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Sella Turcica and Nasal Aesthetics: A Lateral Cephalometric Cross- Sectional Study

Ali Rokia

aliandalus2017@gmail.com

Al- andalus University for Medical Sciences

Mouetaz Kheirallah

Al- andalus University for Medical Sciences

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Abstract

Background: The sella turcica is a crucial neurocranial landmark sharing a close embryological origin with the nasomaxillary complex. While its role in craniofacial growth is established, its direct morphometric correlation with external nasal aesthetics remains poorly understood.

Objective: To evaluate the correlation between the digital structural dimensions of the sella turcica and the specific linear and angular cephalometric variables determining soft-tissue nasal aesthetics and projection in adult patients.

Materials and Methods: This study analyzed 90 pre-treatment lateral cephalometric radiographs of systemically healthy adult patients (45 males, mean age: 20.5 ± 2.8 years; 45 females, mean age: 21.4 ± 2.6 years) presenting with Skeletal Class I malocclusion and a normodivergent growth pattern. Digital tracing and calibration were executed using MicroDicom software. Sella dimensions (length, depth, diameter) and soft-tissue nasal parameters (length, depth, projection angle, bone length, nasolabial angle) were measured. Blinding protocols were strictly implemented. Statistical analyses were performed using Pearson correlation coefficients, with significance set at $P < 0.05$.

Results: A highly significant, positive correlation was identified between soft-tissue nasal length and all sella turcica dimensions across the total sample, presenting with greater statistical strength in females than in males ($P < 0.001$). Sella depth maintained the strongest overall association with external nasal length ($r = 0.695$, $P < 0.001$). Conversely, no statistically significant correlations were found between any of the sella turcica dimensions and nasal projection angle, nasolabial angle, or nasal bone length ($P > 0.05$). A weak but significant positive correlation was exclusively observed between sella length and nasal depth ($r = 0.262$, $P = 0.013$).

Conclusion: Internal sella turcica dimensions serve as significant indicators of soft-tissue nasal length, reflecting a synchronized vertical developmental pathway between the cranial base and the midface. In contrast, external features governing sagittal projection, nasal bone length, and the nasolabial angle operate as morphologically and aesthetically independent traits. These findings offer valuable diagnostic insights for orthodontists and orthognathic surgeons during vertical facial treatment planning.

INTRODUCTION

The sella turcica is among the most widely used neurocranial landmarks in orthodontics and cephalometric diagnostics. Its geometric center, designated as the sella point (S), provides a stable reference for assessing craniofacial growth, skeletal morphology, and sagittal jaw relationships relative to the overlying soft tissues [1]. Anatomically, this bony fossa houses the pituitary gland, bounded by the tuberculum sellae anteriorly and the dorsum sellae posteriorly [2]. Because the cranial base and the nasomaxillary complex share a close embryological origin driven by neural crest cell migration, dimensional variations in the sella turcica (length, depth, and diameter) often serve as early indicators of underlying skeletal discrepancies [3, 4]. This developmental synchronization implies that structural

variations within the cranial base may visibly influence the phenotype of overlying soft tissues, particularly the nose, which develops in close chronological coordination with the midface [4].

From a clinical standpoint, nasal morphology heavily dictates overall facial attractiveness [5]. While early investigations by Jones et al. and Merdink et al. underscored the aesthetic importance of the nose [6, 7], a direct relationship exists between nasal prominence and the perceived beauty of the face, explaining why rhinoplasty remains a highly sought-after procedure [8]. Additionally, the nose acts as a highly sensitive indicator of facial asymmetry; due to its prominent, central position, even a slight midline deviation of the nasal tip can easily create an illusion of global facial asymmetry [9, 10].

The shape of the ideal nose varies significantly depending on genetic backgrounds, ethnic origins, and gender, with the nasal bridge ranging from straight to convex or concave profiles [11,12 ,13] . Achieving balanced facial aesthetics requires a harmonious relationship between these soft tissue contours and the underlying skeleton, traditionally evaluated through parameters like the nasolabial angle and supratip break [11, 14, 15 ,16]. Two-dimensional (2D) lateral radiography remains the gold standard for cephalometric analysis, and consequently, most available data regarding cranial and soft-tissue morphology are based on 2D imaging [17]. Nevertheless, the direct morphometric correlation between the internal boundaries of the sella turcica and external nasal aesthetics is not yet well established.

To address this specific question, the present study evaluates how the structural dimensions of the sella turcica correlate with the cephalometric variables defining nasal aesthetics and projection. By analyzing pre-treatment lateral cephalograms of adult patients, we aim to identify potential anatomical associations that could help clinicians refine treatment planning and optimize profile outcomes.

MATERIAL and METHODS

2.1 Ethical Considerations

The study protocol was reviewed and officially approved by the Institutional Review Board (IRB) of the Faculty of Dentistry at Al-Andalus University for Medical Sciences (Approval No. 12/19, date: July 26, 2026). Due to the retrospective nature of this investigation utilizing archived, de-identified radiographic records, the requirement for individual patient informed consent was waived by the committee. All procedures were conducted in strict accordance with the ethical principles outlined in the Declaration of Helsinki. Patient confidentiality was rigorously protected throughout the study by replacing all personal identifiers with randomized alphanumeric codes.

2.2 Radiographic Material and Image Acquisition

This retrospective cross-sectional study analyzed 90 lateral cephalometric radiographs from patients aged 16 to 26 years. The sample included an equal distribution of 45 males (mean age: 20.5 ± 2.8 years) and 45 females (mean age: 21.4 ± 2.6 years), randomly selected from the radiographic archives of the Radiology Department at the College of Dentistry, .

To eliminate measurement variations and ensure a uniform magnification factor, all cephalograms were captured at a single center by an experienced radiographer using the same equipment (*Cranex D digital cephalometric X-ray unit, Version 3*). Standardized patient positioning and head stabilization were strictly maintained during acquisition, and only images demonstrating exceptional structural clarity of the sella turcica alongside the relevant nasal and facial landmarks were included for analysis.

2.3 Sample Size Calculation

An a priori sample size calculation was performed using G*Power software (*version 3.1.9.7; Heinrich Heine University Düsseldorf, Germany*). Based on pilot study data, we evaluated the Pearson correlation and coefficients of determination (R^2) between nasal length (in millimeters) and sella turcica dimensions. Setting the significance level (alpha) at 0.05 and the statistical power (beta) at 95%, with an observed coefficient of determination of 0.420 and an effect size of 0.65, the analysis indicated a minimum required sample of 21 participants. To strengthen statistical power and compensate for any unforeseen data attrition, this baseline was expanded by 24 subjects. This resulted in a balanced allocation of 45 male and 45 female patients, establishing a final cohort of 90 individuals. Ultimately, no datasets required exclusion during the final analysis.

2.4 Distribution of the Study Sample

A stratified random sampling technique was utilized to select eligible radiographs from the archives. The total pool was divided based on patient gender into male and female strata, followed by the application of a digital randomization tool to each group independently. This selection protocol generated a consecutive series of 45 male and 45 female cephalograms that strictly fulfilled the predetermined inclusion criteria. This approach effectively minimized selection bias and secured an identical gender distribution across the study cohort.

2.5 Inclusion and Exclusion Criteria

The study included systemically healthy individuals aged 16 to 26 years, a timeframe chosen because the dimensions and shape of the sella turcica remain highly stable without significant physiological changes [3]. Skeletal inclusion was restricted to Class I malocclusion (ANB angle = ±2°) exhibiting a normodivergent growth configuration (SN–MP: 30°–35°; FH–MP: 21°–28°). Additionally, candidate radiographs were strictly screened for excellent visibility of all relevant cephalometric and soft tissue nasal landmarks, proper positioning in a natural head posture (NHP), and occlusal contact in maximum intercuspation.

Patients were excluded if they had undergone previous orthodontic treatment, orthognathic surgery, cosmetic facial surgery, rhinoplasty, or experienced oral and facial trauma. Finally, the presence of congenital craniofacial anomalies or skeletal Class II and Class III discrepancies served as grounds for immediate exclusion.

2.6 Blinding Protocol

To minimize potential investigator bias during image analysis, a blinded outcome assessment was maintained. An independent physician, who was completely unaffiliated with the study, removed all

patient names, genders, and demographic identifiers from the radiographic records. These files were subsequently replaced with randomized, coded numbers prior to evaluation. Furthermore, the examining investigator remained completely unaware of the study's specific aims and hypotheses. Demographics and clinical groupings were withheld and only disclosed after the statistical analysis phase had commenced.

2.7 Cephalometric Tracing and Variables Measurement

All digital radiographs were imported into the MicroDicom software (Version 3.1) for landmark identification and measurement. Digital calibration was established for each image using the built-in 10 mm frontal ruler to convert pixels into absolute millimeter values. Following calibration, the primary investigator identified the specific neurocranial and nasal landmarks to calculate the required linear dimensions and angular variables (Tab.1, Fig.1).

Table 1 Cephalometric landmarks and variables measurment in the study]18, 19[.

Landmarks and variables measurement	Identity	Definition
soft tissue Nasion	N′	The deepest point of the concavity overlying the nasofrontal suture.
Nasion	N	The most anterior point on the frontonasal suture.
soft tissue Glabella	G′	The most prominent or anterior point on the midsagittal plane of the forehead, at the level of the supraorbital ridge.
Pronasale	Pn’	The most prominent or frontal point on the tip of the nose.
Tuberculm	TS	anteriorly tuberculum sellae.
Dorsum Sealle	DS	posterior dorsum sellae.
SubNasale	Sn’	The point located at the junction of the lower edge of the nose and the beginning of the upper lip, in the midsagittal plane.
Columella	CM	The most prominent point on the bridge of the nose.
Labrale Superior	Ls’	The most anterior point on the margin of the upper membranous lip.
Rhinion	R	The most prominent and inferior point on the nasal bone.
Sella turcica center	S	The midpoint of the horizontal diameter of the pituitary fossa.
Pogonion	Pog′	The most prominent or anterior point on the soft tissue of the chin in the midsagittal plane.
St (mm)	sella turcica length	as the distance between the dorsum sellae and tuberculum sellae.
St (mm)	sella turcica depth	measured as the perpendicular distance from the line connecting the dorsum and tuberculum sellae to the deepest point of the sellar floor.
St (mm)	sella turcica diameter	was measured as the distance from the tuberculum sellae to the posterior-most point of the posterior wall.
N’–Pr (mm)	Nasal length	Distance between the N’ point and the Pr Point.
Nose depth (mm)	Nose depth	Perpendicular distance between Pr and the N’-Sn line.
NboneL (mm)	Nasal bone length	The line constructed between the N point and the R point.
NLA (°)	Nasolabial angle	The angle formed between the SN-CM line and the Sn-Ls line.

NTP (°)	Tip projection	The nasofacial angle formed by the intersection of the N'–Pr line and the G–Pog' line.

2.8 Methodological Error and Reliability Analysis

To evaluate intra-examiner reliability and measurement reproducibility, twenty lateral cephalograms were randomly selected from the original pool and re-measured by the primary investigator after a two-week interval. The systematic error between the first and second registrations was assessed using a paired t-test, while the random error was calculated via Dahlberg's formula. Additionally, the Intraclass Correlation Coefficient (ICC) was computed to determine the degree of agreement between the two sets of measurements. The ICC values for all linear and angular variables approached 1.0 (ranging from [0.997] to [1.000]), and the paired t-test revealed no statistically significant differences ($P > 0.05$) between the twin sessions. These indices confirmed a high level of stability, precision, and reproducibility for all tracked landmarks.

STATISTICAL ANALYSIS

Data analysis was performed using SPSS software (*Version 20.0; IBM Corp., Chicago, IL, USA*). The normality of the data distribution was assessed and confirmed using the Kolmogorov-Smirnov test, justifying the application of parametric statistical methods. To evaluate the strength and direction of the linear relationships between the sella turcica dimensions and the measured nasal aesthetic variables, Pearson correlation coefficients (r) were calculated. For all statistical tests, the significance threshold was established at a P-value of less than 0.05.

RESULTS

This study analyzed a sample of 90 lateral cephalometric radiographs, consisting of an equal distribution of genders (50% female and 50% male) aged 16 to 26 years, with an overall mean age of 20.9 ± 2.7 years. The baseline descriptive statistics, including the means and standard deviations (SD) for all surveyed neurocranial and nasal soft-tissue variables, are summarized in Table 2. Regarding the morphometric dimensions of the sella turcica, the cohort exhibited a mean length of 9.89 ± 2.61 mm, a mean depth of 7.71 ± 2.13 mm, and a maximum anteroposterior diameter of 11.76 ± 2.79 mm. For the external nasal parameters, the mean values recorded for nasal length, nasal projection angle, and nasal depth were 52.01 ± 10.68 mm, 32.38° ± 5.51°, and 23.69 ± 3.88 mm, respectively. Additionally, the study sample demonstrated a mean nasolabial angle of 103.36° ± 12.55° and a mean nasal bone length of 25.20 ± 4.75 mm. The Pearson correlation analysis revealed statistically significant, positive relationships between all investigated sella turcica dimensions and soft-tissue nasal length across both genders and the total sample (Table 3). For sella length, a moderate positive correlation was observed in males ($r = 0.426$, $P = 0.004$), which strengthened to a strong positive correlation in the female subgroup ($r = 0.635$, $P < 0.001$). Notably, sella depth and diameter demonstrated consistently strong positive correlations with nasal length. Sella depth achieved high significance in both males ($r = 0.648$, $P < 0.001$) and females ($r = 0.740$, $P < 0.001$). Similarly, the maximum anteroposterior diameter of the sella turcica exhibited a robust correlation with nasal length, particularly among female participants, where it reached

its highest value (r = 0.799, P < 0.001) compared to males (r = 0.550, P < 0.001). When analyzing the total sample (N = 90), sella depth maintained the strongest overall association with external nasal length (r = 0.695, P < 0.001).

The Pearson correlation parameters assessing the relationships between sella turcica dimensions and the remaining soft-tissue nasal variables are presented in Table 4. Overall, the analysis demonstrated a general absence of statistically significant associations across most tested variables, with one notable exception. A weak but statistically significant positive correlation was identified between sella turcica length and external nasal depth (r = 0.262, P = 0.013). Conversely, sella depth and diameter showed no significant correlation with nasal depth (P > 0.05). Furthermore, no statistically significant linear or angular relationships were established between any of the sella turcica parameters (length, depth, and diameter) and the nasal projection angle, nasolabial angle, or nasal bone length. All corresponding correlation coefficients approached zero, with (P)-values ranging from 0.107 to as high as 0.946, confirming that variations in internal sella turcica morphology do not fundamentally reflect changes in these specific external aesthetic and angular features.

Table 2: Descriptive statistics (means and standard deviations) for the sella turcica dimensions and soft-tissue nasal parameters of the total study sample (N = 90).

Sella turcica Variables	N	Mean	SD
length	90	9.89	2.61
depth	90	7.71	2.13
diameter	90	11.76	2.79
Nasal length	90	52.01	10.68
Nasal projection angle	90	32.38	5.51
Nasal depth	90	23.69	3.88
Nasolabial Angel	90	103.36	12.55
Nasal bone length	90	25.20	4.75

Table 3: Pearson correlation coefficients between sella turcica dimensions and nasal length, stratified by gender and the total sample.

ellaS turcica	Gender	Nose length			Existence of a correlation	Strength of the relationship
		Pearson correlation (r)coefficient	N	P Value		
Length	male	0.426	45	0.004	Yes	*
	female	0.635	45	0.000	Yes	**
	all	0.551	90	0.000	Yes	**
Depth	male	0.648	45	0.000	Yes	***
	female	0.740	45	0.000	Yes	***
	all	0.695	90	0.000	Yes	***
diameter	male	0.550	45	0.000	Yes	***
	female	0.799	45	0.000	Yes	***
	all	0.683	90	0.000	Yes	***

*, ** Correlation is significant at the 0.01 level; *** Correlation is significant at the 0.001 level.

Table 4 Pearson correlation coefficients (r) between sella turcica dimensions and soft-tissue nasal aesthetic variables for the total sample (N = 90).

sVariable	ellaS turcica	N	Pearson correlation coefficient	P Value	Existence of a correlation
Nasal projection angle	length	90	-0.007	0.946	No
	depth	90	-0.120	0.260	No
	diameter	90	-0.171	0.107	No
Nasal Depth	length	90	0.262	0.013*	Yes
	depth	90	0.165	0.120	No
	diameter	90	0.171	0.107	No
Nasolabial angel	length	90	-0.082	0.441	No
	depth	90	-0.049	0.644	No
	diameter	90	-0.016	0.879	No
Nasal bone length	length	90	0.087	0.416	No
	depth	90	0.064	0.551	No
	diameter	90	0.072	0.500	No

* Correlation is statistically significant at the 0.05 level.

DISCUSSION

This study evaluated the morphometric relationships between internal sella turcica dimensions (length, depth, and maximum anteroposterior diameter) and external soft tissue nasal parameters, specifically nasal length, depth, projection, nasal bone length, and the nasolabial angle, in an adult population with no prior orthodontic treatment history. By restricting the study cohort to individuals presenting with a skeletal Class I relationship, a normodivergent growth configuration, and a balanced gender distribution, this investigation minimized confounding skeletal variables to isolate true baseline anatomical correlations. While various historical studies have evaluated the relationship between the sella turcica or nasal dimensions across Class I, II, and III malocclusions separately, a direct, isolated mapping between specific internal sella turcica dimensions and external nasal measurements remains scarcely documented.

The primary finding of this investigation revealed highly significant, positive correlations between external nasal length and all internal sella turcica dimensions across the entire sample. Notably, this structural relationship manifested with greater statistical strength in female subjects than in males ($P < 0.001$). Clinically, this positive correlation indicates that an increase in the volumetric parameters of the sella turcica directly corresponds to an increase in soft tissue nasal length. These findings strongly support our initial hypothesis that a normodivergent Class I skeletal framework fosters a highly synchronized and balanced growth pattern between the deep cranial base and midfacial development.

Our outcomes contrast with those of Prasad et al., who examined the correlation between nasal length and sagittal skeletal parameters and reported a weak, statistically non-significant positive correlation with the SNA angle, alongside similar non-significant vertical findings [20]. This discrepancy may be attributed to an unbalanced gender distribution within their sample. Furthermore, while Jahanbakhsh et al. [21] demonstrated that general nasal shape is heavily influenced by sagittal skeletal classifications, Zamanipour et al. observed that sella turcica dimensions themselves are not significantly affected by skeletal patterns or gender. The lack of demographic variation reported by Zamanipour et al. might stem from their heavily gender-unbalanced sample (predominantly female) and an excessively broad age spectrum spanning from 18 to 70 years, which likely masked transitional growth traits [22] .

From an embryological and anatomical perspective, the strong vertical association ($P < 0.001$) identified in our study underscores a profound growth proportionality within the craniofacial complex]1, 22 [. Both the sella turcica and the nasomaxillary complex originate from embryonic neural crest cells. The sella turcica occupies the actual geometric center of the middle cranial base (point S)] 1, 22, 23 [. Conversely, the ultimate clinical shape and structure of the nose depend on an intricate assembly of bone and cartilage components, all varying in size, contour, and mutual spatial relationships [24]. The cartilaginous nasal septum plays an imperative role not only in localized nasal development but also in the global downward and forward displacement of the upper jaw]25[. This aligns with Scott’s classic hypothesis,

supported by Babula et al., that the cartilaginous nasal septum acts as a primary pacemaking growth center pushing the midface forward and downward, without necessarily demonstrating structural or timing differences at the immediate skull base]26[.

In contrast, the overall sample analysis showed a complete absence of statistically significant correlations between sella turcica dimensions and either nasal bone length, nasal projection angle, or the nasolabial angle ($P > 0.05$). The only notable correlation observed within these parameters was a weak but statistically significant positive relationship between sella length and nasal depth ($r = 0.262$, $P = 0.013$), whereas sella depth and diameter remained entirely independent of nasal depth metrics. This lack of generalized correlation, both sagitally and regionally, can be scientifically explained by the fact that nasal projection, soft-tissue depth, and nasal bone length are localized phenotypic features. These features are subject to distinct regional genetic influences and the localized functional matrix of neuromuscular and soft tissue sheaths.

This independent development aligns perfectly with classic longitudinal studies showing that the external nose, including its soft tissues and sagittal projection, continues to mature long after structural ossification at the skull base has ceased. Furthermore, facial soft tissues exhibit distinct growth rates and timing, and do not grow in direct proportion to their underlying skeletal components. Consequently, the lack of strong associations observed here matches the findings of Genecov et al., who reported no significant relationship between the degree of external nasal development and sagittal skeletal classification, demonstrating that nasal soft tissue maturation operates relatively independent of underlying hard tissues [27].

Our findings regarding nasal bone length match the outcomes of Chen et al., who established no definitive correlation between nasal bone length and Class I malocclusions]28[. However, our observation regarding the independence of nasal bone length from sella dimensions stands in contrast to Cutović et al., who observed correlated increases in sella boundaries and nasal bone measurements alongside mandibular elongation. This divergence is likely attributable to methodological factors; Cutović et al. [29] relied on a small sample (fewer than 60 patients) consisting exclusively of skeletal Class III malocclusion cases, where mandibular overgrowth triggers distinct skeletal compensatory responses that alter typical hard tissue ratios.

Regarding nasal depth, our data showed no significant correlation with sella depth or diameter. The weak but significant positive association found exclusively with sella length ($P = 0.013$) aligns partially with Chaconas, who observed that nasal depth variations do not strictly follow sagittal skeletal growth vectors]30[. This is further supported by Azizi et al., who concluded that nasal depth does not significantly differ among Class I, II, and III sagittal patterns. This localized growth independence is scientifically explained by the fact that the samples included in our study cover ages starting from 16 years, whereas nasal depth undergoes its most aggressive expansion beginning at six months of age due to localized nasal cartilage development, a process that typically ceases by age fifteen]31[.

Nasal tip projection, evaluated via the nasofacial angle, showed no linear correlation with any sella turcica variables regardless of gender (P > 0.05), maintaining a stable mean sample value of 32.38° ± 5.51°. This outcome differed from Perović et al., who found that the nasofacial angle is significantly influenced by skeletal patterns across Class I, II, and III cases. This discrepancy may be attributed to their larger multi classification sample size and their focus on inter maxillary discrepancies rather than a single stable skeletal category]32[.

Similarly, the nasolabial angle demonstrated no linear correlation with any sella turcica variables across both genders (P > 0.05). Our outcomes are consistent with Prasad et al., who reported It was found that the nasolabial angle was larger in females than in males; this difference might be attributed to the larger sample size and the fact that there were more females than males]20[. While Aljabaa et al. [33] found that the nasolabial angle was significantly larger in females than in males, our results did not replicate this gender dimorphism. This divergence can be accounted for by Aljabaa's reliance on manual cephalometric tracing and a smaller cohort size, which inherently introduces greater measurement variance. Anatomically, the nasolabial angle is directly influenced by localized soft tissue factors, including upper lip thickness, the inclination of the maxillary anterior teeth, and the termination of the inferior nasal cartilage, landmarks far removed from the direct skeletal influence of the deep cranial base.

Strengths and Limitations

A major strength of the current investigation lies in its rigorous methodological design. The utilization of a strictly gender balanced cohort (N = 90), combined with the application of an advanced digital tracing platform (MicroDicom) and a robust blinding protocol, effectively eliminated examiner bias and minimized systematic errors. However, a notable limitation is the reliance on two-dimensional (2D) lateral cephalometric radiography. While 2D imaging remains a highly reliable clinical standard, it lacks the volumetric capability to evaluate three-dimensional transverse dimensions, which could be further explored using Cone-Beam Computed Tomography (CBCT) in future multi center trials across different malocclusion categories.

CONCLUSION

In conclusion, the findings of this study establish that internal sella turcica dimensions can serve as valuable indicators of soft tissue nasal length, a relationship heavily underpinned by their shared vertical craniofacial growth patterns. In contrast, external features governing sagittal projection, nasal depth, nasal bone length, and the nasolabial angle operate as morphologically and aesthetically independent traits. From a clinical standpoint, orthodontists and orthognathic surgeons are encouraged to incorporate sella turcica parameters into vertical facial diagnostic planning. Furthermore, subsequent investigations should explore whether these anatomical correlations undergo phenotypic alterations across distinct skeletal malocclusion classifications (Classes II and III).

Declarations

Ethical approval

The study protocol was reviewed and officially approved by the Institutional Review Board (IRB) of the Faculty of Dentistry at Al-Andalus University for Medical Sciences (Approval No. 12/19, date: July 26, 2026).

Declaration of patient consent

Due to the retrospective nature of this study utilizing archived, completely de-identified radiographic records, the requirement for individual written informed consent was officially waived by the Institutional Review Board (IRB). Patient confidentiality was strictly maintained throughout the investigation in accordance with the Declaration of Helsinki.

Consent for publication

not applicable

Availability of data and materials

The data used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests

The authors declare no competing interests.

Funding

The authors declare no financial support.

Authors' contributions

Ali Rokia performed methodology, data statistics, and conceptualization, and wrote the original draft. Mouetaz Kheirallah performed project administration, supervision, validation, visualization, tables and figures, interpretation of statistical data, and review of it.

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Figures

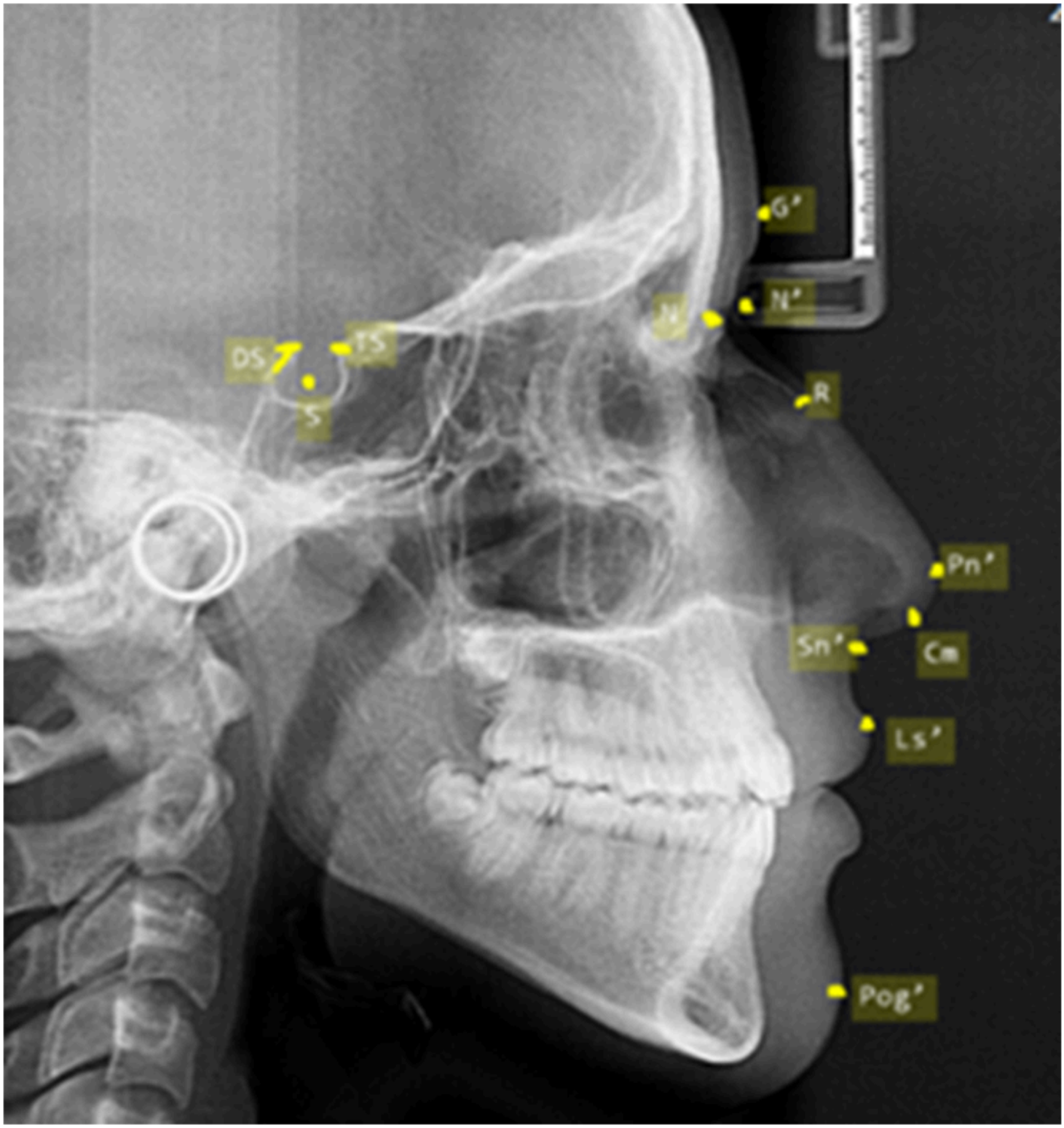


Figure 1

The cephalometric anatomical landmarks including the nasal region and the sella turcica analyzed using MicroDicom software.