Original Research

Cephalometric assessment of the collum angle of maxillary central incisors in different types of malocclusions in western Nepal

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ABSTRACT:
Background: Understanding the crown-root angle in patients with different types of malocclusion is a critical issue. The present study was done to assess the collum angle in population of western Nepal. **Materials and methodology:** Sample size is cephalograms of 60 patients with 25 males and 35 females having class II division 1, class II division 2 and class III malocclusion. **Results**: Collum angle of the patients with class II division 2 is more than that of other malocclusion types. **Conclusion:** While treating the patients, collum angle should be considered, specially patients having class II division 2 malocclussion.
Keywords: Collum Angle, Crown, Root, Cephalogram, Malocclusion

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INTRODUCTION
The Class II, division 2 (Class II/2) malocclusion was originally characterized by Angle as having distal occlusion of the lower teeth in addition to specific features such as "slight narrowing of the maxillary arch, bunching of the maxillary incisors, with overlapping and lingual inclination." There appears to be no consensus on the exact underlying skeletal features of this malocclusion type, since no radiographic records were available at the time when Edward Angle proposed his classification system. Therefore, the Class II/2 might be considered as a unique malocclusion for its dental aspects, i.e., deep overbite and maxillary incisors retroclination.[1-3]
Concerning the maxillary central incisors of Class II/2 individuals, there have been reports regarding its morphological peculiar configuration. Among other documented characteristics, such as reduced labiolingual and mesiodistal dimensions, it has been reported that Class II/2 maxillary central incisors, as opposed to other malocclusion types, frequently demonstrate a certain "misalignment" between its crown and root axes.[4-6] According to several cephalometric studies, maxillary central incisors of Class II/2 individuals, in contrast to other malocclusion types, demonstrate reduced crown-root angles, which indicates an excessive palatal "bend" of the crown.[6-8] The aim of this study was therefore to determine the collum angle of the maxillary central incisors in western Nepali population with different types of malocclusions using lateral cephalogram.

MATERIALS AND METHODS
The present retrospective cross sectional study was done in the department of Orthodontics and Dentofacial Orthopedics, UCMS College of Dental Surgery, Bhairahawa, Nepal during October 2021 to January 2022. Ethical clearance was taken in October

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2021 (UCMS/IRC/157/21). For this, consents of all the patients were also taken. This study (radiographic – cephalometric) was done on lateral cephalograms of 60 patients (collected from the department of orthodontics, UCMS, CODS), including 25 male and 35 female patients (Table-1). The sample included lateral cephalograms of Nepalese citizen of Province 5 meeting the inclusion criteria of having Angle's class II div 1, class II div 2 and class III malocclusions visiting the department of orthodontics and dentofacial orthopedics, UCMS College of Dental Surgery upon which analysis was done regarding collum angle. Being one of the tertiary center in this province, patients coming from different districts of province no. 5, it was relatively easier and less time consuming to collect the required number of samples for the study.

The orthodontists categorized patients into three groups according to the malocclusion type using Angle's classification of malocclusion as: Class-II division-I, Class-II division 2, and Class-III malocclusions. In order to clearly measure the collum angle of the maxillary central incisors on lateral cephalometric radiographs of all patients, researchers had to be able to identify the natural tooth axis of the maxillary central incisors; therefore, no prostheses (posts, dental implants, or fixed partial dentures) could be present in the anterior zone. Additionally, lateral cephalometric radiographs showing patients who underwent previous orthodontic treatment or maxillofacial surgery, patients with craniofacial syndromes or had a history of facial trauma, patients with missing incisor and severe crowding or mixed dentition in the anterior zone were excluded from the analysis

Measurement of collum angle
After sketching the maxillary central incisor type from the lateral cephalometric radiographs, the superiors point of the incisal edge and the middle point of the cementoenamel junction were joined to depict the crown axis, and then the middle point of the cementoenamel junction with the root apex to depict the longitudinal axis were joined. The collum angle was then measured. Based on lateral cephalograms and dental casts (for dental classification), the patients were categorized into three equal-sized groups, class II division 1 class II division 2 and class III. It is then subjected to statistical analysis using ANOVA and Tukeys multiple post-hoc.

RESULTS
58.33 percent of the patients were females. Mean Collum angle among patients of group 1, group 2 and group 3 was 6.25, 12.11 and 5.36 respectively. Collum angle of the patients with class II division 2 is more than that of other malocclusion types.

TABLE 1: Gender-wise distribution of patients

Gender	Number	Percentage
Male	25	41.67
Female	35	58.33
Total	60	100

TABLE 2: Means of collum angle in various malocclusions

Dental malocclusion	Mean	SD
Group-1-Class II Div 1	6.25	5.11
Group-2 -Class II Div 2	12.11	6.36
Group-3-Class III	5.36	5.12
Total	6.45	5.42
F-value	11.862	
p-value	0.0000*	
Pair wise comparison by Tukeys multiple post hoc procedures		
Class II Div 1 vs Class II Div 2	P=0.0000*	
Class II Div 1 vs Class III	P=0.7582	
Class II Div 2 vs Class III	P=0.0000*	

DISCUSSION
Adequate labial or lingual inclination of anterior teeth is important to establish the ideal anterior occlusal relationship and satisfying esthetic effect in orthodontics. However, orthodontists cannot always achieve the expected extent of tooth movement in alveolar bone. Researchers paid plenty of attention to the alveolar height and thickness in the past two decades, while the tooth morphological variation was frequently ignored. In 1984, Bryant firstly analyzed the variability in the permanent incisor morphology by establishing three anatomic features and investigated the discrepancy among different malocclusions, two of which adopted by the following studies. One feature was the crown-root angulation (Collum angle, CA) in a labiolingual direction, which was formed by the long axis of crown and root and might limit the degree to which the roots of incisor could be torqued lingually for relating to the lingual cortical plate of bone. Later, several recent studies suggested that the CA caused abnormal stress distribution of periodontal ligament when tooth movement. Moreover, researchers found the mean value of CA for Angle Class II division 2 malocclusion was significantly larger than Class II division 1 and Class III malocclusions.[6-9] The aim of this study was therefore to determine the collum angle of the maxillary central incisors in western Nepali population with different types of malocclusions using lateral cephalogram.

The results of the present study indicate that there is a wide variation in the shapes and forms of maxillary central incisors within the general population. Although these variations have been noted by orthodontists, there have been relatively few comprehensive studies to quantify them. 58.33 percent of the patients were females. Mean Collum angle among patients of group 1, group 2 and group 3 was 6.25, 12.11 and 5.36 respectively. Collum angle of the patients with class II division 2 is more than

that of other malocclusion types. Bhadrinath Srinivasan et al measured the magnitude of the collum angle (crown-root angulation) of maxillary central incisors present in Class II, division 2 malocclusion and to relate the changes in its magnitude with variations in the lower lip line. A set of 120 conventional lateral cephalograms were selected and divided into three groups of 40 each based on the type of malocclusion presented: Class II, division 2 (group 1); Class II, division 1 (group 2); and Class I (group 3). The collum angle of the maxillary central incisor was measured, and the lower lip line was recorded. Analysis of variance (ANOVA) revealed that the mean collum angle was statistically significantly different in the three groups. The mean collum angle was greatest in Class II, division 2 malocclusion (group 1). The mean collum angles were 3.24 ± 4.69 degrees, 0.95 ± 1.06 degrees, and 1.05 ± 1.50 degrees in groups 1, 2, and 3 respectively. In χ^2 test comparison of the location of the lower lip line (incisal, middle, or apical third of the central incisor) among the three groups, the lower lip line was found to contact the middle third of the central incisor most frequently in Class II, division 2 malocclusion. ANOVA followed by Tukey honestly significant difference (HSD) test showed that the mean collum angle is significantly increased when the lower lip is in the middle third ($P < .05$) of the central incisor. Variations in magnitude of the collum angle with the change in the lower lip line suggest a probable etiologic role of the lower lip line in the development of the collum angle.[10] Based on the cephalometric study done to assess the collum angle in various malocclusions showed that the collum angle between the crown axis and root axis in maxillary central incisors, the class-II division-2 malocclusion group showed a significantly greater collum angle as compared to the other malocclusions.

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