Abstract: Submentovertex cephalometric analysis was used to assess the mandibular symmetry of 20 patients with Class II subdivision malocclusion and 20 controls with Class I occlusions. Using the intercondylar line and the intercondylar axis, the relative differences were measured between mandibular landmarks in both anteroposterior and transverse dimensions. Anteroposterior and transverse differences between left and right mandibular positions and the transverse position of the dental midline showed a statistically significant difference between the groups. The position of the coronoid process also differed between the two groups. We conclude that the entire mandibular dentition is rotated in Class II subdivision malocclusions.

Key words: cephalometric analysis; mandibular symmetry; malocclusion; Class II; intercondylar.

Introduction

Class II subdivision malocclusions account for approximately 50% of all Class II malocclusions (1). Many studies have tried to describe the characteristics of Class II subdivision malocclusions, but the origin and etiological factors of unilateral malocclusions are still questioned (2). These patients present difficulties in orthodontic treatment because of the asymmetric occlusal relationship and the underlying factors responsible for the malocclusion (3). There are questions as to whether the origin of the asymmetry is dentoalveolar, skeletal or a combination of the two (3).

Skeletal and dental asymmetry have been studied in persons exhibiting normal occlusions and various malocclusions. Patients with no obvious facial and dental asymmetry have been found to show skeletal size differences when comparing the left and right sides of the maxilla and mandible (4), although Letzer and Kronman could not find a definite relationship between malocclusion and symmetry (5).

The different results obtained in previous studies can be related to the type of radiographic analysis performed (6). Commonly used skull radiographs to assess skeletal asymmetry include posteroanterior (PA) and submentovertex (SMV) radiographs. Studies that compared the effects of head rotation and positioning in the determination of asymmetry by using PA and SMV radiography revealed that 5° of side-to-side rotation for a PA radiograph caused the side of asymmetry to switch, whereas SMV radiographs were found not to be subject to these effects (6). The problem of selecting a valid midsagittal reference plane associated with the PA has led to more widespread use of the SMV radiograph (7). Others have used SMV radiographs as a means of obtaining accurate temporomandibular joint laminographs (7). This technique allows for investigation of transverse and anteroposterior relationships. In addition, SMV radiographs display superior clarity of reference points, and allow for differentiation of skeletal and/or dental asymmetry (8).

The purpose of this study was to determine the differences that exist with regard to dental and skeletal asymmetries between subjects with Angle Class II subdivision malocclusions, and Angle Class I occlusions using submentovertex radiographs.

Materials and Methods

The study group consisted of 20 Class II subdivision patients (11 females and 9 males) with a mean age of
18.4 yr (standard deviation 2.12 yr). Selection criteria included full dentition in maxillary and mandibular arches, Class I molar relationship on one side of the dental arch with a full Class II relationship on the other side. The subjects also had no previous experience of orthodontic treatment, had no restorations covering the tips of the cusps and no history of facial trauma. These criteria were evaluated by means of clinical history and examination. The control group comprised 20 dental students (10 females and 10 males) with Class I occlusions with a mean age of 22.3 (standard deviation 4.67).

Submentovertex radiographs were obtained for the 40 patients with OP 100 Orthopantomography Machine (Instrumental Imaging, Finland) at 85 kv and 12 mA. The SMV radiographs were taken with the patient’s Frankfort plane positioned perpendicular to the floor and in maximum intercuspsation.

On the SMV films, the outlines of the mandible were traced onto matte acetate. The tracings included the condyles, coronoid processes, gonial angles, first molars, central incisors and the lateral and medial borders of the mandibular body and ramus.

The landmarks for submentovertex radiographs are seen in Fig. 1. The mandibular dental and skeletal asymmetries were assessed using the intercondylar line and the intercondylar axis which were drawn perpendicular to the intercondylar line as coordinate systems (ICL, ICA). The asymmetries were determined by measuring the differences between the right and left bilateral mandibular skeletal and dental landmarks (Go, CP, MCM, DMP) both in the transverse and anteroposterior dimensions and MM and DM in the transverse dimension. The skeletal and dental points used in the assessments are defined as follows:

Go: Gonion point - the most posterior point of the gonial angle
CP: Coronoid process point - the most anterior point on the coronoid process.
MCM: Medial contour of the mandible - the most medial and posterior point on the medial outline of the body of the mandible.
DMP: Distal molar point - the midpoint on the distal outline of the lower first molar
MM: Mandibular midline point - the most anterior point on the midline of the mandible.
DM: Dental midline point - the point between the mesial contacts of the mandibular central incisor crowns.
ICA: Intercondylar axis - the perpendicular bisector of the ICL.

The measurements obtained were evaluated using the t-test for both the study and control groups.

Results

The reproducibility of SMV variables was determined by making the same measurements one week apart by the same investigator. Only five radiographs from each group were chosen for the test. In all cases the differences between the two groups of measurements were not significant (P > 0.05).

The t-tests of variables relative to the mandibular skeletal and dental structures are shown in Table 1. The mean and standard deviation for each variable in both groups are reported along with the results of the t tests. For the study group the differences were obtained by subtracting the left side from the right side. Thus a positive difference value indicates a greater distance between a given landmark and reference line on the right side. There was a significant difference between the groups in the anteroposterior position of the mandibular molar (P < 0.05), and in the transverse position of the mandibular molar and the dental midline (P < 0.001 and P < 0.01 consecutively). On
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average the mandibular molar was 1.70 mm relatively more distal and 3 mm more lateral in the study group than in the control group. Similarly, the mandibular incisor was 2.5 mm more lateral. The anteroposterior coronoid process distance also shows a difference between the two groups.

**Discussion**

We found that the dentoalveolar segment in Class II subdivision malocclusions was asymmetrical when compared with Class I occlusions. The distal molar point on the Class II side was found to be located more lateral and posterior relative to the other side. The dental midline also rotated towards the Class II side. The entire mandibular dentition in subdivision cases may be considered as being rotated within a symmetrical mandible.

Investigators have proposed that Class II malocclusions would result in the subdivision side of the mandible being shorter in length than the opposite side (9). Our study did not demonstrate this assumption. There was no group difference in mandibular skeletal morphology except for the coronoid process \( (P < 0.01) \). Otherwise the size of the left and right mandibles in Class II subdivision malocclusions did not differ significantly from Class I occlusions in either transverse or anteroposterior asymmetry.

Martins de Araujo et al. (10) studied skeletal and dental asymmetries in Class II division I subdivision malocclusions using frontal cephalometric radiographs and dental casts and reported that while the statistical tests did not demonstrate significant differences on the frontal cephalometric radiographs, a statistically significant difference was evident on cast midlines. They concluded that the reference planes were not easily identified on the frontal cephalometric radiographs and the sagittal planes used as references to measure midline deviation on the radiographs and on casts were not coincidental. In this study we observed that the SMV radiographs were superior with regard to clarity of reference points, and allowed for differentiation of skeletal and/or dental asymmetry.

Janson et al. (2) concluded that distal positioning of the mandibular first molars occurs more frequently than mesial positioning of the maxillary first molars in Class II subdivision patients. Our study did not evaluate the position of the maxillary landmarks.

Our study supports the findings of Rose et al. (3) and Alavi et al. (11) concerning the anteroposterior positioning of mandibular molars in Class II subdivision malocclusion. Rose (3) investigated the mandibular asymmetry relative to the cranial floor and within the mandible, while our study concentrated on the symmetry within the mandible only.

We conclude that both the mandibular molars and the dental midline are deviated in Class II subdivision malocclusions, resulting in rotation of the entire mandibular dentition.

**References**

1. Angle EH (1899) Classification of malocclusion. Dental Cosmos 41, 248-264