



M D J

Evaluation of Upper Canine Eruptive Course: A Radiographic study

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Abstract

Early detection of upper canine eruptive problems, give a better chance for the preventive steps to be taken. 328 maxillary canines in pre-emergence phase, were studied on the bases of (164) panoramic radiographic records of Iraqi children age 5-12 years (72 boys - 92 girls). Canine inclination (CI) (relative to a plane between the suborbital points), and its relation to the lateral incisor (CLR) were studied. The lateral incisor developmental stage (LID) was evaluated too.

Results showed that, in initial stages of (LID), the canine lateral incisor relation (CLR) is almost characterized by overlapping, a situation rarely seen in the final stages. Only 8-15% of the overlapping is found when the lateral incisor was completely developed (CO), detecting possible canine anomalies in this stage, especially when associated with other clinical signs as non-palpation of the cuspid bulge in the alveolar process. Then extraction of the primary canine is advised to prevent impaction.

Key words: Canine inclination. Canine eruption. Canine impaction.

Introduction

Early detection of maxillary canine eruptive disorder is of fundamental importance, for suitable preventive measures are to be adopted to prevent its impaction.¹

Functionally, the lack of canine guidance has negative consequences on T.M.J. dynamics, and could lead to a high frequency of root resorption of neighboring teeth, besides, canine impaction treatment is complex, prolonged and of uncertain outcome.² The permanent canine developmental period is long, it takes more than 4 years to develop three quarters of its root length and emerge into the oral cavity. Maxillary canines are the most commonly teeth involved with impaction next to the lower third molars. Approximately 1.5-2 % of general population experiences impaction of the upper canines.³ During

mixed dentition, palpation for unerupted teeth should be a part of every clinical examination especially with canines.⁴

Panoramic, occlusal, and periapical radiographs is indicated. While at the mid-to-late mixed dentition stage (the time of ectopic canine position should be diagnosed), these radiographs providing diagnostic information of lateral incisor anomalies too (e.g. Missing, supernumerary, fused, geminated, or if it is peg shaped or small in size) helping in prediction of canine ectopic eruption. Intervention for ectopic teeth may include extractions and space maintenance to aid eruption and reduce the risk of need for surgical bracket placement and orthodontic traction.^{5,6,7}

Theories of canine impaction can be separated into two categories:

guidance (as delayed resorption of deciduous teeth, cited abnormal tooth bud eruption and abnormal eruption rate), and genetics. The prevalence of malocclusion and its distribution varied among racial, national and ethnic groups.^{8,9}

In the presence of radiologic evidence of anomalous inclination of the permanent canine and/or overlapping of the permanent canine with the root of the complete permanent lateral incisor, primary canine extraction is recommended.^{10,11,12} (Fig: 1)

Aims of the study

Analyze and evaluate the eruption of upper canine in Iraqi sample, on the bases of panoramic radiographic records, detecting eruptive problems.

Materials and methods

This transverse retrospective study is made on computerized panoramic radiographs of (164) children, (72 boys- 92 girls), 5-12 years of age, imported from the computerized orthodontic data base (Planmeca Proline CCP/ Finland) of Al-Dawood center of health, Al- karkh, Baghdad. All were with unerupted upper permanent canines, to study the course of canine eruption, relative to some variables, as:

- Patient's age and sex.
- Canine inclination (CI) following the method described by Bjerklin and Kurol¹³ for the first maxillary molars. Measuring the external angles formed by the major axis of the canine and the straight line through both suborbital points.¹ (Fig.2)
- Canine-lateral incisor relation (CLR). If the canine crossing the lateral incisor distal border and overlapping it, then it considered as

mesial canine to this border [M]. If not crossing it, then it considered as distal to the lateral incisor [D] (Fig.1, 3).

- The amount of the lateral incisor development (LID), considered as complete (CO) when it is fully erupted and possessed a fully formed root, even in the presence of an open apex (Fig.1). This situation corresponded with stage No.9 in the classification of Nolla.¹⁴ All other cases represent an incomplete development (INCO).

Because this study centered on the eruptive period before emergence, many cases had been excluded in which canines had reached the alveolar bone crest level. Exclusion done also to all cases in which the canine had not yet exhibited root formation for the difficulty in identifying their inclination.

Method Error

Angular measurements reliability in panoramic radiograph have been confirmed by different studies.^{1,15} A pilot research was carried out, 15 subjects (30 canines) were selected randomly to analyze the reability of the values of the (CI) variable on three different days. Three repeated measurements of the inclination of each canine were performed by the same person (E.F.A.) .The "interclass correlation coefficient"¹⁶ was calculated ($r = 0.996$) showing high reliability of the method used.

Results

Inclination of the canine (CI)

For descriptive purposes, the study sample was divided into age groups (table 1) to determine the mean inclination of each group. The differences observed were highly significant. No significant differences

were noted between the sexes. ANOVA(table 2) shows, the difference among the means is significant ($p < 0.0001$).

Relation of the canine to the lateral incisor (CLR)

From table 3, [M] was significantly more frequent in < 8 years groups (5, 6 and 7 years). While from age of 8 years onwards, [D] became significantly more frequent. A point between 8 and 9 years shows the change in distribution of the relation [M] and [D].

No (CO) LID observed at 5,6 or 7 years, for that, they are collected as < 8 years group, and also no (INCO) LID at 11 and 12 years, for that, they are collected as > 10 years group.

In table 3, [M] was seen in 67% of cases when LID was (INCO), and only 7% of cases when LID was (CO). Children older than (9) years who exhibited (CO), ($n=162$), the CLR was 91% [D] and only 9% [M], whereas (INCO), ($n= 44$), [M] CLR appeared in 61%, and [D] CLR appears in 39 %.

Association between CI and CLR:

Table 4 shows the average CI values of the total sample in the different age groups related to different CLR values (as [D] and [M]), corresponding to different LID.

The (INCO) LID subgroup shows no differences in CI between the different CLR values (95° and 97° respectively), but when LID was (CO), the CI was found to be significantly greater in [M] cases (97° vs. 105°).

Discussion

Broadbent¹¹ and Moyers¹⁷ established that "the upper cuspids move downward, forward and laterally

away from the root ends of the laterals". Whereas according to the current study, the canine eruptive pathway is of two stages; in the first stage, the canine would move toward the lateral incisor, increasing its mesial inclination, and in the second eruptive stage at approximately 9 years of age, "Lateral movement" and "gradual straightening" of the canine would take place. If this not happened in the last stage, then, a lack of canine guidance and eruptive anomalies are expected.

The late mixed dentition period at age 9 years, mostly providing enough time to predict and try to prevent canine eruptive disorders. Palpation of the canine bulge in the vestibular aspect of the alveolar process, giving good evidence that canine movement takes place not only distally but also in a vestibular direction.^{1,18}

In the studied Iraqi sample, on average, the pre-eruptive canine reaches maximum inclination (103°), to ultimately straighten again in a vertical position (93°) at the time of emergence. The results also show that in the initial stages, the most frequent CLR is [M] presenting an overlapping of the canine on the lateral incisor, which is rarely seen in the final stages, as a result of straightening of the canine.

Lindauer et al¹⁹ studied 41 impacted canines in age 12 ± 1 year, and exhibited that, overlapping of the canine and lateral incisor, found in 78% of them, versus only 4% of the 71 control canines that did not develop impaction. They concluded that such relations detect canine anomalies during the mixed dentition period.

This study shows that predicting sign of canine impaction is not applicable in the entire mixed dentition period, but only at the period that coincides with complete development of the lateral incisor. Therefore LID is a good reference for defining when a

radiographic overlapping image constitutes a sign of canine eruption disorder.

Ericson and Kurol²⁰ demonstrated the predictive value of the absence of the cuspid bulge palpation in the vestibular aspect of the alveolar process after the age of 10 y. Overlapping [M] prevents the natural palatal deviation of the canine, for that it may be displaced, while if overlapping does not occur [D], less incidence of canine impaction can be seen.²¹⁻²³ In the event of such displacement, the stimulus to initiate resorption of the root of the deciduous canine may not occur, increasing the possibility of palatal impaction, and explain why extraction of the deciduous canine or agenesis of the permanent lateral incisor would effectively allow straightening of the canine.^{24, 25}

Therefore in high risk subjects, as, subjects with relatives affected by impacted canines, or subjects exhibited other associated disorders such as agenesis, ankylosis, microdontia of the lateral incisor, a careful radiographic follow-up study is advisable.²⁶

Iraqi children sample exhibited a higher percent of [M] with (CO) LID (8%-15%), versus lower values (7%-11%) recorded on Spanish children sample¹; also higher canine inclination values of the age groups advocate a higher percent of canine malposed or impaction among Iraqi children.

Conclusion

- During the upper canine eruptive course, increasing mesial inclination continued till a maximum angle at approximately 9 years of age. From this inflexion point onwards, the tooth progressively straightens, until it emerges into the oral cavity.
- Overlapping commonly seen when the lateral incisor is not yet fully developed, but if it is completed,

such overlapping is rare. The few cases in which it is observed, may indicate canine eruptive disorder, suggesting the adoption of preventive measures to avoid impaction; as, extraction of the primary canine, especially when the cuspid bulge can't be palpated in the alveolar vestibule after age 10 years, or in cases of dental malformation, agenesis, ankylosis, or ectopic eruptions.

- Iraqis show relatively high canine impaction or ectopic eruption. Advising to emphasize the routine radiographic investigation from 9 years on. Choosing the most suitable preventive measurements to overcome it.

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Table (1) Sample distribution by age and sex.

Age	Boys	Girls	Total	Canines
5	2	3	5	10
6	6	3	9	18
7	8	7	15	30
8	15	17	32	64
9	14	27	41	82
10	15	24	39	78
11	7	8	15	30
12	5	3	8	16
Total	72	92	164	328

Table (2) Canine inclination at different ages.

Age	N	Mean	SD	Max	Min
5	10	91	3	103	85
6	18	93	5	105	87
7	30	96	6	112	88
8	64	99	6	117	90
9	82	103	7	125	92
10	78	101	7	115	91
11	30	97	3	110	88
12	16	93	4	109	90

The ANOVA test shows that the difference among the means is significant ($p < 0.0001$).

Table (3) Distribution of the relation of the canine to the lateral incisor [as M&D] with complete and incomplete lateral incisor developmental stages.

Age	Total Sample	Incomplete					Complete				
		Total	M	%	D	%	Total	M	%	D	%
< 8	58	58	48	83	10	17	0	0	0	0	0
8	64	44	32	73	12	27	20	3	15	17	85
9	82	38	23	61	15	39	44	5	11	39	89
10	78	6	4	67	2	33	72	6	8	66	92
>10	46	0	0	0	0	0	46	3	7	43	93
	328	146					182				

Table (4) Canine inclination related to development of lateral incisor.

Age	Total Sample	Incomplete			Complete		
		Total	D CI°	M CI°	Total	D CI°	M CI°
5	10	10	88	92	0		
6	18	18	92	93	0		
7	30	30	97	95	0		
8	64	44	100	99	20	95	105
9	82	38	97	103	44	100	110
10	78	6	95	100	72	97	102
11	30	0			30	95	99
12	16	0			16	92	96



Fig.:1 The right canine is distal (D) with incomplete lateral incisor development (INCO), while in the left, canine overlapping the lateral incisor (M), with lateral incisor fully erupted, considered as completely developed (CO) even with still opened root.

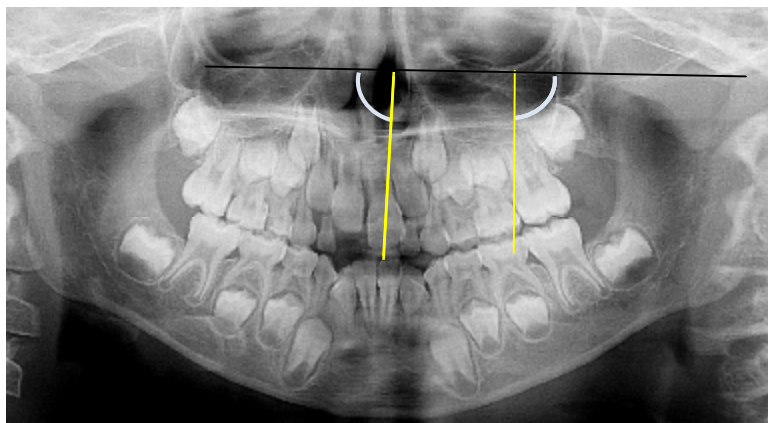


Fig.:2 studying the inclination of the permanent canine according to a reference line join the two Suborbital points (measuring outer angles), also considering its relation or overlapping with the permanent lateral incisor, which in turn is evaluated as complete or incomplete root formation.



Fig.:3 The overlapping of the right canine on the completely developed lateral incisor, in panoramic radiographs, is a sign of eruptive disorders of the canine, suggesting the adoption of preventive measures to avoid impaction; as extraction of the primary canine.