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RESEARCH ARTICLE

A COMPARATIVE ASSESSMENT OF ADJACENT TEETH MORPHOLOGIES, ANGULATIONS AND INCLINATIONS IN BUCCAL AND PALATAL IMPACTED CANINES- AN OBSERVATIONAL STUDY

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ABSTRACT

Objectives: The study aimed to compare and evaluate the morphologies, angulations, and inclinations of lateral incisors, central incisors, and first premolars in of buccal and palatal impacted maxillary canines.

Materials and Methods: The retrospective observational research utilized cone beam computed tomography (CBCT) images from 45 patients, categorized into three groups: Buccal Impacted Canines (BIC), Palatal Impacted Canines (PIC), and a Control Group (CG) devoid of impactions, including 15 patients in each group. Parameters, including crown and root widths and lengths, angulations, and inclinations of adjacent teeth, were measured. Statistical analyses involved one-way ANOVA to compare PIC, BIC and CG. The paired t-test was employed to compare the parameters between the ipsilateral and contralateral sides within the PIC and BIC. p values less than or equal to 0.05 were considered significant.

Results: Notable differences were noted primarily in the lateral incisors among the three groups under study. Palatal impacted canines were associated with shorter root lengths of lateral incisors ($p=0.04$), while buccal impacted canines showed increased angulation and inclination of lateral incisors compared to PIC and CG ($p=0.013$). Within the PIC group, the affected side exhibited narrower buccolingual width and shorter crown length of central incisors ($p<0.001$, $p=0.005$) and reduced root lengths of lateral incisors ($p=0.019$). Conversely, the BIC group demonstrated increased buccolingual width and greater inclination of lateral incisors on the impacted side ($p=0.007$, $p=0.003$). ICC values indicated moderate-good reliability.

Conclusion: Palatal and Buccal impacted maxillary canines were found to be associated with distinct morphological and angulation changes in adjacent lateral incisors.

Keywords: Cuspid, Cone beam computed tomography, Impaction, Orthodontics, Incisors

INTRODUCTION

Maxillary canines are among the most commonly impacted teeth, second only to third molars, with an incidence of 1.7%–4.7%, and are twice as prevalent in females. The prevalence of maxillary canine impaction is nearly double that of mandibular impaction.^{1,2}

Maxillary canine impactions may occur either in buccal or palatal aspects with palatal impactions far more common than buccal impactions. Buccal or palatal impaction can result in cosmetic and functional problems, such as resorption of adjacent teeth. Therefore, the management of canine impaction necessitates specialized surgical and orthodontic procedures for optimal results.³⁻⁵ The early detection and prediction of maxillary canine impaction is essential to avert severe effects, such as root resorption, and to initiate prompt orthodontic treatments. Early recognition of maxillary canine impaction can reduce the duration, complexity, and cost of treatment.⁶ Hence, identification of the aetiology of the impaction is crucial for its prevention and management.

The aetiology of canine impactions remains disputed. Concerning palatal impacted canines, two hypotheses have been proposed to elucidate its development: the genetic theory and guidance theory. Guidance theory posits that morphological changes in lateral incisors lead to the loss of the eruptive guidance for canines.⁷ Increased space within the dental arch along with variations of the lateral incisors are typically correlated with palatal impacted canines.⁸

Previous research by Luik *et al.*⁹ established that the orientation and position of palatal impacted canines are associated with the inclination and dimensions of lateral incisors. Another school of thought is the 'sequential theory', which delineates a pattern wherein the two most widely acknowledged hypotheses may operate at distinct phases in the development of the maxillary canine and its adjacent components. Additional characteristics, including as the mesial displacement of the maxillary first premolar, root dilacerations and the width of the maxillary arch, have also been linked to the occurrence of palatal impacted canines.¹⁰

However, with regard to the buccal impacted canines, dental crowding, constriction of the maxillary arch, and lack of space for eruption are commonly attributed etiologies.⁷ However, the

investigation by Light *et al.*¹¹ observed changes in the inclination of the ipsilateral teeth in cases of both buccal and palatal canine impactions.

While most previous studies have focused on the shape, dimensions, and morphology of the lateral incisor pertaining to the palatal impaction of the maxillary canine, very few investigations have explored the angulation and inclination of both ipsilateral and contralateral central incisors, lateral incisors, and first premolars.^{7, 9, 11-13} Furthermore, there is a dearth of research that has thoroughly evaluated the influence of the three-dimensional positioning of neighboring tooth structures on the type of impaction among the native South Indian population. Hence, the objective of this study is to assess the crown and root morphologies, angulation, and inclinations of the central incisor, lateral incisor, and first premolar in unilateral buccal and palatal canine impactions, while the secondary objectives are to compare the presence of factors like retained deciduous teeth, dilaceration and supernumerary teeth between palatal and buccal canine impactions.

MATERIALS AND METHODS

The retrospective observational investigation was conducted at Saveetha Dental College and hospitals. This study complied with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines, ensuring comprehensive and transparent documentation of the research methodology, analysis, and results. Authorization for the study's conduct was obtained from the institutional review board (SRB/SDC/ORTHO-2306/24/019) prior to the study commencement. In this study, the raw data were first retrieved from institutional archives, and patient identifiers, including names, patient IDs, and mobile phone numbers, were anonymized. Informed consent from the patient was secured for the utilization of the data in the study.

Patient Selection

Cone beam computed tomography (CBCT) images were obtained from the institutional database based on an established inclusion and exclusion criteria. The inclusion criteria consisted of patients with permanent dentition, unilaterally impacted canines in the maxillary arch, with or without retained primary maxillary canines. The exclusion criteria were patients with craniofacial anomalies and syndromes, pathologies associated with impacted canines, patients who underwent prior orthodontic

treatment, substandard quality CBCT images, bilateral canine impactions, mandibular canine impactions, multiple missing teeth in either arch, or significant resorption of the maxillary teeth.

CBCT images that were acquired between 2021 and 2024 were chosen and retrieved. The records were categorized into two groups: Buccal impacted canines (BIC) and Palatal impacted canines (PIC). A separate control group (CG) without impacted canines was used in the current investigation for enhanced comparability. Sample size determination was conducted utilizing G Power software (version 3.0.10) predicated on the effect size derived from a prior investigation.¹²

To obtain an effect size of 0.763, an alpha error of 0.05, and a power of 0.95, a total of 45 patients were required, allocated over three groups with 15 patients in each group. All CBCT files were acquired using the CS 9600 (Carestream Dental LLC) under regular settings, with the patient positioned upright. The field of view (FOV) of the obtained scans was 8x8, offering a three-dimensional viewpoint of the maxilla. The scan parameters were: 120 kV, 150 seconds, 4.0 mA, and 75 mGycm².

Parameters assessed

The obtained CBCT data was examined using the CS 3D Imaging software (v3.10.21, Carestream Dental, LLC). Axial, coronal, and sagittal reconstructions were utilized to localise the canines. The scans were examined at a slice thickness of 0.4 mm, and all measurements were conducted by a single operator. Measurements related to crown and root morphology, inclinations, and angulations were carried out for PIC, BIC, and CG. The measured parameters are outlined in Table 1 and Figure 1.

The evaluated parameters were derived from prior investigations.^{14, 15} Alongside the quantitative characteristics evaluated, variables such as the existence of dilaceration, supernumerary teeth, retained deciduous teeth, and congenitally missing lateral incisors were obtained for the PIC and BIC groups.

Statistical Analysis

Statistical analyses were performed utilizing the Statistical Package for the Social Sciences (SPSS, version 23.0, Armonk, New York). Normality of the data was assessed using Shapiro-Wilk test. One-way ANOVA was employed to compare the parameters among the three groups. For the BIC and PIC, the ipsilateral side was analysed. However for the CG,

right or left side was assigned for each sample randomly. Paired t-tests were employed to compare the teeth parameters between the ipsilateral and contralateral sides within the PIC and BIC groups. Un-paired t-test was used to compare the alpha angle of the impacted canines between PIC and BIC. Descriptive statistics were employed to describe data on the canine sector, the presence or absence of dilaceration in canines and lateral incisors, peg laterals, and retained deciduous canines. The occurrence of dilacerations, supernumerary teeth, retained deciduous teeth and the type of impaction was assessed using Chi square test. Intra examiner reliability for consistency and reliability of the quantitative parameters were assessed using the Intra-class correlation coefficient (ICC) based on values taken one month apart by the same investigator on ten randomly selected samples. A significance level of $p \leq 0.05$ was considered significant for all tests.

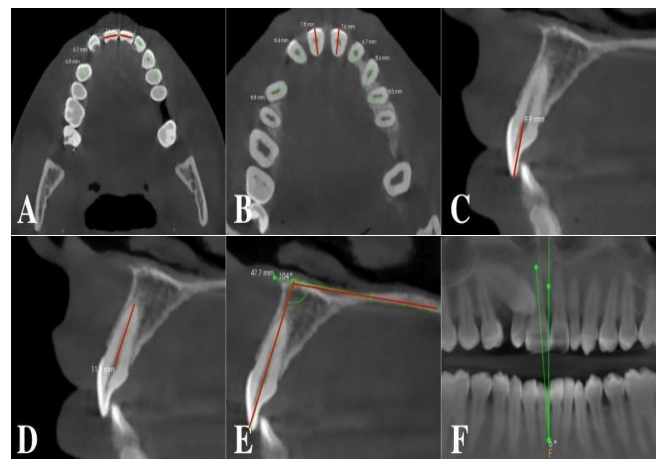


Figure 1. The parameters measured in the CBCT images: A- Mesiodistal width; B- Buccolingual width; C- crown height; D- Root height; E- Tooth angulation; F- Tooth inclination.

RESULTS The current investigation was done over a six-month period from May to October 2024. The current study analyzed a total of 45 CBCTs, which included 15 records in each group. The average age of participants in the BIC was 21.87 ± 5.40 years, in the PIC was 22.40 ± 5.45 years, and in the CG was 23.26 ± 6.57 years. The age disparities across the groups were not statistically significant ($p = 0.803$). The BIC comprised seven females and eight males, whilst the PIC consisted of nine females and six males. The CG included ten females and five males. Regarding impaction, 60% (n=9) of BIC exhibited right-sided impaction, whereas 60% (n=9) of PIC demonstrated left-sided impaction.

Table 1. Parameters assessed in the test groups.

The following parameters were measured on the ipsilateral and contralateral central incisor, lateral incisor and first premolars		
Parameter	CBCT View Used	Description
Mesiodistal Width (mm)	Axial View	Measured as the distance between the most mesial and distal points on the crown contour, taken at the widest part of the tooth.
Buccolingual Width (mm)	Axial View	Measured as the distance between the most buccal and lingual points on the crown contour at the greatest convexity.
Crown Height (mm)	Sagittal View	Measured as the vertical distance from the cementoenamel junction (CEJ) to the most incisal or cuspal tip of the crown.
Root Length (mm)	Sagittal View	Measured as the distance from the cementoenamel junction (CEJ) to the apex of the root along the central long axis of the tooth.
Tooth Inclination (°)	Curved Slice	Measured as the angle formed between the long axis of the tooth and the facial midline.
Tooth Angulation (°)	Sagittal View	Measured as the angle between the tooth's long axis and the ANS-PNS line.
Angle of dilaceration (°)	Sagittal View	Measured as the angle formed between the long axis of the crown and the long axis of the curved portion of the root. Dilaceration refers to deviations in the root portion of a tooth and is defined as an angulation of 20 degrees or more of the root's apical end from the tooth's normal long axis. ¹²
The following parameters were measured with relation to the impacted canines		
Sector Alpha Angle (°)	Sagittal View	The angle formed between the long axis of the impacted canine and the inter-incisor median line
Sector Classification	Panoramic View	Lindauer's modification ¹³ of Ericson and Kurol's definition of sectors is as follows: <ul style="list-style-type: none"> • Sector I is located distal to a line tangent to the distal crown and root of the lateral incisor. • Sector II encompasses the area between the tangent on the distal surface and a midline bisector of the lateral incisor. • Sector III covers the region from the midline bisector to a tangent on the mesial surface of the lateral incisor's crown and root. • Sector IV includes all areas mesial to Sector III.

Comparison of parameters between the three groups

The comparison of tooth morphologies, inclinations, and angulations among buccal, palatal, and control groups using ANOVA revealed significant differences exclusively in the lateral incisors. Specifically, lateral incisors in PIC had a statistically significant short root length when compared to BIC and controls. The differences between the groups were statistically significant ($p=0.04$). Additionally, BIC showed significantly higher angulation and inclination of the lateral incisors compared to PIC and control groups. There was a statistically significant difference in the lateral incisor inclination ($p=0.013$) and angulations ($p=0.013$) between the groups. No significant differences were observed in morphometric parameters of central incisors, canines, or premolars across the buccal, palatal, and control groups (Table 2).

Table 2. The mean and standard deviation (SD) of the parameters assessed for BIC, PIC and CG. One-way ANOVA was used to compare the group. * indicates a p value ≤ 0.05

Teeth	Parameter	Mean and SD			p value
		BUCCAL	PALATAL	CONTROL	
CENTRAL INCISOR	Mesiodistal Width	8.28±0.87	8.07±0.76	8.49±3.3	0.321
	Buccolingual Width	8.55±1.16	8.07±0.99	8.56±3.27	0.346
	Crown Length	10.18±1.33	10.62±0.5	10.97±4.16	0.083
	Root Length	13.17±1.6	12.24±1.52	12.23±4.45	0.165
	Inclination	116.35±11.65	115.81±8.97	117.95±45.31	0.832
	Angulation	8.07±8.26	6.25±7.31	8.91±2.46	0.63
LATERAL INCISOR	Mesiodistal Width	6.89±0.68	6.47±0.67	6.46±2.39	0.202
	Buccolingual Width	7.81±1.18	7.1±0.83	7.22±2.55	0.096
	Crown Length	8.87±1.03	8.51±0.9	8.66±2.92	0.692
	Root Length	12.45±2.17	10.78±1.93	12.18±4.48	0.04*
	Inclination	124.59±11.15	113.7±13.78	114.29±44.5	0.013*
	Angulation	20.31±12.27	11.89±10.89	9.41±4.44	0.013*
CANINE	Mesiodistal Width	7.55±0.51	7.91±0.91	7.71±2.75	0.381
	Buccolingual Width	8.4±0.41	8.59±2.26	8.25±3	0.799
	Crown Length	9.18±1.55	9.38±1.08	9.73±3.72	0.484
	Root Length	13.47±1.68	14.03±1.55	14.56±6	0.833
PREMOLAR	Mesiodistal Width	6.83±0.54	6.93±0.5	7.09±2.78	0.384
	Buccolingual Width	9.41±0.61	9.15±0.48	9.39±3.46	0.409
	Crown Length	7.27±2.16	7.5±1.21	7.82±2.95	0.667
	Root Length	11.57±2.46	12.27±1.89	11.91±4.25	0.612
	Inclination	92.77±10.74	95.3±8.93	94.87±35.97	0.713
	Angulation	9.83±8.52	10.97±6.46	10.17±3.2	0.906

Table 3. Intergroup comparison done using Bonferroni post-hoc test. * indicates a p value ≤ 0.05.

Parameter	Groups		Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Lateral incisor root length	BIC	PIC	.68119	.05*	-.0253	3.3720
	BIC	CG	.68119	1.000	-1.4253	1.9720
	PIC	CG	.68119	.138	-3.0987	.2987
Lateral incisor Inclination	BIC	PIC	3.95621	.026*	1.0212	20.7521
	BIC	CG	3.95621	.038*	.4345	20.1655
	PIC	CG	3.95621	1.000	-10.4521	9.2788
Lateral incisor Angulation	BIC	PIC	3.68976	.083	-.7810	17.6210
	BIC	CG	3.68976	.015*	1.7056	20.1077
	PIC	CG	3.68976	1.000	-6.7144	11.6877

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Inter-group comparison was done for significant parameters using Bonferroni test. For lateral incisor root length, a significant difference was observed between the BIC and PIC groups ($p = 0.05$), with no significant differences involving the CG. In terms of lateral incisor inclination, the BIC group showed significant differences when compared to both the PIC ($p = 0.026$) and CG ($p = 0.038$). For lateral incisor angulation, significant differences were identified between the CG and BIC ($p = 0.015$), whereas comparisons involving the PIC group did not reach statistical significance (Table 3).

Ipsilateral side vs contralateral side in PIC and BIC

Paired t-test was used compare the parameters between ipsilateral and contralateral sides within PIC and BIC. In PIC group, significant differences were observed between ipsilateral and contralateral sides, with ipsilateral side showing a narrower buccolingual width of the central incisors ($p < 0.001$), shorter

crown length ($p = 0.005$), and altered angulation ($p = 0.02$). Additionally, the lateral incisors on the ipsilateral side had reduced root lengths ($p = 0.019$), and impacted canines exhibited smaller mesiodistal widths ($p = 0.03$). In BIC group, significant differences included increased buccolingual width of the lateral incisors ($p = 0.007$), greater inclination ($p = 0.003$), and higher angulation ($p = 0.015$) on the ipsilateral side. Furthermore, canines showed longer root lengths ipsilaterally ($p < 0.001$), and premolars had larger mesiodistal width ($p = 0.039$) and shorter root lengths ($p = 0.047$) ipsilaterally. Other measured parameters did not exhibit significant differences between ipsilateral and contralateral sides in either BIC or PIC (Table 4). The PIC showed a higher mean alpha angle of $41.3 \pm 14.25^{\circ}$ while the mean alpha angle in BIC was $38.9 \pm 26.2^{\circ}$. However the differences were not statistically significant ($p=0.75$).

Table 4. The mean and standard deviations (SD) of measurements and comparison between ipsilateral and contralateral teeth in BIC and PIC groups. A paired t-test was used to compare the groups. * indicates a p value ≤ 0.05 .

Group	Tooth	Parameter	Ipsilateral	Contralateral	p-value
			MEAN±SD	MEAN±SD	
PIC	CENTRAL INCISOR	Mesiodistal Width	8.07±0.76	8.21±0.65	0.057
		Buccolingual Width	8.07±0.99	8.43±0.78	<0.001*
		Crown Length	10.62±0.5	10.9±0.47	0.005*
		Root Length	12.24±1.52	11.88±1.22	0.091
		Inclination	115.81±8.97	117.51±8.72	0.02*
		Angulation	6.25±7.31	6.25±3.79	1
	LATERAL INCISOR	Mesiodistal Width	6.47±0.67	6.41±0.82	0.484
		Buccolingual Width	7.1±0.83	7.05±0.79	0.832
		Crown Length	8.51±0.9	8.77±0.78	0.16
		Root Length	10.78±1.93	11.45±1.04	0.019*
		Inclination	113.7±13.78	114.31±6.81	0.81
		Angulation	11.89±10.89	11.03±6.75	0.659
	CANINE	Mesiodistal Width	7.91±0.91	7.57±0.76	0.03*
		Buccolingual Width	8.59±2.26	8.17±0.51	0.328

		Crown Length	9.38±1.08	9.56±1.32	0.484
		Root Length	14.03±1.55	13.54±3.98	0.497
	PREMOLAR	Mesiodistal Width	6.93±0.5	6.97±0.45	0.668
		Buccolingual Width	9.15±0.48	9.19±0.71	0.646
		Crown Length	7.5±1.21	7.43±1.36	0.73
		Root Length	12.27±1.89	12.49±1.78	0.487
		Inclination	95.3±8.93	97.45±6.15	0.208
		Angulation	10.97±6.46	10.57±5.58	0.81
BIC	CENTRAL INCISOR	Mesiodistal Width	8.28±0.87	8.33±0.84	0.52
		Buccolingual Width	8.55±1.16	8.52±0.98	0.722
		Crown Length	10.18±1.33	10.36±1.27	0.392
		Root Length	13.17±1.6	13.09±1.13	0.534
		Inclination	116.35±11.65	115.79±9.74	0.662
		Angulation	8.07±8.26	9.94±8.55	0.253
	LATERAL INCISOR	Mesiodistal Width	6.89±0.68	6.8±0.68	0.342
		Buccolingual Width	7.81±1.18	7.47±1.05	0.007**
		Crown Length	8.87±1.03	8.78±1.59	0.686
		Root Length	12.45±2.17	18.77±22.24	0.128
		Inclination	124.59±11.15	108.93±26.74	0.003*
		Angulation	20.31±12.27	14.67±7	0.015*
	CANINE	Mesiodistal Width	7.55±0.51	7.45±0.35	0.352
		Buccolingual Width	8.4±0.41	8.47±0.45	0.522
		Crown Length	9.18±1.55	8.96±1.28	0.442
		Root Length	13.47±1.68	15.06±2.07	<0.001*
	PREMOLAR	Mesiodistal Width	6.83±0.54	6.65±0.48	0.039*
		Buccolingual Width	9.41±0.61	9.51±0.52	0.233
		Crown Length	7.27±2.16	6.98±1.34	0.409
		Root Length	11.57±2.46	12.73±1.36	0.047*
		Inclination	92.77±10.74	94.16±7.65	0.457
		Angulation	9.83±8.52	7.95±8.27	0.469

On comparing the prevalence of lateral incisor agenesis and lateral incisor root dilaceration, PIC group presented with only one case in each and it was not statistically significant (p=0.5). 53.3% of patients with PIC presented with a retained deciduous while 33.3% of patients in BIC had retained deciduous canines (p=0.29). There was no significant difference in the distribution of the sector classification in both BIC and PIC (Table 5).

Table 5. Comparison of clinical parameters between BIC and PIC. Chi-square test was used to compare the prevalence of the parameters. * indicates a p value ≤ 0.05.

Parameters	BIC	PIC	p-value
Lateral Incisor Agenesis	0(0%)	1 (6.67%)	0.5
Dilaceration Of Lateral Incisor	0(0%)	1 (6.67%)	0.5
Deciduous Canine	5 (33.3%)	8 (53.3%)	0.296
Sector Classification:			
Sector I	1 (6.67%)	0(0%)	0.5
Sector II	1 (6.67%)	3 (20%)	0.299
Sector III	7(46.6%)	4 (26.6%)	0.256
Sector IV	6 (40%)	8 (53.3%)	0.464

All the quantitative measurements were repeated after a month on 10 randomly selected patients. The ICC for the tooth measurements (Mesiodistal width, Buccolingual width, crown height and root length) was good (0.799-0.854). ICC for inclination and angulation showed moderate-good reliability (0.735-0.786).

DISCUSSION

The present study aimed to compare the morphological and angulation differences of maxillary lateral incisors, central incisors, and first premolars in patients with buccal and palatal impacted canines. This comprehensive assessment contributes to the understanding of localized effects in maxillary canine impactions. The current study revealed that in PIC groups, the roots of the lateral incisors on the side of impaction were shorter than those on the contralateral side and shorter than those in the BIC and CG groups. The BIC group showed significant higher inclination and angulation of the lateral incisors in the ipsilateral side when compared to PIC and CG. On comparing the ipsilateral and contralateral sides, the buccolingual width, of the lateral incisor was larger on the impacted side. Kucukkaraca¹² examined the morphological traits and positions of lateral incisors and canines in buccal and palatal impacted canines. The study revealed that the lateral incisor length and root length on the side of impaction was shorter compared to the buccal instances similar to the present study. The study also revealed that canine angulation in palatal impactions was greater than in buccal impactions Previous studies¹⁶⁻¹⁸ indicated that palatal impacted canines correlate with reduced dimensions of lateral incisors. Nevertheless, the current study did not identify a significant variation in the widths of lateral incisors among BIC, PIC, and CG, in contrast to earlier

investigations. Controversy persists about the influence of lateral incisor dimensions on impactions, since a recent study identified no association between the dimensions of the lateral incisor and palatal canine impactions.¹⁹ Previous research indicate that shorter roots of lateral incisors are associated with impacted canines on the impacted side when compared to contralateral side.^{20, 21} Nevertheless, these investigations have not evaluated palatal and buccal displacements independently.

The angulation of lateral incisors has also been linked to impacted canines. The research conducted by Kanavakis *et al.*²² indicated that in palatal impacted canines, the lateral incisor exhibited a mesial angulation of at least 2.5° greater than that on the non-impacted side, unlike the results of the current study. In the current study, the BIC group exhibited a greater distal angulation compared to the PIC and CG groups. PIC showed slightly more distal angulation than CG, however the differences were not significant. Prior study indicates that distal crown tilting and increased incisor inclination are markers of buccal canine impaction.⁹ The study indicated that the angulation of palatal displaced canines increased when the lateral incisors were less mesially inclined, as shown in the current investigation. Light *et al.*¹¹ investigated the inclinations of teeth in buccal and palatal canine impactions. Buccal impactions were associated with higher inclination, indicating a more palatal positioning of the roots of lateral and central incisors, whereas palatal canine impactions demonstrate a more labial location of the roots of lateral incisors with differing inclinations. These findings align with the conclusions of the present research. Comparable results concerning the inclination of the lateral incisor were also seen in another investigation.²³ The mesiodistal width of the impacted canine was increased in the PIC group. Similar findings were seen in another study.²⁴ In

contrast, a previous study revealed no differences in the mesiodistal width of the canine between the impacted and non-impacted sides, unlike the present results.²⁵ The present study found short lateral incisor roots in patients with palatal impacted canines supporting the guidance theory of canine impaction to an extent.² The buccal canine impactions were associated with proclined and distally angulated incisors. Hence, these parameters can be used early in diagnosis for prediction of canine impactions.

The primary strength of the current investigation was the utilization of accurate 3D measures derived from CBCT data for complete examination of all neighboring tooth structures. CBCT provides an accurate representation of the dental structures unlike traditional 2D imaging.²⁶ Nonetheless, specific limitations existed. The limited sample size, due to the study being conducted at a single center, may diminish the generalizability of the results. Consequently, additional multicentric research with a bigger sample size must be conducted. The investigation was done retrospectively, a method prone to bias due to potential variations in the quality and completeness of the CBCT images. Future research should focus on prospective longitudinal studies that incorporate genetic factors to provide a thorough knowledge of the aetiology of impactions.

CONCLUSION

This study reveals that buccal and palatal impacted maxillary canines were associated with distinct alterations in the morphology and angulation of ipsilateral lateral incisors. Specifically, palatal impactions are linked to shorter root lengths of lateral incisors, while buccal impactions exhibit increased angulation and inclination of incisors. Additionally, in the palatal impaction group, the central incisors on the impacted side showed narrower buccolingual width and shorter crown length, whereas the buccal impaction group demonstrated increased buccolingual width and greater inclination and angulation of lateral incisors on the impacted side compared to the contralateral side. These findings underscore the importance of a thorough assessment of neighboring tooth structures

DECLARATIONS

Conflicts of interest and financial disclosures

The author declares that they have no conflict percent and there was no external source of funding for the research in question.

Ethical approval

This study was approved by the Institutional Review Board of Saveetha Dental College, (SRB/SDC/ORTHO-2306/24/019) and was conducted in accordance with the Declaration of the World Medical Association.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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Informed Consent

All participants signed an informed consent form. Informed consent in regional language Tamil or English

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