Nose morphology in individuals with Angle Class I, Class II or Class III occlusions

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The intention of this work was to describe the nose morphology in individuals with different craniofacial patterns which dentally were characterized by Angle Class I, Class II div. 1, and Class III occlusions. The material comprised male adults (age 20—30 years), and the results are based on measurements on tracings of lateral cephalograms. Generally, the inclination of the nose in relation to the nasion-sella-line was similar in all groups, and so was the nose length as well. The depth of the nose, when related to the hard and soft tissue facial planes was, however, significantly different, apparently due to the different sagittal position of the chin.

Key-words: Nose; cephalometry; face

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The nose is a dominating feature of the face, and greatly influences the degree of profile convexity. Previous studies on nose growth (*Subtelny*, 1959; *Posen*, 1967; *Chaconas*, 1969; *Wisth*, 1972) agree that the growth is in a downward and anterior direction, with a yearly increase in nose length of approximately 1.5 millimeter. *Chaconas* (1969) observed a more pronounced nasal bridge in Angle Class II subjects than in Class I, whereas Class III subjects revealed a concave configuration of the nose along the dorsum. His material was, however, limited to the period between 10 and 16 years, and it has been shown by others (*Subtelny*, 1959; *Posen*, 1967) that the growth proceeds even up to 18 years of age. *Roos* (1974) observed a more posterior position of apex nasalis when related to a perpendicular to the nasion-sella-line through sella in children having Class II, div. 1 occlusion than in children with Class I occlusion. This difference was, however, not verified by the angle formed by the nasion-sella-line and the apex nasalis.

It is known that the growth of the soft tissue is not always directly related to the hard tissue (*Burstone*, 1958, *Subtelny*, 1959; *Wisth*, 1971, 1972), and it has been shown that the soft tissue covering may partly compensate a basal hard tissue discrepancy (*Wisth*, 1973).

The intention of the present study was to investigate whether the nose morphology differs in groups with different craniofacial patterns, and how the nose influence the profile convexity in those groups.

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MATERIAL AND METHODS

The material comprised three groups of male adults (age 20—30 years) who dentally were characterized by Angle Class I, Class II, div. 1, or Class III occlusion which had not been orthodontically corrected.

The craniofacial morphology of the Class I group (n = 30) was characterized by a slight prognathism of both jaws (Table I) with a ss-n-sm angle of 0—4 degrees.

The Class II group (n = 18) displayed a varying degree of maxillary prognathism, and mandibular retrognathism (Table I) and had ss-n-sm angles varying from 4.5—8 degrees. The Class III group (n = 22) also showed a varying degree of maxillary prognathism (Table I), but all displayed a mandibular protrusion beyond the limits for the orthognathic face (*Björk*, 1963) and had negative ss-n-sm angles.

The study is based on measurements on tracings of lateral cephalograms. The recordings were performed twice, and the statistical evaluations are based on the mean of measurements. The measurement error did not exceed 1.5 degrees and 0.4 mm for angular and linear variables respectively. The reference points and lines are described in fig. 1, and the variables studied are listed in the first column of Table II.

Table I. *Craniofacial morphology of the Angle Class I, Class II div. 1, and Class III individuals*

	Class I		Class II div. 1		Class III	
Variable	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
s-n-ss	83.5	3.5	80.0	3.5	82.0	4.0
s-n-sm	81.5	2.5	76.0	3.5	87.5	4.0
s-n-pg	83.5	3.5	77.5	3.5	88.5	4.5
n-s-ba	128.5	4.5	131.5	4.5	127.0	4.5
NL-NSL	8.0	3.0	9.0	4.0	10.5	4.5
ML-NSL	28.0	5.0	35.5	5.5	33.5	5.5

Differences between the means of the variables were tested by Student's two-sample t-test, and differences in variability was checked by the variance ratio test (F).

RESULTS

Table II summarizes the general nose morphology and the profile convexity in the three groups studied, and Table III shows

Table II. *Distribution of the measurements of the different groups*

Measurements		Class I (n = 30)			Class II div. 1 (n=18)			Class III (n = 22)		
	Variable	$\bar{x}$	S.D.	Range	$\bar{x}$	S.D.	Range	$\bar{x}$	S.D.	Range
	s-n-r	117.0	6.5	107.0 132.0	114.0	8.2	100.5 123.0	117.0	6.2	102.0 126.0
Angular	s-n-PNR	120.0	5.0	107.0 133.0	117.0	5.5	99.5 126.0	119.5	6.0	103.0 127.0
and linear	n-r	24.2	3.0	18.3 29.6	23.6	3.1	18.2 30.6	27.6	2.9	22.0 31.4
nose	N-PNR	54.2	2.3	49.3 63.0	55.1	3.7	48.4 62.1	56.0	4.3	47.5 63.0
measure-	r-c	12.8	2.6	7.6 17.1	14.3	2.6	8.6 19.3	13.6	2.7	7.0 16.7
ments	PNR-d	35.5	3.1	28.4 41.4	39.4	3.3	32.3 46.6	31.8	3.6	25.0 37.8
	PNR-E	24.5	3.0	18.6 29.8	30.5	3.1	21.3 36.4	21.0	3.3	15.4 27.3
Angular										
profile	n-ss-pg	180.0	6.3	172.0 179.0	172.0	4.9	161.0 176.5	195.0	6.4	186.0 210.0
measure-	N-PNR-PG	135.0	5.0	124.0 144.0	129.0	5.3	120.0 140.5	142.0	6.0	128.0 152.0
ments										

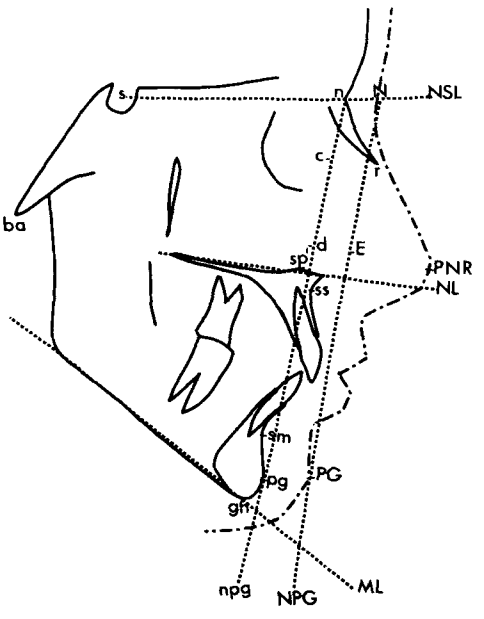

Fig. 1. Reference points and lines.
ba — basion. The intersection between the midsagittal plane and the anterior border of the foramen magnum.
s — sella. The center of sella turcica in the midsagittal plane.
n — nasion. The most anterior point of the frontonasal suture.
N — the intersection between the nasion-sella-line, and the contour of the soft tissue profile.
r — rhinion. The apex of the nasal bone.
c — the intersection between the nasion-pogonion line and a perpendicular from point r.
PNR — the most anterior point on the soft tissue profile of the nose.
d — the intersection between the nasion-pogonion line and a perpendicular from PNR.
E — the intersection between the line from soft tissue nasion to soft tissue pogonion and a perpendicular from PNR.
sp' — the intersection between the line from nasion to gnathion and the nasal line.
ss — subspinale. The most dorsal point on the anterior contour of the maxillary alveolar area.
sm — supramentale. The most dorsal point on the anterior contour of the mandibular alveolar area.
pg — pogonion. The most anterior point on the mandibular symphysis.
PG — the most anterior point on the soft tissue profile anterior to the mandibular symphysis.
gn — gnathion. The most inferior point on the mandibular symphysis.
NSL — nasion-sella line. The line through nasion and sella.
NL — nasal line. The line through the anterior nasal spine and pterygomaxillare.
n-pg — the line through nasion and pogonion (The hard tissue facial plane).
N-PG — the line through soft tissue nasion and soft tissue pogonion (The soft tissue facial plane).
ML — mandibular line. The tangent of the mandibular corpus through gnathion.

Table III. *Comparison of the Angle Class I and Angle Class II div. 1 groups, and the Angle Class I and Angle Class III groups*

Measurements	Variable	Class I against Class II div. 1 t	F	Class I against Class III t	F
	s-n-r	1.32	1.61	0.00	1.10
	s-n-PNR	1.89	1.21	0.28	1.44
Angular	n-r	0.66	1.13	—3.63**	0.93
and linear	N-PNR	—0.93	2.62*	—1.60	3.50**
nose	r-c	—1.94	1.00	—0.95	1.08
measurement	PNR-d	—4.05**	1.13	3.44**	1.35
	PNR-E	—6.57**	1.07	3.47**	1.21
Angular profile	n-ss-pg	4.91**	1.65	—7.43**	1.03
measurements	N-PNR-PG	3.81**	1.12	—3.95**	1.44

** $p < 0.01$
* $p < 0.05$

the actual t- and F-values derived from a comparison of the Class I and the Class II groups, and the Class I and the Class III groups.

In the Class I and Class II groups no significant differences in the form of the nose was observed, but the depth of the nose, when related to the hard (PNR-d) and soft tissue (PNR-E) facial planes was significantly greater ($p < 0.01$) in the Class II group. The Class II group also displayed significantly greater variability ($p < 0.05$) in nose length (N—PNR). The comparison of the Class I group and the Class III group revealed a significantly ($p < 0.01$) longer nose bone (n-r) in Class III individuals, whereas the nose depth, (PNR-d, PNR-E) was significantly less ($p < 0.01$). The Class III group also displayed a significantly greater variability in nose length (N-PNR) ($p < 0.01$).

The Class II individuals displayed a significantly greater profile convexity ($p < 0.01$) than the Class I individuals, both for the hard (n-ss-pg) and soft (N-PNR-PG) tissue, whereas the Class III group displayed significantly less profile convexity ($p < 0.01$).

DISCUSSION

In spite of the fact that the nose characterizes the profile through its form, length, width, texture and colour, it has received little attention in the orthodontic literature. Its growth reveals a rather consistent increase both downward and forward from infancy to early adulthood (*Subtelny*, 1959; *Manera & Subtelny*, 1961; *Posen*, 1967). The inclination of the nasal bone increases during the growth period (*Stramrud*, 1959; *Posen*, 1967; *Wisth*, 1971). So does the cartilaginous part of the nose as well, but not to the same degree, and the result is that the dorsum of the nose straightens out.

Chaconas (1969) demonstrates that the nasal growth pattern between 10 and 16 years is different in Angle Class I and Class II subjects. The Class I individuals tend to have greater nasal depth, and a straight dorsum, whereas Class II subjects grow more downward than forward, and thereby there is a greater possibility for an elevated nasal bridge to occur in these patients. From this he concluded that the configuration of the nose follows the general convexity of the face, with a straight nose in Class I cases a more convex nose in Class II cases and a concave nose configuration in Class III cases. This study on adult males did not confirm his finding, as there was no significant differences neither of the inclination of the nasal bone, nor the soft tissue nose between the three groups studied. The only linear difference observed, was a significantly greater length of the nasal bone in the Class III group. These findings were not unexpected, as the nose is closely related to the upper part of the face, and even if the three groups differed greatly in lower face morphology, their upper faces did not reveal great differences (Table I). The range of the variables showed, however, that relatively great variability existed in all groups, which means that different nose forms may be found in all the groups studied, but that no systematic tendency to a special nose configuration exists. The only measurement displaying significantly different variability between the groups was the length of the nose, which varied more in the Class II and Class III groups than in the Class I group.

When the nose was related to the sagittal position of the lower jaw by the distance from the tip of the nose to the hard and soft tissue facial planes, it became evident that its protrusion is

greatly influenced by the chin position. The distance was significantly greater in the Class II group, and significantly less in the Class III group, compared to the Class I individuals. Thus, with the same nose inclination and nose length, it will characterize the profile differently, depending on the sagittal position of the mandible. From this material, therefore, it can be concluded that the soft tissue profile convexity is chiefly determined by the position of the chin, and is less due to variation in inclination or form of the nose.

This group study thus indicates that the nose does not help to compensate a facial imbalance by variation in its form or inclination. Clinically this means, that if the mandible can be brought to its correct position in relation to the maxilla, the profile will automatically attain the form of Class I individuals. It is shown that this holds true for patients who have had a mandibular protrusion corrected by surgery (*Wisth*, 1973). Thus, rhinoplasty in order to correct the profile convexity should be avoided, except when the nose has a really abnorm form, or it is impossible to correct the sagittal position of the mandible.

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