter	∠ SN-GoMe	∠ FHGoMe	∠Sb.Y-FH	∠NPog-FH
ANS-Me (mm)	r : 0,782 p : 0,066	r : 0,876 p : 0,022	r : 0,623 p : 0,186	r : -0,754** p : 0,083
Upper and lower M1 extrusion	r : -0,387 p : 0,448	r : -0,484 p : 0,330	r : -0,856 p : 0,030	r : 0,507 p : 0,305

Description: r : pearson correlation value ; p : significance value; α = 0,05, **: meaningful difference

From the results of the Pearson test, it was concluded there is a parameter correlation between FH-GoMe and ANS-Me angles (mm) and there is a parameter correlation between Y-FH axis angle and upper and lower M1 extrusion (mm).

Table 5. Direction change of mandibular rotational movement on ∠SN-GoMe, ∠FH-GoMe and ∠Sb.Y-FH measurements before and after orthodontic treatment in group 1.

Parameter of mandibular rotation change	*Backward - Downward*	*Forward - Upward*
Cumulative Percent (%)	50 %	50

From the results above, it was obtained that the movement of the mandible rotation direction backward and downward was 50% and the movement of the mandibular rotation direction towards the front (forward) and upwards was 50% of the whole group 1.

Table 6. Direction change of mandibular rotation movement on ∠SN-GoMe, ∠FH-GoMe and ∠Sb.Y-FH measurements before and after orthodontic treatment in group 2.

Parameter of mandibular rotation change	*Backward - Downward*	*Forward - Upward*
Cumulative Percent (%)	66,7 %	33,3 %

From the results, it was obtained that the movement of the mandibular rotation direction backwards and downwards was 66.7% and the movement of the mandibular rotation direction towards the front (forward) and upward was 33.3% of the whole group 2.

Table 7. Direction change of mandibular rotation movement on ∠SN-GoMe, ∠FH-GoMe and ∠Sb.Y-FH measurements before and after orthodontic treatment in group 3.

Parameter of mandibular rotation change	*Backward - Downward*	*Forward - Upward*
Cumulative Percent (%)	33,3 %	66,7 %

From the results, it was obtained that the movement of the mandible rotation backward and downwards was 33.3% and the movement of the mandibular rotation direction forward and upwards upward was obtained 66.7% of the whole group 3.

Table 8. Direction change of mandibular rotation movement on ∠SN-GoMe, ∠FH-GoMe and ∠Sb.Y-FH measurements before and after orthodontic treatment in group 4.

Parameter of mandibular rotation change	*Backward - Downward*	*Forward - Upward*
Cumulative Percent (%)	83,3 %	16,7 %

From the results, it was obtained that the movement of the mandible rotation backward and downwards was 83.3% and the movement of the mandibular rotation direction forward and upward 16.7% of the whole group 4.

DISCUSSION

The results of the study above shows the comparison of the percentage of change in the direction of mandibular rotation after treatment varied greatly in each group. Reviewing the causes of the rotational movement direction to be backward and downward or upward and forward, cannot be separated from the initial treatment plan with a diagnosis of class II division 1 malocclusion.[5] The choice of treatment plans depends on the expected biomechanics at the time of treatment. After the treatment was finished, then it was known how the movement effect the teeth on changes the direction of mandibular rotation. Reviewing the sample subpopulation criteria was a patient whose refuse to have orthognatic surgery and the treatment plan is extraction without specifying the type of tooth to be extracted. Looking back at the patient's medical record, it turned out that 40% of the treatment plans were bilateral maxillary first premolars extraction, 30% extraction of the first four premolars, 20% using the mutilated space or gangrenous teeth indicated to extraction (such as the first molars) and the rest were non-extracted because of multiple diastema.[6] In this study emphasized that most cases use camouflage treatment, which is the skeleton was not corrected and only relied on dental manipulation, whereas dental manipulation can affect the height of the face in vertical direction. In the selection of treatment for extraction of first or second premolars, the biomechanics of tooth movement are mesial translational movements of the molars, so it will affect the forward mandibular movements and can reduce the vertical height of the face.[4,6]

The rotation of the mandible results from the fact that the mandible is far posteriorly in class II dentoskeletal, division 1 cases. Direction change

of upward and forward rotation at the end of the treatment are compensatory occlusion, in class II mechanical finishing treatment using intermaxillary elastic. The use of intermaxillary elastics depends on the frequency, duration and type of diameter and strength (Oz) the patient wears, so it will produce the expected direction of rotation, which causes the occlusal plane and mandible to rotate counter-clockwise or forward and upward.[1,7] Despite the fact in cases of the retruded mandible (group 2) and the combined dentoskeletal cases (group 3), the lower anterior height change was not significant. This is due to the skeleton is not corrected even though the main abnormality is a skeletal discrepancy that is too large and the patient's profile is still convex. Patients in group of dentoskeletal disorders generally have a tendency to have a long-faced profile. This is due to the impression position of the mandible is too posterior and position of the maxilla much more anterior.[8] The forward and upward rotations in this study were only limited to dental correction and their effect on the overall facial profile was not too significant. The solution that can be done in patients with long-faced is orthognatic surgery or genioplasty.[9]

Another reason for this change in mandibular rotation is as the previous discussion where Nanda states that the effect of extrusion of posterior teeth can result in a backward-downward rotation of the mandible due to the correction of dental malocclusion class II division 1 Angle (in group 4), using 3 basic principles, namely extruding the posterior teeth, intruding the anterior teeth and flaring the mandibular incisors. It should be emphasized that the changes in the degree of mandibular rotation in these study groups were not too drastic, this was due to the limitations of extrusion and intrusion of the teeth.[1,7]

According to the end of this discussion, the author emphasizes in the cases of Class II Angle Division 1 malocclusion accompanied by dentoskeletal abnormalities, the choice of treatment plans should be paid more attention. The patient's facial profile from both sagittal and transverse aspects were used as the main consideration in the selection of treatment plans. Therefore, in the cases of Class II division 1 malocclusion, the expected rotation pattern at the end of treatment is forward and upward rotation. Decrease in the anterior height of the lower face cause the face will appears convex or convex-corrected. On the other hand, if the mandibular rotation pattern at the end of the treatment is backward and downward, the face will be more convex.[10] This is an undesirable change in mandibular rotation, as a result of increased the anterior height of the lower face. If the patient before treatment has long-faced, especially in patients with dolichocephalic, then at the end of the treatment it will get higher and it will look aesthetically unpleasant. In conclucion, there was a relationship between changes of mandibular rotation with changes of lower anterior face height before and after orthodontic treatment in dentoskeletal malocclusion class II division 1 Angle.

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