

Observational study on the angulation and the degree of overlap of the maxillary impacted canine



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Abstract

Introduction: The multitude of clinical forms of dental impaction has led to many classification attempts, thus having to use various classification criteria.

The aim of this study was to evaluate the quantitative and qualitative characteristics of the impacted permanent canines.

Material and methods: Parameters measured after Stivaros and Mandall made assessments regarding the canine's angulation to the mid-sagittal plane and the degree of overlap with the root of the adjacent incisor.

Results: The changes obtained regarding the used parameters used mainly noticed at female patients. The impaction of the canine has certain peculiarities depending on its location on the jaw, vestibular or oral, being identified most frequently in the second quadrant. Thus, regarding the presence of canine impaction on the two maxillaries, the frequency is higher in the upper arch.

Conclusions: Managing an impacted canine can be a complex interdisciplinary approach.

Keywords: canine inclusion, Stivaros and Mandall, canine angulation, overlap degree (or degree of overlap)

INTRODUCTION

Canine impaction is a common clinical problem among patients, and its treatment usually requires an interdisciplinary approach.

Surgical exposure of the affected tooth and the complex orthodontic mechanisms that are used to align the tooth on the arch can lead to various amounts of damage to the supporting structures of the tooth, not to mention the long duration of treatment and the financial costs for the patient. Therefore, it is useful to focus on the means of early diagnosis and interception of this clinical situation [1].

Tooth eruption is a complex process, so teeth may appear on the arch earlier, may erupt late or may not erupt at all. Impacted teeth are defined as teeth that remain completely embedded in the bone or mucosa more than 2 years after the physiological eruption. Although there are large variations of the impacted teeth among individuals, molar 3 remains the most common affected tooth, followed by maxillary canines.

There are incriminated several responsible factors for the higher prevalence of canine inclusion; for example, maxillary canines have comparatively longer roots and eruption pathways, grow deep into the jaw, and subsequently erupt into neighboring teeth [2].

There are several methods for diagnosing canine impaction, including: chronological age, clinical examination and radiographic examination. For a correct and accurate diagnosis it is necessary to perform a CBCT in order to present the general case, the location of the impacted canines, prognosis and the follow-up of the tooth eruption and results of the treatment [3]. The predictability of the treatment's success was mainly based on personal clinical experience. The presence of a universal system that provides an improved assessment of the degree of difficulty of correct alignment of the affected canine on the arch would be beneficial for both the patient and the clinician [4]. Pitt et al. have developed a "treatment difficulty index/parameter" for the impaction of maxillary canines. This index/parameter is based on age, midline angle, vertical position, vestibulo-oral position, horizontal position, degree of alignment of the upper incisors, canine space in the dental arch, degree of deviation of the interincisive line and canine rotation [5].

Aim and objectives

The purpose of this study was to evaluate the quantitative and qualitative characteristics of the impacted permanent canines, from a group of minor patients who presented in the Pedodontics Discipline of the Timișoara Municipal Emergency Clinical Hospital. The following were evaluated on orthopantomography: the canine's angulation with respect to the mid-sagittal plane and the degree of overlap with the root of the adjacent incisive.

MATERIAL AND METHODS

Through the observational, retrospective, non-interventional study, the incidence of permanent canines in minor-aged patients was evaluated.

The study was performed on a batch of 29 radiographs of patients, who presented for specialized treatment at the Municipal Emergency Clinical Hospital Timisoara, Pedodontics, between January 2018 - January 2019.

Exclusion criteria: patients over 18 years of age, patients with various genetic syndromes who have dental abnormalities of number / shape, respectively patients with erupting canines. Out of the total number of 29 radiographs, a number of 3 did not meet the inclusion criteria.

In the elaboration of the study, the database of the Discipline was used, according to the examinations performed on the orthopantomographs of the patients.

From the radiological paraclinical examinations of the respective patients, we selected a series of personal data, respectively the dental age of the patients and the sex. By protecting the identity of patients, the incidence of permanent canines was included and the classification of patients according to sex and dental age was established.

Parameters measured after Stivaros and Mandall made assessments regarding:

I. Canine angle to the mid-sagittal plane (Fig. 1)

First degree: 0-15°

Second degree: 16-30°

Third degree: over 30°

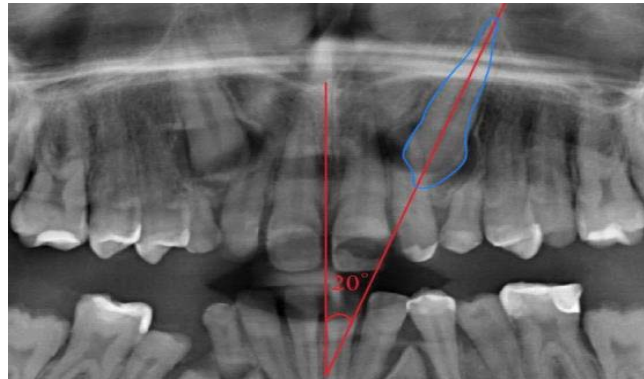


Figure 1. Canine angle to the mid-sagittal plane

II. Degree of overlap with the root of the adjacent incisor (Fig. 2)

First degree: there is no overlap

Second degree: overlap over less than half the width of the incisive

Third degree: overlap over more than half but does not fully cover

Fourth degree: complete overlap over the width of the incisive or even larger

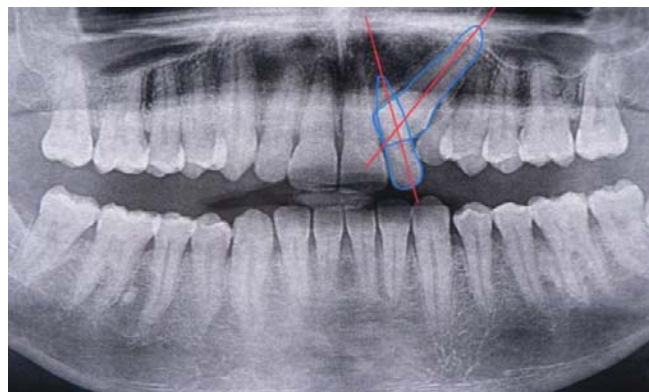


Figure 2. Degree of overlap with the root of the adjacent incisor

III. Canine angle to the mid-sagittal plane

Most frequently, patients have canines with first degree angulation compared to the mid-sagittal plane - 79% of cases, while grade II angulation was identified in 14% of the canines investigated. Only 7% of patients have canines with grade III angulation compared to the mid-sagittal plane (Fig. 3).

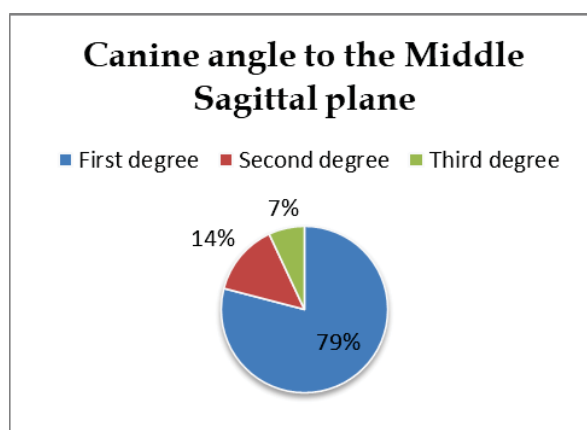


Figure 3. Data distribution of canine angle to the mid-sagittal plane

The gender comparison of the angulation of the canines in relation to the mid-sagittal plane and the degree of overlap of the canines included over the root of the corresponding lateral incisor, the obtained data revealed differences in all the registered parameters. According to the analyzed data, canines have more frequent accentuated angles (grade 2 and 3) in female patients. 68% of canine girls have an angulation of the grade I mid-sagittal plane, while 85% of male patients have a grade I angulation (Fig. 4).

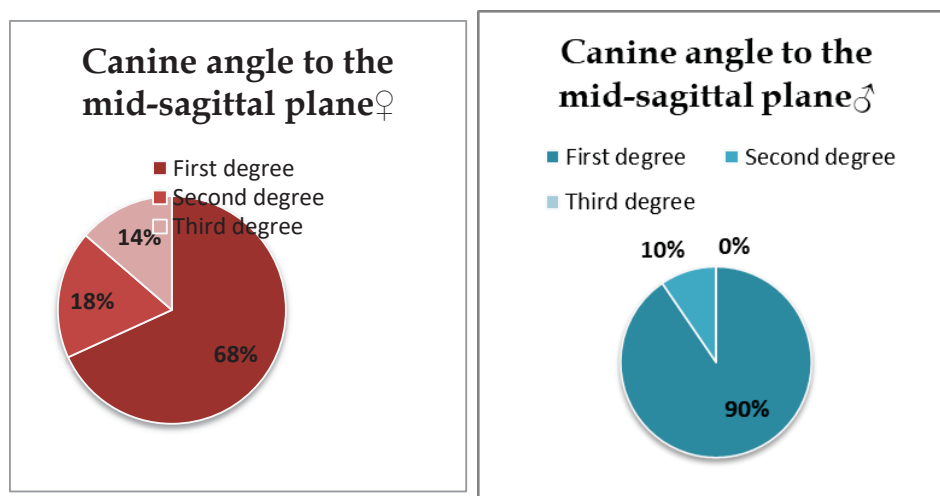


Figure 4. Gender data distribution of canine angle to the mid-sagittal plane

The comparison between quadrants 1 and 2 in terms of canine angulation to the mid-sagittal plane reveals significant differences. In quadrant 1, 76% of canines have grade I angulation and 24% - grade II. In quadrant II, grade I was found in 82% of cases, grade II - 16% and grade 3 - 12% (Fig. 5).

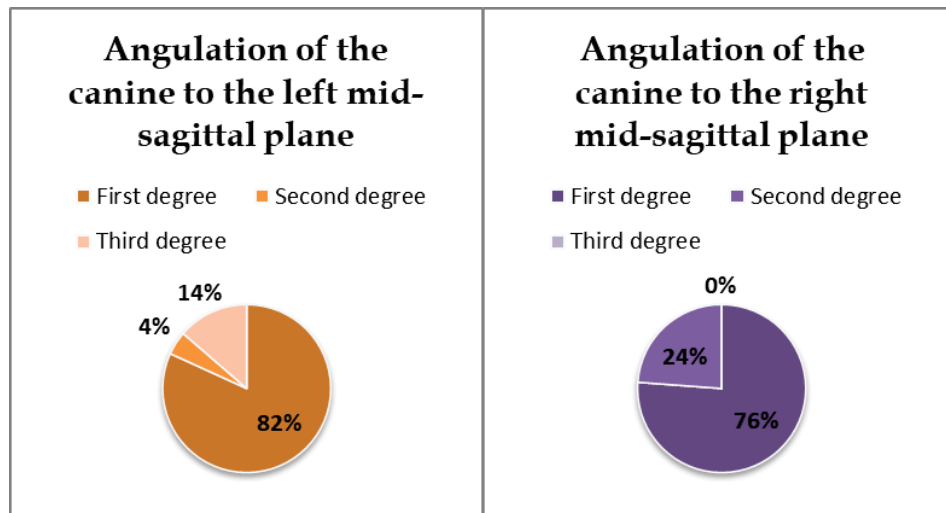


Figure 5. Data distribution of the angulation of the canine to the right and left mid-sagittal plane

IV. Degree of canine overlap with the root of the adjacent incisor

Regarding the degree of canine overlap over the root of the lateral incisor, 63% of all patients presented grade I, 21% - grade II, 9% - grade IV and 7% - grade III (Fig. 6).

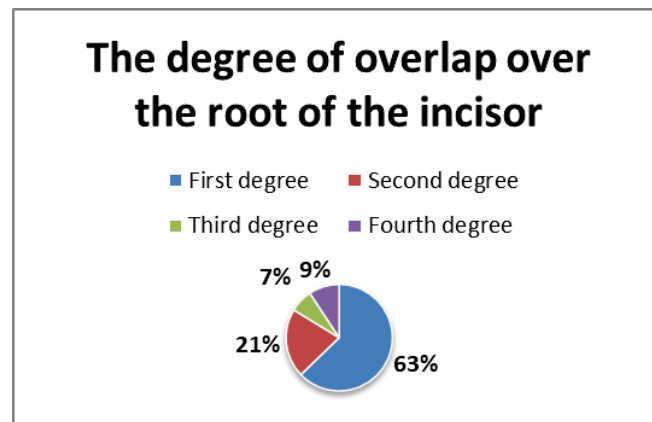


Figure 6. Data distribution of the degree of canine overlap over the root of the adjacent

According to the figures, the high degree of overlap of the canines over the lateral incisors is more common in female patients (14% - grade IV) than in male patients, in whom grade IV overlap was not identified, in addition, only 5% of the male patients showed grade III overlap. 86% of them have a low degree (degree I) of overlapping of the canine over the root of the lateral incisor. Only 41% of the female patients have grade I, 32% - grade II, 18% - grade IV and 9% - grade III (Fig. 7).

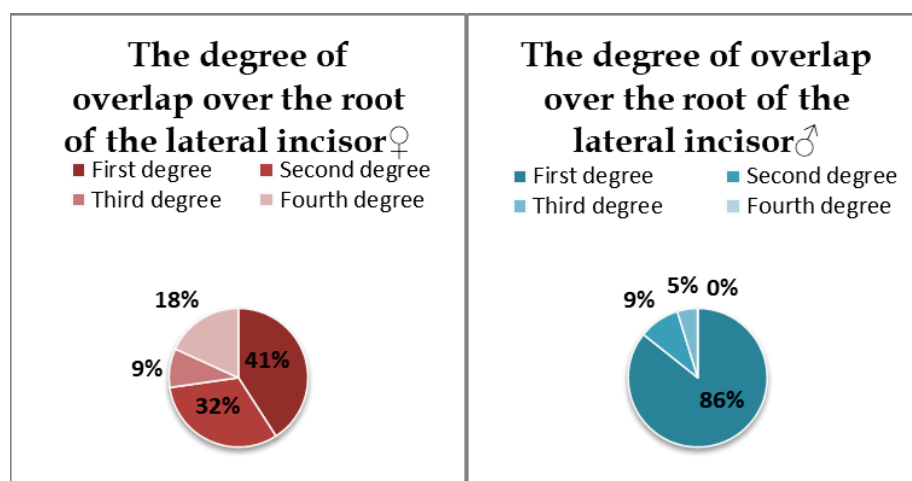


Figure 7. Gender data distribution of the degree of overlap over the root of the lateral incisor

According to the measurements, the degree of overlap of the canines over the root of the lateral incisor is higher in quadrant 2, compared to the first quadrant. On the right side, the most frequently observed was the first degree overlap, in descending order of frequency we identified grade II in 24% of cases analyzed on the right side, grade III and IV are represented by 5 percent each. At the level of quadrant 2, 59% of patients have grade I overlap, 18% - grade II, 14% - grade 4 and 9% grade III (Fig. 8).

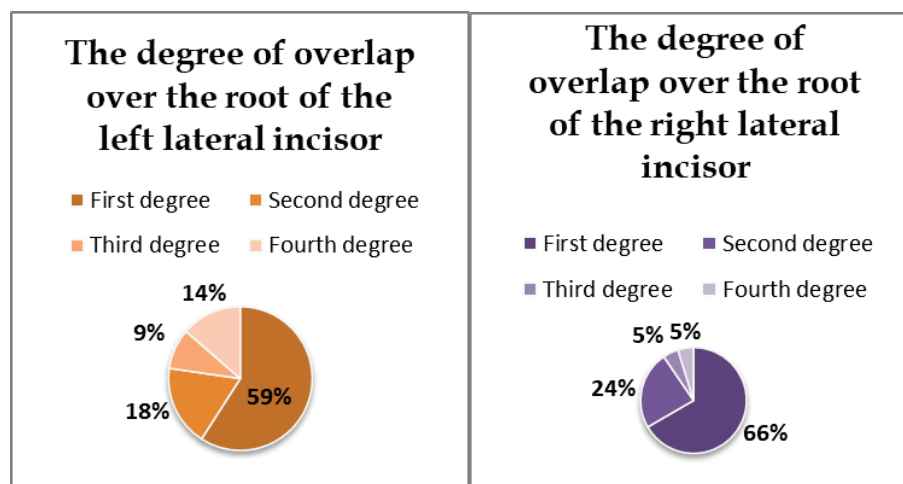


Figure 8. Data distribution of the degree of overlap over the root of the right and left lateral incisor

RESULTS

Regarding the canine impaction, while using the criteria of Stivaros and Mandall, compared to the mid-sagittal plane, a statistically significant difference was observed between the two sexes regarding the angulation of the canine of grade I, the male patients being affected in proportion of 85% compared to female ones, where values were recorded in proportion of 68%. In the case of females, a predisposition for grade II and III angle values was observed. In quadrant I, a higher frequency of the type I canine angulation was found (76%), followed by grade II (24%) and no grade III value was recorded; in comparison, in quadrant II there was a frequency of 82% for grade I, 14% for grade II and only 4% for grade III.

Regarding the degree of overlap of the canine over the root of the lateral incisor, the following sequence was identified: 63% - grade I, 21% - grade II, 9% - grade IV and 7% - grade

III. In the case of female patients, grade IV (14%) was more common compared to male patients where no case of this grade was identified. While in the case of male patients grade I was identified in 86% of cases, in females a percentage of only 41% was observed. Regarding the distribution by quadrants, there was a higher frequency of canine impaction in quadrant 2, the highest proportion being grade I in both quadrant 2 (59%) and quadrant 1 (66%). The lowest parameters in quadrant 1 were those of grade III (5%) and IV (5%), compared to quadrant 2 where 9% of cases were grade III.

DISCUSSIONS

To design a correct and effective treatment plan, the diagnosis of dental abnormalities is essential. Thus, knowing the ethnic differences is important in the dental routine, in order to avoid possible future complications.

In a study conducted for the Gizan population of Saudi Arabia, the following factors were taken into account: patient age, canine angle to midline, vertical position, bucolingual position, horizontal position, incisor alignment, canine space, upper and lower interincisive lines, rotation teeth included [6]. The angle of the canine towards the mid-sagittal line in male patients was mainly grade 3 (27%), as opposed to 6% in the case of our patients, and grade 1 was registered in a percentage of 4% compared to 85%. Regarding female patients, grade 3 was found most frequently (50%) and grade 1 the least (20%) compared to our results in which grade 1 was 68% and grade 3 was 14%. Regarding the degree of overlap of the canine over the root of the lateral incisor, in male patients, the majority have a higher degree of overlap (22%), in our country being dominant (86%) grade 1, without overlap. In the case of women, the high degree of overlap (36%) is very close to grade 1 (35%), unlike our results, in which the highest percentage (43%) is for grade 1 and grade 4 is present at 14% of patients. The results of this study showed that canine impaction was twice as common in female patients, while the index of difficulty in orthodontic treatment was higher in male.

According to the study by Maged-Sultan, Hanan-Ahmed and Abeer-Abdulkarem, the patient's age is an important factor in the treatment of forced eruption in childhood or adolescence, because with age, the impacted tooth may become ankylosed. But an increased angulation of the mid-sagittal line may indicate surgical treatment, not a forced eruption. [6].

According to a study by Sung-Hun et al., in which the position of the canine roots impacted on the panoramic radiographs was analyzed, 44.2% had a labial position and 38.5% palatal. Labial inclusion is often attributed to crowding, as opposed to palatal impaction, which can occur in their absence, so it is difficult to prevent the inclusion of canines in the developmental stage. However, an early diagnosis can prevent root resorption of neighboring teeth, cyst formation and pain [7]. If the apexes of the canine roots impacted palatally are oriented towards the first maxillary premolars, the canine crown will most likely be located mesially, towards the lateral incisor. If the apex is oriented towards the lateral incisor, it is likely to be impacted in the labial position [7].

In the study conducted by Bandar Alymi, Ramat Braimah and Saeed Alharieth, the prevalence and characteristics of the impacted canines were analyzed. 2000 panoramic radiographs were analyzed, of which 107 cases of canines were highlighted, resulting in a prevalence of 5.35%.

Amongst the patients with impacted canines, 38 were male, and the remaining 69 were female, with an M:F ratio of 1:1.8. The patients were between 15 and 75 years old. More affected were the maxillary canines (92.5%) than the mandibular ones (7.5%). The palatal position was discovered more frequently than the vestibular one [9].

According to the study by İlhan Metin Dağsuyu, Fatih Kahraman and Rıdvan Okşayan, who analyzed 140 canines impacted on CBCT in 102 patients, unilateral impaction was found in 64 subjects, while the remaining 38 had bilateral impaction and 14 canines

showed severe resorption. The lateral incisor was more frequently affected than the first premolar. Angulation of the midline in the impacted maxillary canines of the right hemiarcade was significantly higher than in the left hemiarcade ($p < 0.05$). [10].

CONCLUSIONS

This study on canine impaction, like most in the literature, shows results based on the 2D image. No significant differences were found between male and female patients. Grade 1 was recorded in both groups, in terms of canine angulation to the mid-sagittal plane and the degree of overlap of the canine over the root of the lateral incisor.

REFERENCES

1. Manne R, Gandikota C, Juvvadi SR, Rama HR, Anche S. Impacted canines: Etiology, diagnosis, and orthodontic management. *J Pharm Bioallied Sci.* 2012;4(Suppl 2):S234-S238. doi:10.4103/0975-7406.100216
2. Al-Zoubi H, Alharbi AA, Ferguson DJ, Zafar MS. Frequency of impacted teeth and categorization of impacted canines: A retrospective radiographic study using orthopantomograms. *Eur J Dent.* 2017;11(1):117-121. doi:10.4103/ejd.ejd_308_16
3. Chaushu S, Chaushu G, Becker A. The use of panoramic radiographs to localize displaced maxillary canines. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1999; 88:511-6.
4. Alhammadi, M., Asiri, H., & Almashraqi, A. (2018). Incidence, severity and orthodontic treatment difficulty index of impacted canines in Saudi population. *Journal of Clinical and Experimental Dentistry*, 0-0. doi:10.4317/jced.54385
5. Pitt S, Hamdan A, Rock P. A treatment difficulty index for unerupted maxillary canines. *Eur J Orthod.* 2006; 28:141-4.
6. Maged-Sultan Alhammadi, Hanan-Ahmed Asiri, Abeer-Abdulkarem Almashraqi. Incidence, severity and orthodontic treatment difficulty index of impacted canines in Saudi population. *J Clin Exp Dent.* 2018;
7. Sung-Hun Kim, Woo-Sung Son, Tetsutaro Yamaguchi, Koutaro Maki, Seong-Sik Kim, Soo-Byung Park, Yong-Il Kim. Assessment of the root apex position of impacted maxillary canines on panoramic films. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2017;
8. Ericson S, Kurol J. Resorption of incisors after ectopic eruption of maxillary canines: a CT study. *Angle Orthod* 2000.
9. Bandar Alymi, Ramat Braimah, Saeed Alhariet. Prevalence and pattern of impacted canines in Najran, South Western Saudi Arabian population. *The Saudi Dental Journal*, 2019.
10. İlhan Metin Dağsuyu, Fatih Kahraman, Rıdvan Okşayan, Three-dimensional evaluation of angular, linear, and resorption features of maxillary impacted canines on cone-beam computed tomography. *Oral Radiology* 2017