Prediction and incidence of unfavourably angulated canines using Orthopantomograms

G. Vivek Reddy[1,*], Y. Sri. Harsha[2], Swaroopa Rani Ponnada[3], Yudhister Palla[4], K. Bhagyalakshmi[5]

[1,3,5]Reader, [2]Assitant Professor, [4]Professor, Dept. of Orthodontics, [1,2]Narayana Dental College, [3]Army Dental College, [4]Mallareddy Dental College, [5]CKS Teja Dental College

***Corresponding Author:**
Email: gv07375@gmail.com

Abstract

Introduction: This study was designed to find the incidence of unfavorably angulated canines using angular measurements on orthopantomograms described by war ford et al and extended it even to mandible.

Methods: Sample of100 subjects with in the age group of 18 -25 years were selected and divided into two groups based on severity of crowding, of which one group was taken as control and the other group with severe crowding was taken as the study group . Study models and orthopantomograms were taken for all the subjects.

Results: Normal range of canine angulation in controls is from 85-95˚, minimum angulation of 67˚ and maximum of 105˚ were found in crowding cases.

Conclusion: Orthopantomograms can be used for predicting the canine angulation, the incidence of distally angulated canines were about 18% and mesially angulated canines were 37%.

Keywords: Unfavorably Angulated Canines, Orthopantomograms.

Introduction

The significance of appropriate mesiodistal angulations of the teeth in orthodonticallytreated patients has been highlighted by many clinicians.[1-4] Inclination and angulation of teeth has a major role since the introduction of edgewise appliance by Angle[1] where bends were used in the archwires were used to correct them.

Axial inclination of the teeth, especially maxillary anteriors which have the longest crowns play a major role in attaining normal occlusion. Furthermore, the degree of incisor and canine tip determines the amount of mesiodistal space they consume and, therefore, has a considerable effect on posterior occlusion and anterior esthetics.[1]

Although orthodontists realized the advantage of angulating brackets, but no specific prescription was available regarding the appropriate amount of angulation for each tooth.[5] This lead to design individual brackets for each type of tooth and reduced the strain in making arch wires with bends.

In search of determining the goals of treatment Andrew's has introduced "The Six Keys to Normal Occlusion," which described six common characteristics of 120 models of optimal natural occlusion.[1] In our study, the second key of normal occlusion i.e., the crown angulation, mainly canine angulation is considered.

Biomechanically Canine retraction plays an important role in orthodontic treatment. The canine which is the corner stone of dental arch needs to be placed in a stable position to attain functional occlusion. Bishara reported that incidence of maxillary canine impactions ranges between 1% and 3% of patients.[6]

Orthopantamograms give necessary information that should not be neglected. Since they are taken as essential diagnostic aids; they serve as primary tool for detecting ectopically erupting canines.[7]

Sector and linear measurements proposed by WARFORD et al are used for assessment of impaction of canines for measuring the angulations of canines and the study was done only on maxillary canines. But the need to know about the disto-angular or unfavorably angulated canines is necessary as unfavorably angulated canines can be detrimental in creating problems during leveling and aligning phase, thus there is need to study the prevalence of distoangular canines in crowding cases.

Materials and Method

100 male subjects with age group of 18-25 were randomly selected from our department; the sample was categorized into 2 groups based on the amount of anterior crowding, which was estimated by using dental VTO based on Mclaughlin and John C. Bennett method. Ethical committee clearance was obtained and informed consent was taken from the subjects. The patients were selected according to following criteria,

Crowding cases: Patients without history of previous orthodontic treatment, dental VTO greater than 5 mm both on maxilla and mandible, Patients without missing teeth.

Non crowding cases: Patients without history of previous orthodontic treatment, dental VTO less than 2mm both in maxilla and mandible.

Study models and orthopantomograms were obtained from all the subjects, study models were obtained to know the space requirement and amount of crowding and orthopantomograms were obtained for assessing the angulation of canines both in maxilla and mandible, orthopantomograms were traced and on the tracings a bicondylar axis line is drawn and long axis of maxillary canines were plotted as given by warford et al,[7] the bicondylar axis line is transferred to the lower border of mandible with the help of vertical lines, long axis of mandibular canines were drawn on to this line, a vertical line through midline is drawn, and all canine angulations were measured as shown in Fig. 1

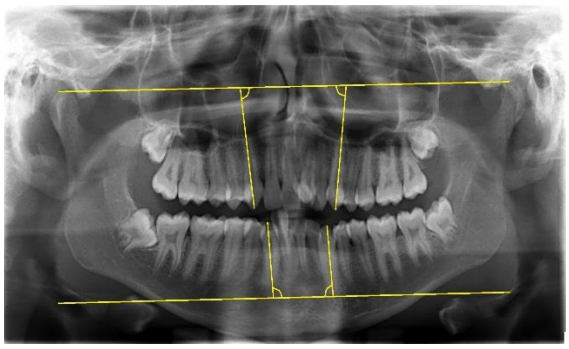

Fig. 1: Method of the study: a) Showing a bicondylar axis line, b) Transferred bicondylar line to mandible, c) Long axis of canine line extending horizontal lines, d) Mesial angle considered

Statistical Analysis: The data was analyzed using Statistical Package for Social Science (SPSS) version 15.0., The p value was taken significant when less than 0.05., The proportion was calculated by using chi square test, mean and standard deviation were calculated by using student t-test and significant value of canine angulations between the four arches were drawn by logistic regression analysis.

The distribution curve was normal for canine angulations in both the groups (p> 0.05) in 50% of the cases. The minimum value of angulation is 80 and maximum of 105 in controls as shown in Table 1, and the minimum angulation of 67 and maximum of 105 in crowding cases as shown in Table 2, there is a significant decrease in canine angulation both in crowding and non-crowding cases as shown in Tables 4 and 5.

If the angle is more than 95 the canine is tipped distally, if the angle is less than 85 the canine is said to be tipped messily, the prevalence of mesioangular canines is more.

Table 1: Canine angulations among controls

Arch	N	Range	Mini-mum	Maxi-mum
Mandibular left	50	20	80	100
Mandibular right	50	20	80	100
Maxillary left	50	25	80	105
Maxillary right	50	25	80	105

Table 2: Canine angulations among cases

Arch	N	Range	Mini-mum	Maxi-mum
Mandibular left	50	35	67	102
Mandibular right	50	40	65	105
maxillary left	50	29	71	100
Maxillary right	50	15	83	98

Results

Table 3: Mean and standard deviation of canine angulation among study population

Canine Angulation	Groups	N	Mean	Std. Deviation	t- value	P Value
Mandibular left	cases	50	87.96	6.919	-0.314	0.002
	controls	50	88.32	4.216		
Mandibular right	cases	50	86.50	7.854	-1.874	0.000
	controls	50	88.82	3.863		
maxillary left	cases	50	89.24	5.794	0.707	0.068
	controls	50	88.50	4.604		
Maxillary right	cases	50	89.20	3.753	-0.808	0.865
	controls	50	89.84	4.157		

Table 4: Proportion of mandibular canine angulations among study population

Canine angulation	Mandibular left canine		Mandibular right canine	
	cases	controls	cases	controls
Angulation < 85	16 (32.0%)	12 (24.0%)	22 (44.0%)*	7 (14.0%)
Angulation 85 to 95	25 (50.0%)	34 (68.0%)	25 (50.0%)	41 (82.0%)*
Angulation > 95	9 (18.0%)	4 (8.0%)	3 (6.0%)	2 (4.0%)
Total	50 (100.0%)	50 (100.0%)	50 (100.0%)	50 (100.0%)

*p< 0.05 significant

Table 5: Proportion of maxillary canine angulations among study population

Canine angulation	Maxillary left canine		Maxillary right canine	
	Cases	Controls	Cases	Controls
Angulation < 85	12 (24.0%)	12 (24.0%)	11 (22.0%)	5 (10.0%)
Angulation 85 to 95	32 (64.0%)	35 (70.0%)	36 (72.0%)	42 (84.0%)
Angulation > 95	6 (12.0%)	3 (6.0%)	3 (6.0%)	3 (6.0%)
Total	50 (100.0%)	50 (100.0%)	50 (100.0%)	50 (100.0%)

Table 6: Logistic regression analysis of canine angulations among study polulation

Arch	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Mandibular left	-0.062	0.080	-0.077	-0.772	0.442
Mandibular right	0.257	0.093	0.273	2.768	0.007*
Maxillary left	-0.096	0.094	-0.106	-1.021	0.310
Maxillary right	0.188	0.113	0.172	1.667	0.099

*p< 0.05 significant

Discussion

The primary aim of this study was focused on the differences in angulation of permanent canines among subjects with crowding and non-crowding teeth. Andrews has used study models to measure the angulations of teeth.[1] Lucyana Ramos Azevedo et al[8] used digital photographs of study models to study angulation of canine in class I and class II cases and some relied on measurements taken from models, as they considered it as a direct method.

To localize the position of the unerupted permanent canines, various radiographs are in use.[9] To localize the position in the mesio-distal and superoinferior direction, IOPA's can be used and to determine buccolingual position tube shift technique (two periapical radiographs taken from two different angulations), Occlusal vertex and modified occiptomental views are in use.

Panoramic radiographs are essentially used in orthodontic practice to diagnose axial inclinations of teeth, maturation periods, and pathologies of surrounding tissues.[10] However, similar to other radiographic methods, there is a possibility of magnification error in panoramic radiographs.[10-14] Larheim and Svanaes[14] emphasized that horizontal measurements were unreliable and there will be not much variation in the angularmeasurements, such as axial tooth inclinations.[13,14] Panoramic radiographs can accurately measure mesiodistal tooth inclinations.[3,12-14]

warford et al[7] used orthopantomograms for estimating the angulation of impacted maxillary canines, in our study we used orthopantomograms to measure the angulation of canines by modified warford method and extending it to both maxillary and mandibular canines.

Canines being corner stones of dental arches they need to be positioned in stable point to attain functional occlusion.

It is always desirable to distalizecanine bodily instead of tipping it distally ordistopalatally. The long rootand greater buccolingual dimensions of canine make the movement challenging.[5]

The unfavorably angulated canine should be dealt more cautiously where up righting of root and distal movement of canine should occur simultaneously, by estimating the angulation of the canine before treatment, better planning of mechanics can be done for retracting the canine.

Conclusions

1. There is a statistically significant difference in the angulation of permanent canines between crowding and non-crowding cases,
2. Mesially angulated canines are more prevalent compared to distally angulated canines,
3. Normal range of canine angulation is in the range of 85-95˚

4. By using Orthopantomograms angulation of canines can be measured both in maxilla and mandible to estimate the root position.

Clinical Significance of the Study- If a continuous wire is engaged in extraction cases with distoangular canines there may be a chance of deepening of the bite and further tipping the distally angulated canine more distally without correcting the angulation of the root, there may be more chances of relapse if space closure is done without correction of unfavorably angulated root ,thus there is a need to consider the correction of distally angulated canines as a pre-leveling and alignment procedure and necessary steps can be taken if we can know the amount of angulation exactly.

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