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Comparative study on the angulation of mandibular canines due to dentoalveolar compensation as assessed on an orthopantomogram

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Abstract

Introduction: This study was carried out to determine and compare the mesio-distal angulation of mandibular canine crowns in individuals with skeletal and dental Class I, Class II and Class III malocclusions.

Material and Methods: A total of 120 patients were chosen as a sample with 70 females and 50 males. Lateral cephalograms and clinical pictures of patients were used to classify them into three groups i.e. Class I, Class II and Class III malocclusion groups. Orthopantomograms (OPG) were used to measure right and left mandibular canine angulations. The data was then analyzed using SPSS version 16.0. The inclusion criteria comprised of patients with complete permanent dentition, no previous orthodontic treatment and the same skeletal and dental malocclusion.

Results: "One Way Analysis" showed mean canine angulation for Class I as 70.938, for Class II as 69.600 and for Class III as 69.725. Significance level comparison between the three groups, made via Tukey HSD test, was set at $P \leq 0.05$. Significance level between Class I and II was 0.657, between Class I and III, 0.708 and between Class II and III, 0.996. These values stood insignificant. ANOVA test was applied to assess the overall significance level of the study, which showed insignificance as well.

Conclusions: Results of our study showed insignificant comparisons among mandibular canine angulations for all three groups of malocclusion.

Keywords: Mesio-distal angulation; canine; dentoalveolar compensation; occlusion; tip; torque

Introduction

Dentoalveolar compensation is a physiological process which is observed in various skeletal dysplasias. It helps to direct eruption and position of the teeth in relation to their respective alveolar bone, in order to establish a normal relationship between the upper and lower dental arches even in the case of any skeletal disharmony. In the field of Orthodontics, Andrews Six keys of occlusion have been used to study the correct inclination and angulation of teeth, throughout history.[1]

In the straight wire technique and contemporary appliances, the brackets have compensations incorporated in terms of bucco-lingual inclinations (torque) and mesio-distal angulations (tip). These compensations help in treating different skeletal dysplasias non surgically using comprehensive orthodontic treatment. For treating such patients, determining their pretreatment canine angulations is imperative in order to incorporate additional tip and torque in the brackets and wire which shall help in creating a post treatment ideal occlusion.[2]

Our study aims to evaluate the mesio-distal angulation of canines, which occurs as a result of dento-alveolar compensation in

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patients with permanent dentition having either skeletal or dental malocclusions. Previous studies have been carried out using digital images of dental casts pertaining to Class I and Class III malocclusions.[3,6] Prior to this, no research has been conducted on the proposed topic using Orthopantomograms (OPG) as a means to evaluate canine angulation, which may serve as a convenient method while carrying out future studies.

Material and Methods

In this study, a sample size of 120 was chosen and the patients were selected from the Orthodontics Department of Islamic International Dental College and Hospital. 70 females and 50 males were a part of the study. The sample was divided into three groups of 40, each pertaining to Class I, II and III skeletal and dental malocclusion

The skeletal malocclusion was established using the Lateral Cephalograms of each patient, whereas the dental malocclusion was determined using clinical pictures.

Inclusion criteria

- Patients age 11 and above
- Patients having permanent dentition with fully erupted mandibular canines.
- Patients with clear Orthopantomograms, lateral cephalograms and clinical pictures.
- Patients with similar skeletal and dental malocclusion.
- No history of previous orthodontic treatment.

Exclusion criteria

- Missing Mandibular first molars.
- Primary or mixed dentition.
- Impacted canines
- Unclear OPG where canine root was not properly visible.
- Presence of any syndrome.
- Absence of any of the above mentioned records.

The comparative analysis of canine angulations was specified to the mandibular arch only. The angulations were measured on both the right and left sides of the jaw by using an individual's OPG. This was done by first drawing a mandibular plane along the lower border of the mandible from the anatomical reference points Gonion to Menton. Next, a line was drawn along the long axis of the canine from the tip of crown to the apex of the root. The inner angle between the two lines was measured using a protractor. Same procedure was repeated on the contralateral side. After calculating the angles on each side, average value was calculated for each patient and documented. Same procedure was repeated for every patient included in the study.

Statistical Analysis:

The data was analyzed using SPSS version 16.0, "One Way Analysis", "Post Hoc", "Tukey HSD" and "ANOVA" tests.

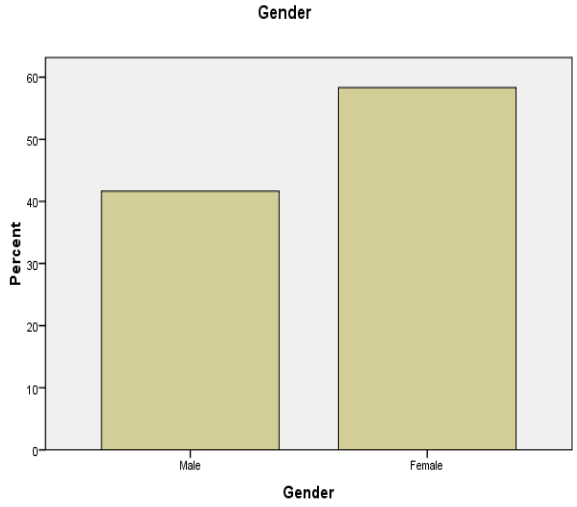
Results

There were 70 females (58.3%) and 50 males (41.7%) in our study (Table I). The minimum age was 10.6 years while the maximum age was calculated to be 38.0 years, the mean age was 18.445 with a standard deviation of 0.495 (Table II).

One way Analysis was used to calculate mean difference of canine angulations for each malocclusion group. The mean canine angulation for Class I group was calculated to be 70.938, for class II, 69.600 and for class III, 69.725 (Table III). Multiple comparisons among the three groups was carried out. The significance levels between the three groups were calculated using the Tukey HSD test. The significance level was set at $P \leq 0.05$. Significance level between Class I and Class II was calculated to be 0.657 which is insignificant while the significance level for class I and III was 0.708, also

insignificant. Moreover the significance levels between Class II and Class III came out to be 0.996 which proved to be insignificant as well. To calculate the overall significance level the ANOVA test was applied. A value of 0.628, was calculated which is also insignificant.

Our study showed insignificant results, among the mandibular canine mesio-distal angulations, due to dento alveolar compensation for all three groups of malocclusion.



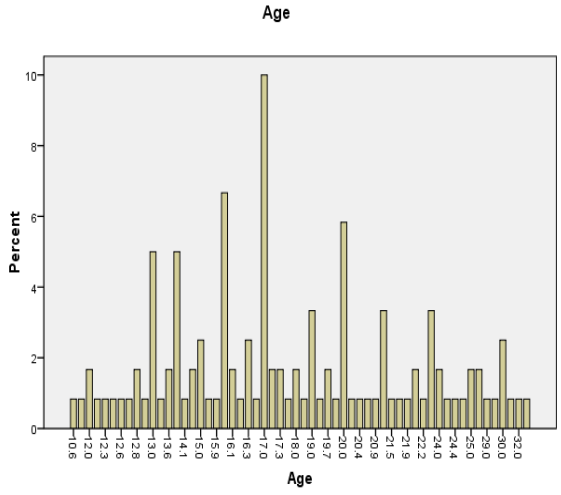


Table I. Mean Canine Angulation for each group

	N	Mean Canine Angulation	Std. Deviation
Class I	40	70.938	6.3571
Class II	40	69.600	7.6520
Class III	40	69.725	6.4181
Total	120	70.088	6.8045

Table II. Level of significance among groups

Class of Malocclusion	Level of Significance
Class I & Class II	p = 0.657
Class I & Class III	p = 0.708
Class II & Class III	p = 0.996

Discussion

The primary aim of our study was to examine whether there were significant differences in the angulation of permanent mandibular canines due to dentoalveolar compensation, among individuals with Class I, Class II and Class III malocclusions, using an Orthopantomogram. In 1991 Happonen RP et. al. suggested the use of orthopantomography for visualization of the structures of the jaws in a single radiograph. Hearting et. al. indicated that panoramic dental radiography is the only "truly reliable identification card" in order to carry out comparison in odontology.[4]

A study was carried out using digital photographs of plaster models which were then transferred to an imaging program (ImageTool®) to compare the canine angulations between individuals having Class I and Class III malocclusion.[3] On the other hand, this study focuses on the use of an OPG as a simple method to measure mesio-distal canine angulations, among individuals with skeletal and dental Class I, Class II and Class III malocclusions. OPG was chosen as an

effective tool, to determine whether there was a difference in the values for canine angulations measured using digital photographs and those values obtained using plane radiography. OPG of every patient can easily be saved on a database and retrieved whenever the need arises. Meanwhile dental casts are made once the patient comes to the dental clinic and the whole process is time consuming and laborious. If the dental cast is lost or breaks due to any reason, the patient has to be recalled to give another dental impression for a new dental cast.[5] ImageTool® was used to trace the long axis of the canine while the angulation was measured from the intersection of the occlusal plane and the long axis of the clinical crown. However in this study, the mandibular plane was used, which was drawn on the OPG from Gonion to Menton bilaterally. The long axis of the canine was drawn from the canine tip to the root apex. A protractor was used to measure the angle formed between the mandibular plane and the long axis of the canine. The clinical implication of using mandibular plane in this study was that, since teeth correlate with their respective skeletal bases, this plane of reference would prove to be more reliable than the occlusal plane. Furthermore, there can be occlusal plane variations in patients having maxillary and mandibular occlusal canting.

Since OPG and lateral cephalograms are routinely done around world for orthodontic cases, our method can be used to determine dentoalveolar compensations, unless circumstances are such that the use of radiographs is contraindicated due to radiation exposure.

One of the limitations of the present study was the fact that it was carried out in only one institute of Islamabad, whereas more hospitals in the vicinity should have been included to increase diversity of the sample. Moreover, further studies on the same topic should use Cone Beam Computed Tomography (CBCT), in order to obtain more accurate results.

Conclusions

OPG is not a suitable and reliable method to evaluate canine angulations. Advanced technology such as CBCT can be used for the same purpose. A drawback of using an Orthopantomogram is that there is a variation in the mandibular trough, especially in canine and premolar region. Therefore it is difficult to determine canine angulation on an OPG.

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