

Correlation between nasolabial angle and antero-posterior position of maxilla in orthodontic patients

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Aim: Evaluation of facial shape and proportions is one of the most important steps in determining treatment options and outcomes. Balancing the position of the lips in relation to the nose and chin has a direct effect on patient aesthetic preference. Therefore the aim of this study was evaluation of the correlation between nasolabial angle and antero-posterior position of maxilla in orthodontic patients who referred to private dental office in Yazd city.

Material and Methods: In this cross-sectional descriptive study position of maxilla were evaluated based on Mc. Namara and Steiner analysis in the lateral cephalometric radiographs of 47 orthodontics patients (21 male and 26 female). Nasolabial angle (NLA) and lower nasolabial angle (LNLA) were measured and correlation between these parameters were analyzed by ANOVA test and Pearson's correlation tests using SPSS(version 16).

Results: Differences of Wit's appraisal SNA and Mc namara values among three groups of maxillary deficiency, maxillary excess and orthognatic patients were statistically significant ($p.value < 0.05$) but no correlation found among NLA or LNLA and maxillary position ($p.value > 0.05$)

Conclusion: Due to compensation of skeletal problems by teeth, NLA can not describe position of maxilla perfectly.

Key Words: NLA, Maxillary Position, Mc Namara, SNA.

Introduction

Physical appearance is an important facial character which severely affect on personal self confidence. (1,2)

On the other hand facial attractiveness-as a subjective issue-is influenced by age, gender, ethnicity, culture and personal character. (1)

But facial proportion is different. (3) Facial parts should be in coordination to produce proportion. (2)

Cephalometric analysis has been used as an diagnostic element for ease of obtaining, measuring and comparing skeletal structures. For many years ideal cephalometric measurements were synonyms for facial aesthetics. Nowadays facial soft tissue proportion is more important. (4)

In orthodontics much attention has been devoted to facial esthetics, harmony and balance, because well-proportioned and balanced soft tissue contours presupposed well-defined underlying and dental structures.(5)

Several angles are introduced to evaluate facial soft tissue proportion, Nasolabial angle (NLA) is one of them.

This angle is formed by the tangent to the lower border of nose and upper Lip and is considered a dependable representative of soft tissue profile and clinical and cephalometric parameter to establish the treatment goals. (6)

As the other soft tissues this angle is affected by underlying hard tissues. (7)

So it could be affected by nose and lip (lip thickness, and dento-skeletal hard tissues under Lip). Protrusion or retrusion of jaws or teeth may alter NLA. (7,8)

Freer and Saxby found that position of lips and soft tissues lining A,B Points is related to Antro-Posterior position of upper and lower incisors, and ANB angle affects on soft tissues severely. (7)

Talass et al admitted that NLA is increased by retraction of upper incisors. (9)

Fitzgerald et al didn't find significant correlation between NLA and underlying skeletal structures. (10)

Jensen et al found that soft tissue changes are greater in response to incisal movement than jaw movement. (11)

Louis et al pointed out that in Maxillary advancement procedure with vertical control, hard tissue to soft tissue proportion would change but NLA would not. (12)

Ramos et al mentioned that NLA and labial angle would increased with incisor retraction but it's predictability is low. (13)

Zhang et al announced that some differences could be seen in lip shape and position in three Angle malocclusion Classifications. But due to compensation, deformity is not clear in malocclusions (CL II, CL III). NLA reflect upper lip changes, but it can not notify facial profile. (14)

Erdinc et al in evaluation of profile changes with or without premolar extraction found that there were no clinically significant correlation between hard and soft tissue variables before ,at the end four years after treatment. Changes in lip position are variable and might depend on several morphologic factors and growth.(15)

Misiretal proposed that there is a significant correlation between nasal tip and incisal tip but there is no correlation between nasal tip and point A. (16)

Vasudavan et al reported that Lefort I Maxillary advancement produces elevation of nasal tip, reduction of nasal length, increase in the nasal tip protrusion, increase in cutaneous lip height, and cause forward movement of upper Lip. (17)

Celikoglu et al found that Maxillary protraction in early treatment of CL III malocclusion changes LS-E which is statistically significant. (18)

Seben et al stated that Maxillary premolar extraction in CL II div 1 patients causes increase in NLA and retraction of upper lip. (19)

Nowadays malocclusion should be treated under an aesthetic point of view to improve facial aesthetic, but

on the other hand success of treatment almost always tied to predetermined criteria in cephalometric analysis. (4)

So aim of this study is evaluating the correlation of NLA and Maxillary position in patients with Maxillary deficiency or excess and in orthognatic patients.

Material & Methods

It is a cross sectional descriptive study which was done on 47 patients (26 female, 21 male) who referred to private office in Yazd.

In first step female patients with age 14-25 years and male patients with age 16-25 years who had sharp and clear cephalometric radiographs were chosen. In this age period, lip growth is almost complete and lips do not drop down due to age. (2,3)

In the second step patient were clinically examined under dental unit light.

Patients were divided to CLI, CLII, CL III of Angle classification, Based on canine relationship, and to convex (CLII), Concave (CL III), Straight (CLI), based on profile. In concave group patients with depressed malar area (Maxillary deficiency) and in convex group patient with midface protrusion (maxillary excess) were chosen.

At last Patients were divided in three groups: orthognathic CL I, Maxillary excess CL II, Maxillary deficiency CL III. In the case of disharmony between dental and facial proportion, facial relation was considered.

Exclusion criteria are shown in table 1.

Table 1: exclusion criteria(3)

- | |
|--|
| 1) Crowding more than 4mm (IOTN grade 3) |
| 2) Over jet more than 9mm (IOTN grade 4) |
| 3) reverse overjet more than 3.5mm (IOTN grade 4) |
| 4) Sever vertical discrepancies: |
| Open bite anterior or posterior more than 4mm (IOTN grade 4) |
| Deep bite with trauma to soft tissue |
| 5) Skeletal asymmetry |
| 6) Congenital problems like clefts |
| 7) dental problems which affect on lip position like missing and supernumerary |
| 8) indistinct cephalometric radiographs |

Cephalometric evaluation was done on acetate matte tracing paper [8×10 inches, 0.003 inche thick]

(orthotechnology). Points, Lines and angles were included in table2. Jaws relation were analysed by wit's appraisal (normal o in females, -1 in males) Maxillary position was determined based on Mc Namara and Steiner analysis.

In Mc Namara analysis distance of A point to N-Perpendicular was measured in millimeter. (Normal Value in orthognatic patients is 0-1mm). positive and negative values demonstrates maxillary protrusion and maxillary retrusion respectively. (8)

In Steiner analysis SNA was measured.

Normal Value of SNA is 82°. Values more than 82° reflect maxillary protrusion and vice versa. (8)

Nasolabial angle (normal value: 90-110°) was divided to upper part (normal value: 25°) and lower part (normal Value: 85°) to eliminate effect of nasal slope in NLA investigation.

Tracing of a patient is shown in figure 1.

Then antro-posterior position of maxilla was compared by NLA and LNLA.

Data were analyzed by SPSS software(version 16), ANOVA and pearson's correlation tests with significant level of 95%.

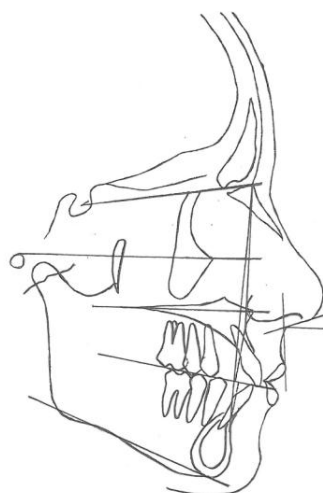


Fig1.tracing of a patient

Table 2: definition of points, lines, angles which are used in cephalometric tracing (8)

N(Nasion): the most anterior point on the frontonasal suture in midsagittal plan.
S(Sella): geometric center of pituitary fossa located by visual inspection
Or (Orbitale): the lowest point on the inferior rim of the orbit.
Po(Porion): the most superiorly positioned point of the external auditory meatus.
A(Subspinale): the most posterior midline point in the concavity between ANS and Prosthion.
B(Supramentale): The most posterior midline point in the concavity of mandible between the most superior point of the alveolar bone overlying the lower incisors and Pogonion.
G(Glabella): The most prominent anterior point in the midsagittal plane of forehead.
Sn(Subnasal): The point at which the Columella merges with upper lip in the midsagittal plan.
SN: Line between S and N.
FH: Line between Po and Or.
N-Perpendicular: Perpendicular line from N to FH.
NA: line between N and A
NLA(Nasolabial angle): Angle which is constructed by tangent to the lower border of nose and upper lip.
Upper NLA: Angle between tangent of lower border of nose and true horizontal line
Lower NLA: Angle between true horizontal line and tangent of upper lip.
SNA: Angle which is formed by two lines of SN and NA.

Results

Data were analyzed by SPSS, ANOVA and pearson's correlation test. Results are shown in table 3.4. ANOVA analysis showed that there is a statistically significant difference between wit's, Mc Namara, SNA in three skeletal groups. (P.value<0.05) (table3). pearson's correlation test showed that there is no statistical correlations between Mc Namara, and SNA with NLA and LNLA based on sex and skeletal relationship (P.value>0.05) (table4)

Table 3: Comparisons of parameters in three groups based on NOVA Analysis

Parameter	N	Mean	SD	P.value
Wit's	CL I	14	0.03	1.27
	CL II	17	4.58	1.76
	CL III	16	-8	6.03
	Total	47	-1.05	6.50
MC Namara	CL I	14	0.85	1.99
	CL II	17	3.05	2.19
	CL III	16	4.55	-2.37
	Total	47	3.86	0.55
SNA	CL I	14	81.42	1.28
	CL II	17	83.47	2.55
	CL III	16	78.25	3.27
	Total	47	81.08	3.34
NLA	CL I	14	100	9.67
	CL II	17	103.35	10.27
	CL III	16	99.93	9.61
	Total	47	101.19	9.79
LNLA	CL I	14	82.78	6.73
	CL II	17	81.82	7.95
	CL III	16	85.18	8.59
	Total	47	83.25	7.81

Table 4: Correlation between Mc Namara and SNA with NLA, LNLA based on sex and skeletal relationship(based Pearson's correlation test)

Variable	MC Namara		SNA			
	NLA	LNLA	NLA	LNLA		
Sex	Male	0.186	-0.313	0.189	-0.025	CC
		0.41	0.167	0.41	0.913	P.value
	Femal	-0.031	-0.137	-0.029	-0.22	CC
		-0.87	0.5	0.89	0.26	P.value
Skeletal relationship	Mea n	0.1	-0.25	0.05	0.11	CC
		0.5	0.08	0.72	0.43	P.value
	CL I	-0.132	-0.45	-0.27	-0.22	CC
Skeletal relationship	CL	0.65	0.1	0.33	0.45	P.value
	II	-0.215	-0.03	-0.042	-0.02	CC
	CL	0.4	0.88	0.87	0.93	P.value
	III	0.21	-0.18	0.009	0.091	CC
	III	0.43	0.5	0.97	0.73	P.value

Discussion

Soft tissue profile evaluation is an important step in diagnosis and treatment. Soft tissue changes could be associate with orthodontic treatment or orthosurgery. (20)

NLA is formed by the tangent to the lower border of nose and upper lip and both lip and nose affect the angle. So net value of the angle can not show which one alters the angle. So for eliminating the effect of nose on NLA in this study NLA divided to upper NLA (UNLA) and lower NLA (LNLA) by true horizontal line. (8)

Also soft tissues are lying on hard tissues so it seems maxillary position and upper incisors can affect on lip position and on NLA value. This study was design to evaluate this correlation.

In this study 47 orthodontic patients (26 females- 21 males) were divided in 3 groups: skeletal CLI (orthognatic), CLII (Maxillary excess), CL III (Maxillary deficiency).

Maxillary position was determined based on Mc Namara and Steiner analysis and Compared by NLA and LNLA.

Results were shown in table 3 and 4.

Based on results differences between wit's and maxillary position (based on Mc namara and Steiner

analysis values) in three groups are statistically significant ($P < 0.05$) but differences between NLA and LNLA and maxillary position in three groups are not ($P > 0.05$) (table.3)

There is not statistically significant correlation between NLA and LNLA and Maxillary position (Mc Namara and Steiner analysis), skeletal relationship and sex. (table.4)

Fitzgerald et al announced NLA could not describe variation in soft tissue. It might be in normal range but patient might have maxillary incisor protrusion. (10)

Zhang et al also remark there are some differences in lip form and position in three malocclusion classification but due to compensation it is not clear. So NLA could only reflect upper lip changes not facial profile. (14)

Most of studies in this era evaluate upper incisor position in NLA changes and there are a few articles on correlation between maxillary skeletal position and NLA changes.

Freer and Saxby mentioned that lip posture is influenced by upper and lower incisors horizontal positions. (7)

Talass et al and also Ramos et al and Seben et al proposed that NLA would increase by upper incisor retraction. (9,13,19)

Erdinc et al in evaluation of profile changes with or without premolar extraction found that there were no clinically significant correlation between hard and soft tissue variables before ,at the end four years after treatment.(15)

So it seems that although soft tissues are lying on hard tissues but they don't imitate them completely.

And also tooth changes could alter lip position more than maxillary positional changes.

Jensen et al pointed out that soft tissue changes in relation to incisor movement is (60-70%) but in relation to jaw surgery is little. (11)

Louis et al found that maxillary advancement with vertical control in jaw movement would change the proportion of hard to soft tissues. But NLA would not change dramatically. (12)

On the other hand Celikoglu et al found that maxillary protraction in early CL III treatment could alter LS-E Significantly. (18)

Vasaudan et al reported in Lefort I maxillary advancement upper lip move forward. (17)

So it seems changes in lip position are variable and might depend on several morphologic factors and growth.(15)

Dental compensation which occur in skeletal problems could alter correlation between maxillary position and NLA. For example in CL III Max deficiency, incisor protrusion is probable. But this study was designed to evaluate correlation of maxillary position (but not incisor position) on NLA.

It is better to perform a comprehend study on NLA and its correlation with variables which alter it.

Conclusion

NLA and specially LNLA could not influence by maxillary position dramatically, Because several morphologic factors, growth and dental compensation could alter skeletal discrepancies .

References:

1. Milosevicy SA, Varga ML, Slaj M. Analysis of the soft tissue facial profile by means of measurement. *Europ J Orthod* 2008; 30: 135-140.
2. Nanda R. *Biomechanics and Esthetic Strategies in clinical orthodontics*. 1st ed. Philadelphia: W.B. Saunders; 2005.p. 93-109.
3. Proffit WR, Fields HW, Sarver DM. *Contemporary orthodontics*. 4th ed. St Louis: Mosby; 2007.p. 27-617.
4. Oliveira MT, Candemil A. Assessment of the correlation between cephalometric and facial analysis. *J research in dent* 2013; 1: 34-40.
5. Al-gunaid T, Yamada K, Saito I. Soft tissue cephalometric norms in Yemeni men. *Am J Orthod Dentofac Orthop* 2007; 132: 576.e7-756.e14.
6. Shweta B, Jitender S, Nameeta K. Nasolabial angle-diagnostic esthetic parameter?. *J Orofac health sciences* 2013; 4: 68-75.
7. Saxby PJ, Freer TJ. Dentoskeletal determinants of soft tissue morphology. *Angle Orthod* 1985; 55:147-154.
8. Jacobson A, Jacobson R. *Radiographic cephalometry: from basics to 3-D imaging*. 2nd Ed. St Louis: Mosby Co; 2006.p.1-145.

9. Talass MF, Talass L, Baker RC. Soft-tissue profile changes resulting from retraction of maxillary incisors. *Am J Orthod Dentofac Orthop* 1987; 91:385-94.
 10. Fitzgerald JP, Nanda RS, Currier GF. An evaluation of the nasolabial angle and the relative inclinations of the nose and upper lip. *Am J Orthod Dentofac Orthop* 1992; 102:328-34.
 11. Jensen AC, Sinclair PM, Wolford LM. Soft tissue changes associated with double jaw surgery. *Am J Orthod dentofac Orthop* 1992; 101: 266-75.
 12. Louis PJ, Austin RB, Waite PD, Mathews CS. Soft tissue changes of the upper lip associated with maxillary advancement in obstructive sleep apnea patients. *J Oral Maxillofac Surg* 2001; 59: 151-6.
 13. Ramos AL, Sakima MT, Santos pinto AD, Bowman SJ. Upper lip changes correlated to maxillary incisor retraction: A metallic implant study. *Angle Orthod* 2004; 75:499-505.
 14. Zhang DQ, Shi X, Zheng MQ. The study on characteristics of soft tissue profile for different malocclusion. *Hua Xi Kou Qiang Yi Xue Za Zhi*. 2004; 22: 496-8.
 15. Erdinc AE, Nanda RS, Dandajena TC. Profile changes of patients treated with and without premolar extraction. *Am J Orthod Dentofac Orthop* 2007; 132:324-31.
 16. Misir AF, Manisali M, Egrioglu E, Naini FB. Retrospective analysis of nasal soft tissue profile changes with maxillary surgery. *J Oral Maxillofac Surg* 2011; 69: 190-4.
 17. Vasudavan S, Jayaratne YSN, Padwa BL. Nasolabial soft tissue changes after Lefort I advancement. *J Oral Maxillofac surg* 2012; 10 : 270-277.
 18. Celikoglu M, Oktay H. Effect of maxillary protraction for early correction of CL III malocclusion. *Europ j Orthod* 2014; 36: 86-92.
 19. Seben MP, Valarelli FP, DeFreitas KMS, Cancado RH, Correa A, Neto B. Cephalometric changes in CL II div1 patients treated with two manillary premolar extraction. *Dent Pres J Orthod* 2013; 18: 61-69.
- Waldo CM. Orthodontic research as a component part of a balanced longitudinal study of 100 children. *Int J Orthod* 1936; 22:659-673.