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Correlation between the Lateral Ala Nasi Point and the midpoint of the maxillary canine the community of faculty of dental medicine Universitas Airlangga

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Abstract

This study is to analyse the correlation between the lateral ala nasi point and the midpoint of the maxillary canine. This observational study employed a cross-sectional design with 60 samples aged 20-39 years from the Faculty of Dental Medicine, Universitas Airlangga, selected using purposive sampling based on inclusion criteria. Interalare distance and inter-canine distance were measured using digital callipers with 0.01 mm precision. Data analysis was conducted using the Kolmogorov-Smirnov normality test, Levene's homogeneity test, and Spearman rank correlation test with significance level set at $p < 0.05$. The mean inter-alare distance was 38.03 ± 2.97 mm (range: 31.00-47.10 mm), whilst the mean inter-canine distance was 37.43 ± 2.36 mm (range: 33.70-48.37 mm). Spearman correlation analysis revealed a statistically significant positive correlation between the lateral ala nasi point and the midpoint of the maxillary canine ($\rho = 0.570$, $p < 0.001$). The correlation remained significant despite the multi-ethnic composition of the study population, which included 48.3% Javanese participants and 16 different ethnic backgrounds. There is a moderate positive correlation between the lateral ala nasi point and the midpoint of the maxillary canine in the multi-ethnic Indonesian young adult population at Universitas Airlangga.

Keywords: Ala Nasi; Anthropometry; Biometrics; Facial Landmarks; Prosthodontics; Maxillary Canine

1. Introduction

Loss of teeth disturbs both functional and aesthetic sides of an individual's life, affecting masticatory function, facial aesthetics, and overall oral architecture. Prosthodontics plays an essential role in by replacing missing teeth while maintaining aesthetic harmony.[1] Anterior tooth arrangement and position should be in accordance with phonetics, aesthetics, and functional requirements, and proper placement should be a copy of what nature intended.[2] Anterior placement of teeth is guided by biometrics to create a reliable anchor for aesthetic quality as well as performance attributes.[3]

Dental positioning has been found to be correlated with facial landmarks through studies. Distance between the outer edge of the ala nasi, for instance, has been correlated with distance between maxillary canine crests, and it has been theorized in some studies that a line passing over the lateral aspect of the ala nasi is on the midline of the maxillary canines.

In Indonesia diversity has increased due to greater interracial and inter-tribal marriages post-independence, resulting in a wide range of physical and genetic traits).[4] As human evolution reflects adaptation to environmental challenges, the diversity in facial characteristics among different groups requires precise biometrics in prosthodontics to achieve aesthetically harmonious results.

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A positive correlation suggesting that as the width between the lateral points of the ala nasi increases, the distance between maxillary canine midpoints correspondingly increases between the lateral ala nasi measurement and maxillary canine to midline distance among the 20 – 40 year old Deutero-Malay ethnic group at Universitas Airlangga, consisting of 30 male and 30 female participants.[5]

The current study differs from previous research in its methodological approach. While former study focused exclusively on the Deutero-Malay ethnic group, this research incorporates a broader demographic representation from the multi-ethnic population at Universitas Airlangga. The present study employs digital callipers for enhanced measurement precision. Additionally, the current methodology incorporates statistical analysis including appropriate sample size calculations, correlation coefficients with proper power analysis, and comprehensive control, which in previous study test are conducted with t-test method.

This research seeks to explore the correlation between the lateral point of the ala nasi and the midpoint of the maxillary canine, filling the gap in the knowledge of this guidelines in multi-ethnicity population. The findings will assist in the improvement of functional and aesthetic outcomes of prosthetic care, particularly in diverse populations.

2. Material and methods

This research is an observational analytic study with a cross-sectional approach, with the alare point and positions of maxillary canines simultaneously measured at one time. This design is suitable to establish the association between two anatomical measures without experimental control. The target population are community of the Faculty of Oral Medicine in Universitas Airlangga. Sample of this research was chosen using Pearson's correlation formula for two quantitative variables. Total sample for this research was 60 people.

The participants in this study were young adult men and women aged 20 to 39 years old. They had no dental caries and did not wear dentures. Each participant had a normal nose and had never undergone nasal surgery. None were currently undergoing or had previously undergone orthodontic treatment. Additionally, they had no loss, fracture, or restoration of the maxillary anterior teeth, and their maxillary anterior teeth were not crowded. Finally, all participants exhibited no facial abnormalities such as facial, nasal, or lip defects.

The independent variable in this study is the lateral ala nasi point (inter-alare), while the dependent variable is the midpoint of the maxillary canine. The control variables include age (20–39 years), sex (male or female), and ethnicity. The study was conducted from July to September 2025 at the Faculty of Dental Medicine, Universitas Airlangga. The materials and equipment used in this research include a digital vernier caliper (Deli, China), a smartphone camera (iPhone 14 Pro, Apple Inc., USA), 70% ethanol alcohol wipes (OneMed Healthcare, Indonesia), a water-based eyeliner marker (Basisi, Indonesia), cotton buds, micellar water (Garnier, L'Oréal Indonesia), a nierbeken, an informed consent form, measurement recording sheets (Google Sheets), a laptop (MacBook Pro 2020, Apple Inc., USA), and SPSS software version 25.

To ensure measurement consistency, intra-examiner calibration was conducted prior to data collection, with a single examiner performing all measurements to eliminate inter-observer variability. This approach aligns with recommendations for standardized data collection protocols to minimize confounding influences on responses. [6] The use of a single examiner reduces inter-rater variability and ensures consistency in measurement techniques.[7]

Intra-rater reliability was assessed using a test–retest method on a subset of 6 participants which are the 10% of the sample. Measurements were repeated after a 2 weeks interval to reduce physiological variation and avoid artificial consistency or recall bias[6,8]. All assessments followed standardized protocols and were conducted under consistent environmental conditions between 09:00 and 12:00 to minimize circadian and muscle fatigue effects.

An intraclass correlation coefficient threshold of ≥ 0.60 was established as the minimum acceptable value for reliability, in line with previous research. The ICC obtained in this study was 0.640, indicating acceptable intra-rater consistency.[9] If the ICC value were to fall below this threshold, corrective steps would include reviewing measurement procedures, retraining the examiner, and refining measurement instruments. Additionally, alternative reliability analysis using the Mean Error of Measurement could be applied to further evaluate the magnitude of measurement inconsistency.

Data will be gathered by direct measurement and linear measurement by one calibrated examiner to maintain consistency. Every measure will be taken three times, and the mean will be used for analysis. After data collection, a systematic analytical procedure will be employed to address the study aims. The data will be treated utilizing SPSS

Statistics version 25, ensuring it is accurate and valid. Descriptive statistics will be employed in the preliminary analysis, continuous variables will be reported as mean ± standard deviation when normally distributed, or median with range for non-normal data.

Prior to inferential analysis, assumptions for parametric testing will be evaluated critically. Levene's test will test homogeneity of variances for male and female groups, and Kolmogorov-Smirnov test will be employed for testing data normality.

Correlation analysis was examined inter-variable relationships, with the choice of methods based on types of distributions. Pearson's correlation will be used for normally distributed data, while Spearman's rank correlation will be used for non parametric data. Statistical significance is based on a p-value < 0.05. Such a systematic strategy ensures that the analysis is rigorous and suitable, thus ensuring the validity and reliability of study outcomes.

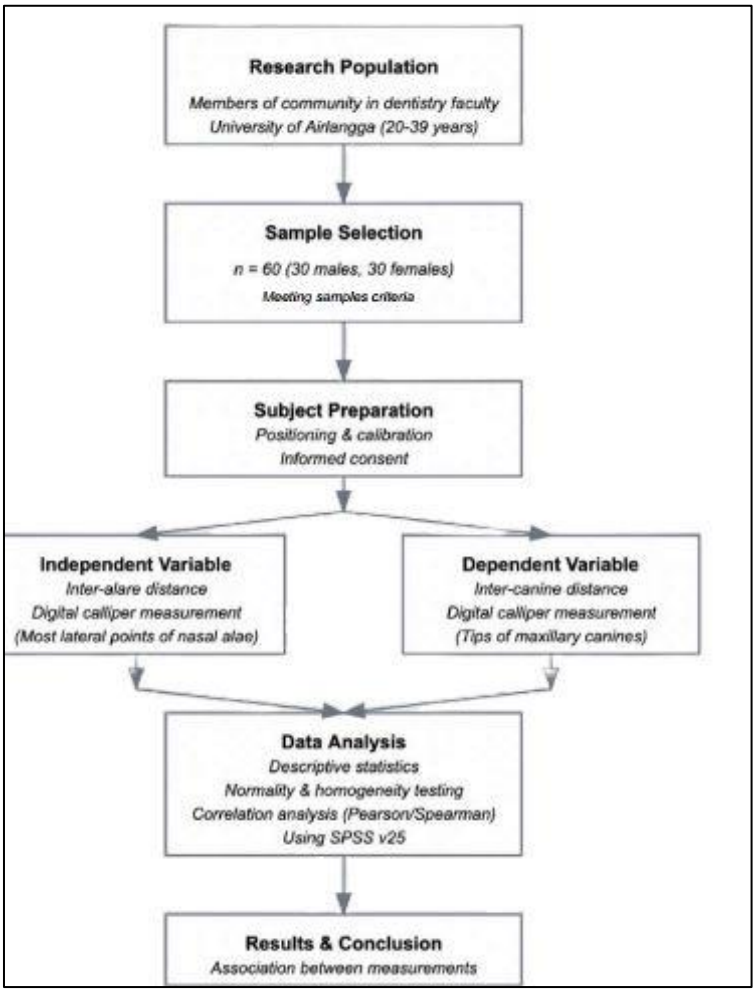

Figure 1 Research Flow

3. Results

Table 1 Average value, standard deviation, and the minimum and maximum values result

Samples	Average Value (mm)	SD (mm)	Minimum (mm)	Maximum (mm)
Lateral Ala Nasi Point	38.0267	2.96618	31.00	47.10
Midpoint of Maxillary Canine.	37.4339	2.35632	33.70	48.37

Data presented above shows Lateral Ala Nasi Point values range from 31.00 to 47.10, with a mean of 38.03 and a standard deviation of 2.97. This indicates a relatively small variation in the measurements among the respondents. In contrast, the Midpoint of Maxillary Canine exhibits a minimum value of 33.70 and a maximum value of 48.37, with a mean of 37.43 and a standard deviation of 2.36.

Table 2 Participant Ethnicity Percentage Result

Participant Ethnicity	Frequency	Valid Percent
Arab	1	1.7
Batak	3	5.0
Cina	4	6.7
Cina-Palembang	1	1.7
Jawa	29	48.3
Jawa-Venezuelan	1	1.7
Jawa-Betawi	3	5.0
Jawa-Cina	2	3.3
Jawa-Jambi	1	1.7
Jawa-Jepang	1	1.7
Jawa-Madura	4	6.7
Jawa-Minang	3	5.0
Jawa-Palembang	1	1.7
Jawa-Sunda	3	5.0
Melayu	1	1.7
Rejang	1	1.7
Sunda	1	1.7
Total	60	100

Majority of participants belong to the Javanese ethnic group, with a total of 29 individuals (48.3%) followed by Chinese and Javanese-Madura group as many as 6.7%, each of Bataknese, Javanese-Betawi, Javanese-Minangkabau, and Javanese-Sundanese tribe contributing 5.0% of the participants. Although there is ethnic diversity among the participants, the composition is dominated by the Javanese ethnic group.

Table 3 Intraclass Correlation Coefficient Reliability For All Subjects Result

Interclass Correlation	95% Confidence Interval		df1	df2	Sig.
	Lower bound	Upper bound			
643	0.254	0.927	5	15	0.001

Correlation Coefficient (ICC) value obtained was 0.643, with a 95% confidence interval ranging from 0.264 to 0.927, and a significance level of p = 0.001. An ICC value of 0.643 indicates a moderate to good level of reliability between the two measurement sessions, suggesting that the measurements demonstrated a satisfactory degree of consistency across all subjects. Furthermore, the p-value < 0.05 confirms that the result is statistically significant, indicating a meaningful agreement between the repeated measurements.

Table 4 Intraclass Correlation Coefficient Reliability For Different Measurements

Readings	Intraclass Correlation	Sig
Lateral Ala Nasi Point	.959	.000
Maxillary Canine Tip	.849	.010

The overall ICC value was 0.643 (p = 0.001) with a 95% confidence interval ranging from 0.264 to 0.927, indicating a moderate to good level of reliability across all subjects. The reliability analysis for each measurement point demonstrated that Ala Nasi Point 1 and 2 had an ICC value of 0.959 (p = 0.000), indicating excellent reliability between repeated measurements. Meanwhile, Tip of Canine Point 1 and 2 showed an ICC value of 0.849 (p = 0.010), which falls within the category of good reliability.

Table 5 Normality Test Result

	dF	Sig
Lateral Ala Nasi Point	60	.200
Tip of Maxillary Canine Point	60	.001

The Kolmogorov-Smirnov test was used to evaluate the normality of the two primary variables in this study. For Lateral Ala Nasi Point, the test yielded a p-value of 0.200, which is greater than the significance threshold of 0.05. This suggests that the distribution of Lateral Ala Nasi Point is not significantly different from a normal distribution. The Midpoint of Maxillary Canine produced a p-value of 0.001, which is less than 0.05, indicating that the data is significantly different from a normal distribution.

Table 6 Homogenity Test Result

Levene Statistic	Df1	Df2	Sig.
3.825	1	118	0.053

Based on the results of the homogeneity of variances test which in this study using Levene's Test, a Levene Statistic of 3.825 was obtained with a significance value (Sig.) of 0.053. This significance value is greater than the significance level of 0.05, indicating that there is no significant difference in variances between the data groups.

Table 7 Corelation Analysis Result

Spearman's rho		Lateral Ala Nasi Point	Tip of Maxillary Canine Point
	Coefficient Sig. (2-tailed) N	1.000 . 60	0.570 0.000* 60
	Coefficient Sig. (2-tailed) N	1.000 . 60	0.570 0.000* 60
	Coefficient Sig. (2-tailed) N	1.000 . 60	0.570 0.000* 60

The Spearman's rho correlation analysis revealed a significant positive relationship with moderate strength between the Lateral Ala Nasi Point and the Midpoint of Maxillary Canine.

4. Discussion

The mean interalare distance measured 38.03 ± 2.97 mm, whilst the mean inter-canine distance measured 37.43 ± 2.36 mm, with inter-alare distance consistently larger by approximately 0.6 mm. These findings provide quantitative evidence for the anatomical relationship between facial and dental landmarks in a multi-ethnic Indonesian population and demonstrate that the research objectives were successfully achieved.

The moderate correlation strength (ρ = 0.570) indicates that approximately 32.5% of variance in inter-canine distance can be explained by inter-alare distance, suggesting that whilst a meaningful relationship exists, additional anatomical factors influence maxillary canine positioning. A positive correlation in Deutero-Malay populations, though without modern statistical quantification.[5] Similarly, documented correlation coefficients ranging from 0.52 to 0.64 in Indian populations,[10] whilst reported mean inter alare distances of 36.8 mm in Thai populations.[11] The current findings align with and extend this body of evidence by providing precise correlation values for a multiethnic Indonesian sample, demonstrating consistency across geographically distinct Asian populations. The slightly higher measurements observed may reflect ethnic variations or methodological differences between studies. These findings support and refine existing anatomical theories suggesting that nasal width can serve as a predictor for maxillary canine position, whilst extending current knowledge to multi-ethnic Indonesian populations.

The observed correlation reflects coordinated craniofacial development, as both nasal ala and maxillary canines relate to maxillary complex transverse dimensions that undergo synchronized growth. Significant correlations (r = 0.58) between nasal width and maxillary bone dimensions using three-dimensional computed tomography in Korean subjects,[12]. Furthermore, another research demonstrated that the levator labii superioris alaeque nasi muscle creates functional continuity between the nasal ala region and perioral tissues overlying the maxillary canine area.[13]

Normality testing revealed differential distribution patterns between the two primary variables, with inter-alare distance following normal distribution (p = 0.200) whilst inter-canine distance exhibited non-normal distribution (p = 0.001). This divergence reflects fundamental differences between soft tissue and hard tissue measurement properties. Soft tissue craniofacial landmarks exhibit more consistent morphology compared to hard tissue structures, which show greater individual variation due to developmental and environmental influences.[14] The inter-alare distance represents a soft tissue measurement determined primarily by alar cartilages and overlying skin, structures demonstrating relatively uniform morphology due to genetic determination. Conversely, inter-canine distance represents a dental landmark influenced by multiple factors including maxillary arch morphology, dental eruption patterns, and occlusal forces. Dental measurements frequently exhibit non-normal distributions due to individual developmental patterns and ethnic craniofacial variation.[15] The multi-ethnic composition of the current study population further contributes to heterogeneous distribution. Substantial tooth morphology variability across ethnic groups, with dental structures showing marked morphological heterogeneity compared to soft tissue landmarks.[16]

This deviation from normality reflects genuine anatomical heterogeneity rather than measurement error, as confirmed by acceptable intra-examiner reliability (ICC = 0.640), and supports the methodological decision to employ Spearman rank correlation. Although gender distribution was controlled in this study, previous literature indicates that males typically exhibit greater inter-alar and inter-canine dimensions due to larger facial morphology and more prominent canine structures. Exploring these sex-based differences in future research may enhance understanding of craniofacial sexual dimorphism and improve the precision of population-specific prosthodontic guidelines.

The study population demonstrated substantial ethnic diversity, with 48.3% identifying as Javanese and the remainder representing 16 different ethnic backgrounds or mixed ethnicities, reflecting Indonesia's multi-ethnic demographic composition following increased interracial marriages post.[4] The detection of significant correlations despite this heterogeneity suggests that the inter-alare to inter-canine relationship transcends specific ethnic boundaries within Indonesian populations. Mean inter-alare distances of 37.4 ± 3.2 mm in Malay adults,[17] closely aligning with current findings. These findings support developing universal prosthodontic guidelines adaptable to population-specific mean values, providing clinically relevant biometric data for Indonesia's diverse demographic whilst acknowledging that absolute measurements require population-specific calibration. The demonstrated correlation provides practical guidelines for maxillary anterior tooth positioning in prosthodontic rehabilitation, particularly for edentulous patients lacking intraoral references.

The alare point offers an accessible, non-invasive external landmark for estimating appropriate canine positions.[18]·[19] However, the moderate correlation strength indicates that inter-alare measurements should form one component of comprehensive assessment rather than serving as sole determinants.[20] Digital prosthodontic workflows increasingly incorporate three-dimensional facial scanning and computer-aided design. By incorporating

facial scan data into CAD/CAM denture design reduced clinical adjustment time by 40% and improved patient satisfaction by 28%.[21] Comprehensive digital protocols integrating multiple data sources for improved anterior tooth positioning accuracy.[22] These findings provide foundational biometric data that can be integrated into AI-assisted digital denture design systems for more individualised treatment planning, supporting the continued evolution of evidence-based prosthodontic practice.

The acceptable intra-examiner reliability (ICC = 0.640) confirms that observed variation stems primarily from biological rather than measurement error. The two-week test-retest interval for optimizing reliability assessment,[23] whilst the reliability subsample of 6 participants (10%) aligned with guidelines by Mondal et al for adequate ICC estimation precision.[24] The methodological rigour of single-examiner measurements using digital callipers with 0.01 mm precision further strengthens confidence that distributional characteristics reflect genuine biological variation rather than methodological artifacts.

5. Conclusion

This study successfully established a statistically significant positive correlation between the lateral ala nasi point and the midpoint of the maxillary canine in a multi-ethnic Indonesian population at the Faculty of Dental Medicine, Universitas Airlangga. The correlation remained statistically significant despite ethnic diversity, suggesting this anatomical relationship transcends specific ethnic boundaries within Indonesian populations. These findings demonstrate that interalare measurement can serve as a practical, non-invasive external facial landmark for estimating maxillary canine positioning in prosthodontic rehabilitation, particularly for edentulous patients, though it should be used as part of comprehensive facial assessment rather than as a sole determinant, supporting contemporary prosthodontic principles emphasizing multifactorial approaches balancing aesthetic, functional, and phonetic considerations.

Further research is required with larger and more diverse samples stratified by specific ethnic groups across various Indonesian to enable subgroup analysis and establish comprehensive national reference data that accurately represents regional variations. Similar research employing more advanced analytical methods is necessary, including three-dimensional imaging modalities such as conebeam computed tomography (CBCT) or three-dimensional facial scanning, to improve accuracy of measurements.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest declared by authors in this study.

Statement of informed consent

Informed consent was obtained from all individual participants included in this study

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