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The relationship between posterior septum deviation and depth of maxillopalatal arch

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ABSTRACT

Objective: To investigate the relationship between depth of maxillopalatal arch and deviation of posterior septum.
Methods: This study is based on paranasal sinus CT (PNSCT) scan in the coronal plane evaluation, and sinus paranasal scans were obtained from the database. One-hundred and fifty PNSCT scans were randomly chosen among the PNSCT scans which belong to adult (18 and older) patients. All scans were divided to three different groups. The first group constituted by those patients who had more convex deviation. The second group had those patients with either crest or spur deviations. The last group (control group) had no septum deviation. The data collected from each group were statistically compared. Exclusion criteria: CT imaging which has a chronic sinusitis, nasal cavity mass, and nasal polyps. Main outcome measures: angle and distance measures were taken on maxillopalatal arch and posterior nasal septum.
Results: Strongly positive correlation between posterior septum deviation and depth of maxillopalatal arch was determined ($r = 0.479$, $p = 0.001$).
Conclusion: These findings suggest that posterior septum deviations are considered as a result of increase in maxillopalatal depth.

1. Introduction

Septal deviation has been classified and quantified in several ways. Cottle et al. classified them into four types: large spur, subluxation, caudal deflection, and tension septum [1]. Buyukertan et al. classified them by separating the nasal septum into 10 segments to better localize the deformity [2]. Kawalski et al. classified deviations as anterior, posterior, and antero-posterior [3]. In this study, we classified the deviations as anterior and posterior. Many studies showed that isolated anterior septum deviation was related to trauma. In this study, we considered the possibility of occurrence of posterior septum deviations based on developmental process and we also discussed posterior deviations.

1.1. Hypothesis

Crest/spur deviations of septum might be traumatic; therefore, morphometry of palate resembles those of normal septums. Regarding larger convex deviations, it is considered that morphometry of palate might be more arched than those of normal septums.

1.2. Aim

The purpose of planning this study was investigation of whether this hypothesis was true. Therefore, three groups were created (convex, spur/crests and normal nasal septum) and correlation between septal deviation degree and palatal convexity for each group was investigated. Existence of an angle on perpendicular plate stated the difference between convex and spur/crest deviations.

2. Material and methods

2.1. CT image study

This article is based on paranasal sinus CT evaluation from the database of University Hospital. All patients underwent sinus CT scan in the coronal plane. All the relative screenings of the patients were conducted in the same clinic using the same devices. CT scans were performed by a Toshiba Aquilion64®, Japan system at 120 kV and 75 mA with 5 mm intervals and a gantry tilt, a 2 s time and in the coronal plane (bone window: WW = 2700, WL = 350).

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2.2. Data collection

Some inclusion criteria were used to identify studies for this article. All data were randomly selected among the images of patients who are at least 18 years old. PNSCT with chronic sinusitis and nasal polyps or other nasal cavity mass are excluded. Three groups were created, and total of 150 different PNSCT (50 PNSCT from each group) were examined. The first group consisted of the patients who have convex deviation as severe as causing an angle on perpendicular plate. The second group included the patients who have either crest or spur style deviations which do not block nasal passage, do not cause an internal angle between perpendicular plate and septum, and do not cause displacement on vomer. The third group is constituted by the patients who do not have any septum deviations at all.

Measurements were taken on pre-determined standard points on coronal plane. On the other hand, on sagittal plane, the vertical line from the midpoint of lamina cribrosa of ethmoid bone to maxillopalatal bone was taken as the base. Since, in the PNSCT images that were examined pre-study, posteriors and great majority of deviations were seen in this line; we have taken this point as the reference. We performed some measurements on the coronal plane images going through these points. Then, we have statistically compared the results of the measurements.

2.3. Definition of length and angle for measurement

In order to perform measurements; following points, distances, and angles were defined on coronal plane computed tomography (Fig. 1):

(1) Palatal interalveolar length (PIL): Top-view length of the line from one side's merging point of enamel and gingiva on alveolar arch to the same point of the other side's alveolar arch.
(2) Palatal arch depth (PAD): The length of the line from intersection of hard palates to the inter-alveolar line.
(3) Maxillopalatal arch angle (MPAA): The angle which is formed by the lines from the interpalatal's mergence point to the both mergence points of enamel–gingiva of alveolar arches.
(4) Septal vertical length (SVL): Top-view distance of septum drawn from the mid-point of cribrosa to maxillary crest.
(5) Deviated septal length (DSL): The length of the horizontal line from the highest point of deviated septum to vertical axis where septum is supposed to be.
(6) Deviated septal curve angle (DSCA): Taking the highest point of deviated septum as an edge, the obtuse angle drawn from this edge point; to the mergence point of perpendicular plate and lamina cribrosa (superior); and to the maxillary crest (inferior).
(7) Palatal arch depth/palatal inter-alveolar length (PAD/PIL): The ratio of hard palate depth to the inter-alveolar length.

2.4. Statistical analysis

On statistically analysis, ANOVA was used for comparing the three groups; in addition, Tukey (Post hoc) test was used to compare the subgroups. While Chi-square test was used for sex-based variables; Pearson correlation test was used to compare the ratio of forming either palatal or septal angles. A "p" value of less than 0.05 was accepted as statistically significant.

3. Results

Average age of the first group with large convex deviation sample is 28.02 ± 10.43 (min. 19–max. 83). The first group sample included 36 (72%) males and 14 (28%) females. Average age of the second group which consists of crest/spur style deviation sample is 34.70 ± 18.21 (min. 19–max. 79). This group sample had 34 (68%) males and 16 (32%) females. Average age of the control group which does not contain deviations is found as 37.02 ± 16.07 (min. 19–max. 66). The control group sample was constituted by 23 (46%) males and 27 (54%) females.

Table 1
Mean, minimum and maximum, and standard deviation values of the data for all three groups.

Length angle	Groups	Mean	Std. dev.	Min.	Max.
PAD/PIL (percent)	Group I	0.47	0.08	0.32	0.66
	Group II	0.30	0.04	0.21	0.40
	Group III	0.30	0.04	0.18	0.45
SVL (mm.)	Group I	43.72	2.57	39.31	49.60
	Group II	46.38	3.83	38.43	57.53
	Group III	46.56	2.59	40.44	54.81
DSL (mm.)	Group I	7.38	2.29	4.22	15.83
	Group II	6.40	1.85	3.18	12.76
	Group III	0.00	0.00	0.00	0.00
MPAA (°)	Group I	90.55	7.95	72.40	117.30
	Group II	106.75	8.49	81.30	128.70
	Group III	110.04	9.78	91.00	142.10
PIL (mm.)	Group I	31.45	4.33	20.61	40.71
	Group II	33.48	3.37	25.31	38.84
	Group III	32.98	3.75	27.68	41.27
PAD (mm.)	Group I	14.58	2.19	9.45	18.57
	Group II	10.00	1.51	6.80	13.44
	Group III	9.87	1.65	6.91	13.51
DSCA (°)	Group I	145.54	11.28	103.10	156.90
	Group II	150.53	12.14	122.40	170.20
	Group III	180.00	0.00	180.00	180.00

While SVL values were found similarly in the 2nd and 3rd groups, it was significantly shorter in the 1st group ($p < 0.05$) (Table 1). Similarly; MPAA value for the 1st group (90.55 ± 7.95°; min. 72.4°–max. 117.3°) was found significantly narrower than the 2nd (106.75 ± 8.49°; min. 81.3°–max. 128.7°) and 3rd (110.04 ± 9.78; min. 91.0°–max. 142.10°) groups (Figs. 1–3). Although, significantly angle reduction was seen in the 2nd group compared to the normal septum; this narrowing was more obvious for the 1st group. Ratio of palatal angle formation (PAD divided by PIL) was found significantly higher in the 1st group (0.47 ± 0.09) than the 2nd (0.30 ± 0.05) and 3rd (0.30 ± 0.05) groups ($p < 0.05$). When this ratio determined via Post hoc Tukey analysis, the ratio was close for the 2nd and the normal septum groups. These findings showed that while maxillopalatal curvature was nearly close to normal for crest/

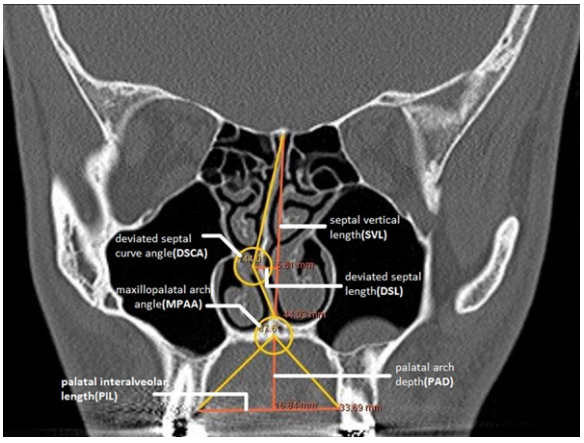

Fig. 1. Presentation of terminological terms, which were taken as basis for measurement, on a PNSCT with wide-convex deviation.