COMPARISON OF COLLUM ANGLE OF MAXILLARY CENTRAL INCISORS IN CLASS II DIV 1 & 2 MALOCCLUSIONS

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ABSTRACT

The Collum angle or the cephalometric crown-root angulation of permanent maxillary central incisors is an angle formed between the long axes of the crown and root of upper central incisors. This study aimed to evaluate the Collum angle in patients with Class II division 1 and 2 malocclusions for identifying the nature of differences, if any. Out of a total of 565 lateral cephalograms available at Lahore Medical and Dental College Orthodontic department during 2013-2014, 60 satisfied the inclusion criteria and 30 each were selected for the two malocclusion groups. The Collum angle of the permanent maxillary central incisors differ significantly among Class II division 1 and 2 permanent maxillary central incisor and showed pronounced axial bending in division 2 incisors (10.03° ± 4.37°) as compared to division 1 (3.65° ± 3.79°). The mean difference between both groups was 6.38° + 5.81°. This feature could possibly contribute to the development of a deep overbite in Class II division 2 malocclusion and also may limit the amount of root torque during fixed appliance therapy.

Key Words: Collum Angle, Crown-root angle, maxillary central incisors, Angle's Class II division 1, Angle's Class II division 2.

INTRODUCTION

The improvement in facial aesthetics is one of the most important motivating factors for patients to seek orthodontic treatment.[1] Smile plays a critical role in dental aesthetics and social behaviour.[2] Smiling aesthetics, especially frontal smiling aesthetics, have been frequently studied in dental literature[3] and thus formed the basis of this study.

The maxillary central incisor's distinct morphology is a key factor in achieving an aesthetic, functional, and stable Class I incisor relationship with orthodontic treatment.[4] Maxillary incisors anteroposterior position is also a key component of smiling profile.[5]

Normal Collum angle incisor plays important role in development of dentition and occlusion. Collum angle of single rooted teeth is of particular interest to orthodontists as any variation in root angulations lends to unpredictable axial force application in movements such as intrusion and extrusion. This may also cause roots to violate labial/lingual cortical boundaries when being repositioned.[22]

The morphology of the permanent maxillary central incisors has been investigated in different malocclusion groups.[8-13] The Collum angle has been investigated most frequently using lateral cephalometric radiographs.[4,8,10-13] Although recently CT[14] and CBCT[15,16] are also being used to evaluate this angle thoroughly but, cephalometrics is still considered quite satisfactory.

The aim of this study was to determine whether the lateral cephalometric crown root angulation differs among the permanent maxillary central incisors in Class II division 1 and 2 malocclusions in a representative population sample presenting at Orthodontic department, Lahore Medical & Dental College, Lahore. The null hypothesis tested was that there was no difference in the root angulation of the permanent maxillary central incisor among Class II division 1 and 2 malocclusion groups in the study sample, when assessed using the lateral cephalogram.

METHODOLOGY

This was a cross sectional observational study, conducted in the department of Orthodontics at Lahore medical and dental college, Lahore. The study included lateral cephalometric radiographs from 60 female patients.

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TABLE 1: DESCRIPTIVE STATISTICS OF COLLUM ANGLE IN DIFFERENT MALOCCLUSION TYPES

Malocclusion Type	Sample Number	Mean+ SD	Minimum	Maximum	Std Error Mean
Class II/2	30	10.03 + 4.37	4.00	21.00	0.79
Class II/1	30	3.65 + 3.79	0.00	15.00	0.69

TABLE 2: COMPARISON OF COLLUM ANGLE BETWEEN CLASS II DIV 2 & 1

Comparison	Mean Difference	Standard Deviation	Standard Error Mean	Significance	P-Value	95% Confidence Interval of the Difference	
						Lower	Upper
Class II div 2 Class II div 1	6.38	5.81	1.06	0.955	<0.001	4.21	8.21

Based on lateral cephalograms and dental casts (for dental classification), the patients were categorized into two equal-sized groups, Class II division 1 and 2 malocclusion groups. In order to clearly measure the Collum angle of maxillary central incisors, all patients with mixed dentition/supernumerary teeth, hypodontia, subdivision malocclusions, prostheses (post, dental implants, and fixed partial dentures), Orofacial clefting/craniofacial syndromes, poor incisor definition due to superimposed teeth, incisor rotations, or inferior image quality were excluded from study group.

After sketching the maxillary central incisor type from the lateral cephalometric radiographs, the superius point of the incisal edge was joined with the middle point of the cementoenamel junction to depict the crown axis, and the middle point of the cementoenamel junction was joined with the root apex to depict the longitudinal axis. The Collum angle was then measured, as shown in Fig 1.

STATISTICAL ANALYSIS

Data were analyzed using SPSS version 16.0 for Windows (SPSS, Inc; Chicago, Illinois). Mean and standard deviation were calculated for numerical variable. Student t-test was used to compare between Class II Div 1 and Div 2 Collum angle.

RESULTS

Both Class II division 1 and 2 groups had a sample size of 30 subjects each. The ages ranged from 13 to 32 years, and the average age was 19 years. The average value for Collum angle in Class II division 1 sample was 3.65° ± 3.79° with minimum being O° and maximum 15°. The average values for Class II division 2 was 10.03° ± 4.37° with minimum 4° and a maximum 21° (Table 1).

Paired samples t-test comparison showed that the Collum angle for maxillary central incisor for patients with Class II division 2 malocclusion was significantly
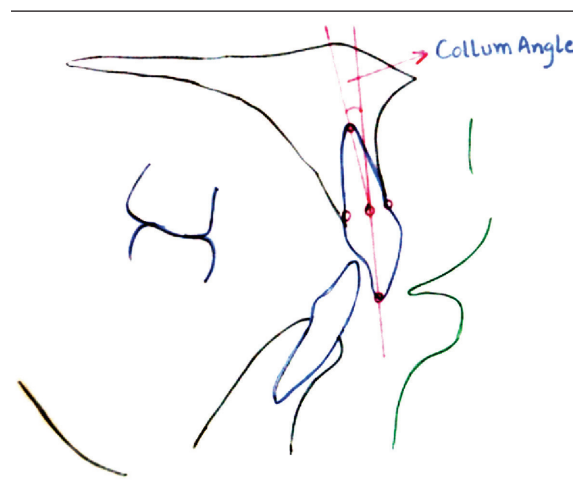

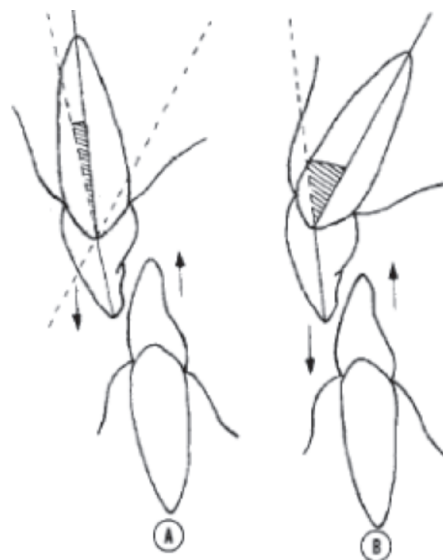Fig 1: Schematic representation of measurement of the Collum Angle

Fig 2: Class II Div 2 central incisor in straight position (a). Class II Div 2 central incisor with a very large Collum Angle (b)

higher than Class II division 1, mean difference being 6.38° ± 5.81°.(Table 2)

DISCUSSION

With the advent of cone beam computed tomography (CBCT), similar studies could be conducted for every tooth using analogous measurements. While it would be impractical to describe these landmarks and angles for every clinical case, establishing mean values for normal occlusion samples and malocclusion samples would allow the creation of a more accurately torqued straight wire appliance, customizable even to the patient's individual occlusal needs. In addition, it would be useful to describe the plane of the anterior palatal cortex and correlate it with the initial incisor torque. The amount of torque applied during treatment to achieve dental compensation should be taken into account. The cephalometric techniques proposed in this study could also be applied to a Class I & III samples.[23]

Andrews' preadjusted straight wire concept was based on his six keys of ideal occlusion.[5,6] Correct crown inclination was the third key and the Collum angle was assumed to be zero for each tooth.[5] This assumption of Andrews has been perpetuated in cephalometric tracing templates ever since. The limitations of the straight-wire appliance become apparent, however, when one considers the variations inherent in natural crown forms, as well as the variations of root position in relation to the clinical crown (Fig 2). While the former may be readily visualized and compensated for by alterations in wire or bracket position, the latter is typically not addressed routinely in clinical practice.

Numerous reasons explain the formation of the Collum angle. Backlund17 proposed that the reason may be that the force of the lower lip influences growth of the maxillary central incisors, causing the phenomenon of bending, leading to formation of the Collum angle. Other scholars have indicated that heredity is also a primary cause of maxillary central incisor bending.[18]

Class II is the most prevalent malocclusion in Pakistani patients.[19] The crown-root angles of maxillary incisors in class II division 2 malocclusions are significantly different from the other groups of malocclusions.[20] These differences can be seen as shorter roots, larger crowns, greater axial curvatures, and reduced labiopalatal thickness. It is a possibility that these severely retracted incisors with abnormal crown-root angles may complicate orthodontic treatments.

Significance of Collum angle from orthodontic point of view has been studied in various research publications.[11,21-24] The effect of various kinds of orthodontic forces and lip pressure has been studied on Collum angle. Heravi[21] et al concluded that maxillary central incisor's periodontal ligament experiences more stress during retraction when the Collum angle is large and vice versa. They also found that the intrusion forces experienced by teeth with large Collum angle are lower as compared to ones with smaller Collum angle.

Williams[11] and co-workers traced the maxillary central incisors of different malocclusions and found that the crown-root angles significantly differs between class II division 2 and 1 malocclusions. Bauer[22] et al compared Collum angle of class I with Class II division 2 samples and showed a statistically significant greater Collum Angle in class II division 2 patients (1.78° VS 4.29°).

Shen[23] et al compared Collum angle of different malocclusion types and concluded that the Collum angle in patients with Class II division 2 malocclusion was the greatest and inferred that this may be due to the influence of differences in hereditary genes between Western and Oriental races. Bone development in Oriental races tends towards bimaxillary protrusion; therefore, Oriental races have greater tooth axis bending compensating for bony protrusion.

Srinivasan[24] et al stated the average value of the Collum angle was 5.3°± 4.2° for Class II division 1 malocclusion and 10.6° ± 4.4° for Class II division 2 malocclusion and found that the variations in magnitude of the Collum angle is probably due to change in the position of lower lip line in various malocclusions. The results of present study were also in accordance with these values, suggesting that there is probably an ethnic and racial predisposition to Collum angle. The average value for Collum angle in Class II division 1 sample being 3.65° ± 3.79° and for Class II division 2 was 10.03° ± 4.37° respectively.

CONCLUSION

This study concluded:

1   The mean Collum Angle in Class II division 1 malocclusions is statistically different from zero degrees unlike assumed by Andrews.

2   Patients with Class II division 2 malocclusion exhibit statistically higher mean Collum angle values than patients with Class II division 1 malocclusion.

3   This feature could possibly contribute to the development of a deep overbite in Class II division 2 malocclusion but also may limit the amount of palatal root torque during fixed appliance therapy.

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