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To evaluate the changes in Natural Head Position after Orthognathic surgeries in Class II patients and Class III patients

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ABSTRACT

After the introduction of cephalometric radiography, orthodontists have been using cephalometric analysis to plan orthodontic treatment and to evaluate the treatment results. For cephalometric analysis, Sella-Nasion plane and the Frankfort horizontal plane are considered as stable horizontal reference planes. Unfortunately, measurements based on the Frankfort horizontal plane do not always correspond with clinical examination. Therefore, the use of the true horizontal line (THL) and true vertical line (TVL) as alternatives seems to be advisable.

This study was done in order to compare and evaluate the changes in natural head position in patients who underwent maxillary Lefort I osteotomy and mandibular set back orthognathic surgery. Thirteen pre treatment(T1) and post treatment(T2) lateral cephalometric radiographs were collected. The T1 lateral cephalometric radiographs were taken at the beginning of the treatment, and the T2 data immediately after the removal of the orthodontic appliances. The patients were instructed to stand in their natural position. 9 landmarks and 6 reference planes were traced. Results showed that Class I patients who had received conventional orthodontic treatment showed a minimal or no change in their NHP, but some Class III patients showed a change in their NHP,which tended towards head extension. Patients who have undergone Lefort I surgery and BSSO set back have shown the changes in their natural head position the differences were in their SNA, SNB, ANB, Facial contour angle and Frankfort horizontal plane angle.

Keywords: Natural head position, conventional orthodontic treatment, Lefort I surgery, BSSO set back.

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INTRODUCTION

The natural head position (NHP) is the position of the head in relation to the cervical spine when a person stands upright with the eyes staring at infinity at horizontal level, or the mirror image of eyes. It is primarily based on the balancing system of the propriosensitive nerves and can be substituted using the cranio-cervical angle[1]which has been proved to vary little over time even in fast developing adolescents.[1-3]

Orthodontists have used cephalometric analysis to plan orthodontic treatment and to evaluate the treatment results after the introduction of cephalometric radiography. For cephalometric analysis, intracranial structures like the sella-nasion plane (SN plane) and the Frankfort horizontal plane (FH plane) are considered as stable horizontal reference planes. However, Lundstorm[4] have reported individual variations of intracranial landmarks. The use of cranial reference lines to assess anteroposterior skeletal relationship is inherently unreliable. But still they were widely used for diagnosis and treatment planning in orthodontics and orthognathic surgery.

Ellis and McNamara[5] supported the opinion that the position of sella can vary both antero-posteriorly and vertically. Unfortunately, measurements based on the Frankfort horizontal plane do not always correspond with clinical examination. So, intracranial reference planes can vary, over time, within a given individual. So the measurements based on these planes are likely to yield misleading information. According to Proffit et al[6] when these measurements are used for orthognathic patients, they might be even more misleading; therefore, the use of the true horizontal line (THL)and true vertical line (TVL) as alternatives seems to be advisable. Natural head position provides the significant cephalometric analysis as the extracranial reference line is used instead of intracranial reference lines, which is considerable as biological variation in their inclination using TVL and THL.[7]

The concept of natural head position in orthodontics was introduced by Moorrees and Keanin the late 1950s.[8] Natural head position is defined as standardized and reproducible position of a head when it is in an upright position, with eyes looking straight at a mark. A horizontal line related to the natural head position was suggested as the most reliable plane to study cephalometric_analysis. Many studies have suggested that there was reproducibility of the NHP. Cooke et al[9] reported in a 5-year longitudinal study on the reproducibility of the NHP method errors of 1.9^{o} after 1 to 2 hours, 2.3 ^{o} after 3 to 6 months, and 3.0 ^{o} after 5 years. In 1981, Spradley et al[10] suggested that the true vertical line taken from subnasale may provide a useful tool for research on the changes in soft tissue connected with both orthodontic and orthognathic surgical treatments. In the present study true vertical line was taken 5.0mm ahead from subnasale which was also done in the previous studies according to Sugawara and Kawamura[11]also used a TVL 5 mm ahead of the subnasale for planning the surgical treatment objective in soft tissue analysis.

There is ambiguity whether the change in NHP occurs either due to conventional orthodontic treatment and orthognathnic surgery. Vig et al[12] suggested that orthognathic surgery most likely shifts the centre of mass of the head, thereby affecting head position. Arnett and McLaughlin[13] recommended adjusting the head position during NHP registration because patients with Class II and Class III facial types tend to compensate for their head position. In order to avoid this uncertainty, the aim of this study was to evaluate the changes in natural head position in Class II patients and Class III patients who underwent orthognathic surgeries.

MATERIALS AND METHOD

Thirteen pre treatment(T1) and post treatment(T2) lateral cephalometric radiographs of skeletal Class I, skeletal Class II(Lefort I set superior impaction) and Class III(BSSO set back) was collected. The T1 lateral

cephalometric radiographs were taken at the beginning of the treatment, and the T2 data were recorded immediately after the removal of the orthodontic appliances. The patients were instructed to stand in their natural position and to stare at their own eyes reflected in a 60 x 90 cm mirror at a distance of 1m and lateral cephalogram was taken using cephalostat.

9 landmarks and 6 reference planes were traced on the cephalometric radiographs using acetate paper and 0.5-mm pencils. The SN and FH planes of the T1 cephalograms were transferred to the T2 cephalograms with cranial-base superimpositions. Then in each T1 and T2 tracing, linear measurement and angular measurements were manually made with a protractor and a digital caliper. The linear measurements were calibrated by considering the magnification ratio of the radiographs (110%). All measurements and analyses were performed by 1 examiner.

Cephalometric reference planes for the linear and angular measurements: TVL, a true vertical line through 5 mm ahead of subnasale (Sn); SN, sella-nasion line; FH, Frankfort horizontal plane; SVL, a perpendicular line to the FH plane through sella.

RESULTS:

One way ANOVA/kruskal wellis test were used for multiple group comparisons. A paired t/wilcoxson test was used to determine the differences between the T1 and T2 measurements in each group.

The following inferences were drawn from the results obtained.

Skeletal Class I patients treated with conventional orthodontic treatment showed no significant difference in head position, only minimal changes were observed. And only the facial contour angle is statistically significant(p =0.056).(Table - I)

Skeletal Class II patients treated with Lefort I set back showed statistically significant difference in SNA (p =0.011), SNB (p =0.000), Frankhort mandibular plane angle (p =0.018). (Table - II)

Skeletal Class III patients treated with BSSO set back have shown significant difference in SNB (p =0.005), ANB (p =0.001), Facial contour angle (p=0.006). (Table - III)

By Pair wise comparison of SNB angle, the significant difference was between Class I and Class III (p =0.030). By Pair wise comparison of ANB angle using Tukey's test the significant difference was between Class I and Class III (p =0.000). By Pair wise comparison of facial

contour angle using Tukey's test the significant difference was between Class I and Class II (p =0.002)and Class I Class III (p =0.001).

Pair wise comparison of SNB, ANB and facial contour angle using tukey's test was shown in Table - IV

TABLE I: COMPARISON OF CHANGE IN NATURAL HEAD POSITION OF CONVENTIONAL ORTHODONTICALLY TREATED SKELETAL CLASS I PATIENTS

SNO	PARAMETER		MEAN ± SD	t value	P value
1	TVL-SN	T0	80.1538 ± 4.524	-0.352	0.804
		T1	80.6923 ± 3.521		
2	TVL- FH	T0	88.1538 ± 3.362	-0.086	0.208
		T1	88.2308 ± 2.081		
3	SNA	T0	82.9231 ± 3.303	0.874	0.178
		T1	81.9231 ± 4.112		
4	SNB	T0	77.4615 ± 2.904	-0.118	0.915
		T1	77.6154 ± 3.775		
5	ANB	T0	6.8462 ± 5.913	1.607	0.366
		T1	4.3077 ± 1.887		
6	Frankhort mandibular plane	T0	25.6154 ± 5.299	-1.376	0.146
		T1	27.5385 ± 3.82		
7	Facial contour angle	T0	23.6923 ± 3.449	2.595	0.056**
		T1	20.8462 ± 4.5615		

TABLE II: COMPARISON OF CHANGE IN NATURAL HEAD POSITION OF LEFORT I SET BACK IN SKELETAL CLASS II PATIENTS

SNO	PA RAMETER		MEAN ± SD	t value	P value
1	TVL-SN	T0	77.9231 ± 4.443	-1.071	0.136
		T1	79.2308 ± 3.789		
2	TVL- FH	T0	87.8462 ± 3.46	-0.328	0.749
		T1	88.2308 ± 2.80		
3	SNA	T0	82.6923 ± 4.67	-0.307	0.011**
		T1	83.0000 ± 4.281		
4	SNB	T0	74.5385 ± 3.843	-2.799	0.000**
		T1	76.3077 ± 3.92		
5	ANB	T0	8.1538 ± 2.409	1.570	0.940
		T1	6.6923 ± 2.393		
6	Frankhort mandibular plane	T0	27.1538 ± 5.956	1.918	0.018**
		T1	24.3077 ± 6.638		
7	Facial contour angle	T0	24.6154 ± 4.5741	-3.221	0.286
		T1	30.1538 ± 5.899		

TABLE III: COMPARISON OF CHANGE IN NATURAL HEAD POSITION OF BSSO SET BACK IN SKELETAL CLASS III PATIENTS

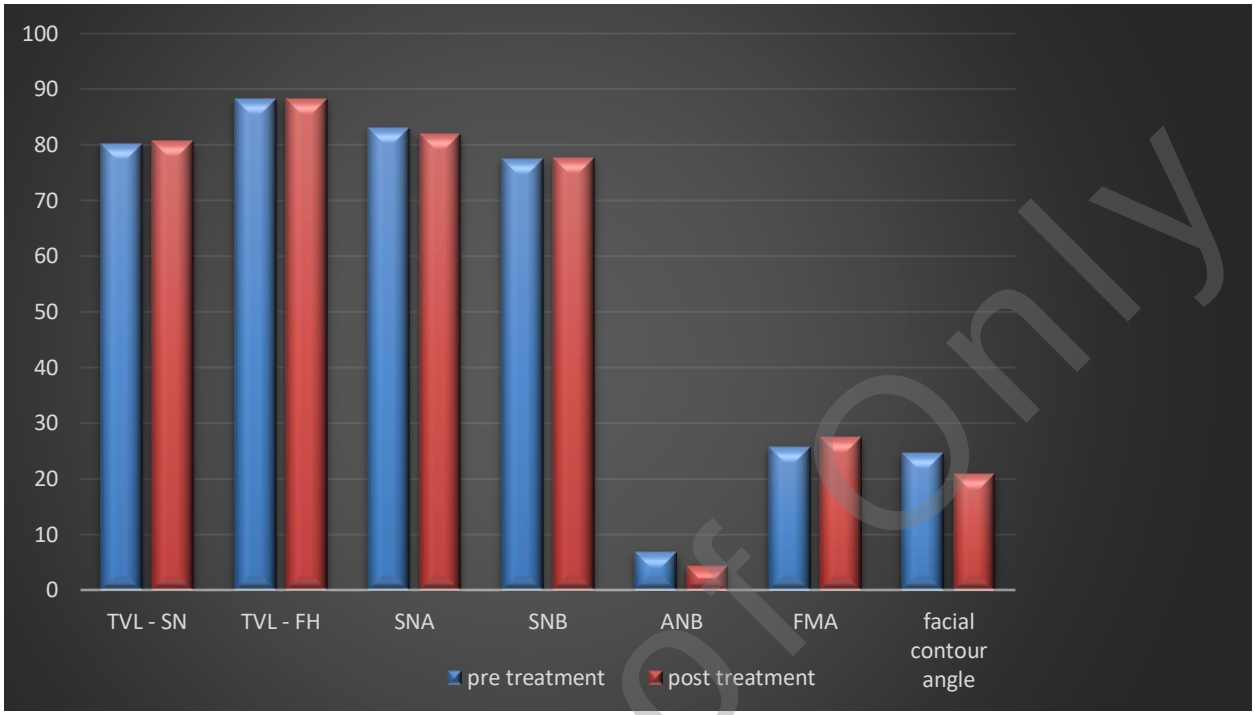
SNO	PRAMETER		MEAN ± SD	t value	P value
1	TVL-SN	T0	85.2308 ± 4.67	-0.036	

					0.971
		T1	85.3077 ± 7.134		
2	TVL- FH	T0	90.6154 ± 4.330	0.725	0.482
		T1	89.1538 ± 6.95		
3	SNA	T0	81.5385 ± 4.926	-0.674	0.513
		T1	82.3846 ± 3.042		
4	SNB	T0	86.9231 ± 4.59	3.399	0.005***
		T1	83.0769 ± 2.841		
5	ANB	T0	-5.4615 ± 3.406	-4.461	0.001***
		T1	-0.6923 ± 2.62		
6	Frankhort mandibular plane	T0	26.4615 ± 6.78	0.701	0.497
		T1	24.5385 ± 7.512		
7	Facial contour angle	T0	4.0000 ± 6.757	-3.326	0.006**
		T1	10.0769 ± 4.64		

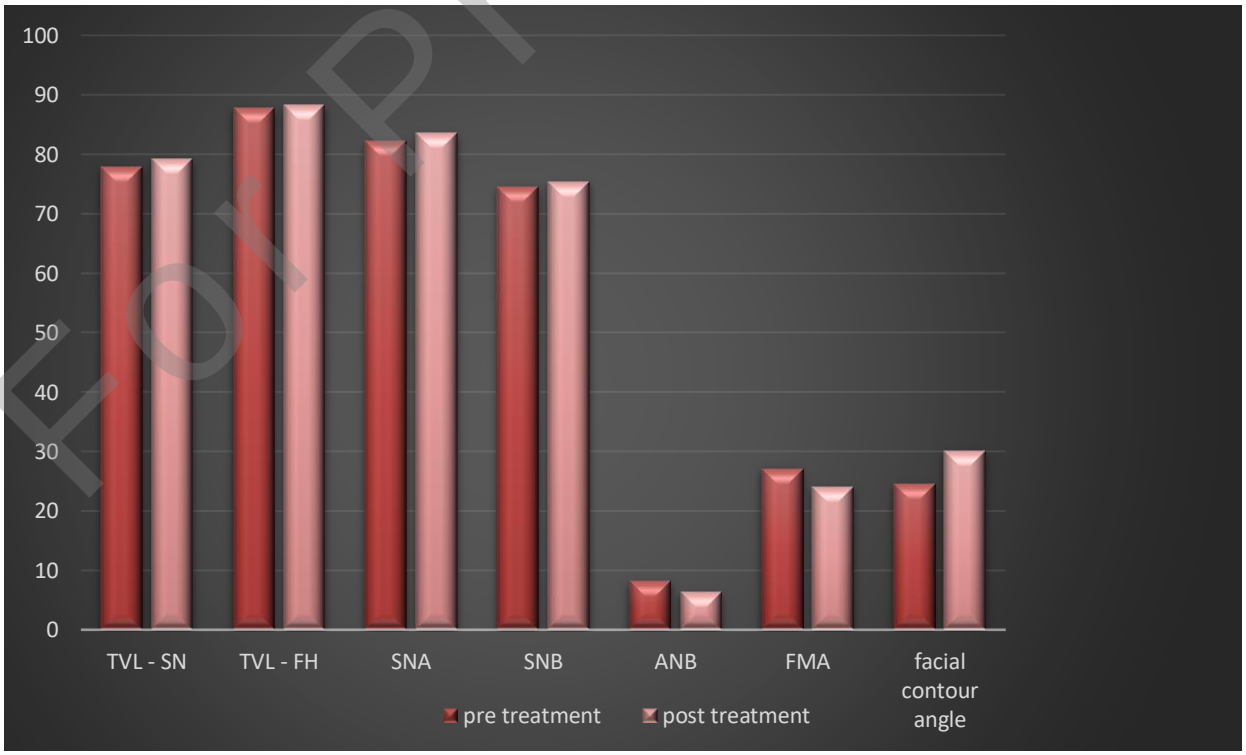
TABLE IV: PAIR WISE COMPARISON OF SNB, ANB AND FACIAL CONTOUR ANGLE USING TUKEY'S TEST

S NO	Dependent Variable	Group	Group	Mean Difference	P Value
1	SNB	Class 1	Class 2	1.61538	0.534
			Class 3	-4.00000*	0.030***
		Class 2	Class 1	-1.61538	0.534
			Class 3	-5.61538*	0.002***
		Class 3	Class 1	4.00000*	0.030***
			Class 2	5.61538*	0.002***
2	ANB	Class 1	Class 2	1.07692	0.809
			Class 3	7.30769*	0.000***
		Class 2	Class 1	-1.07692	0.809
			Class 3	6.23077*	0.003***
		Class 3	Class 1	-7.30769*	0.000***
			Class 2	-6.23077*	0.003***
3	Facial contour angle	Class 1	Class 2	8.38462*	0.002***
			Class 3	8.92308*	0.001***
		Class 2	Class 1	-8.38462*	0.002***

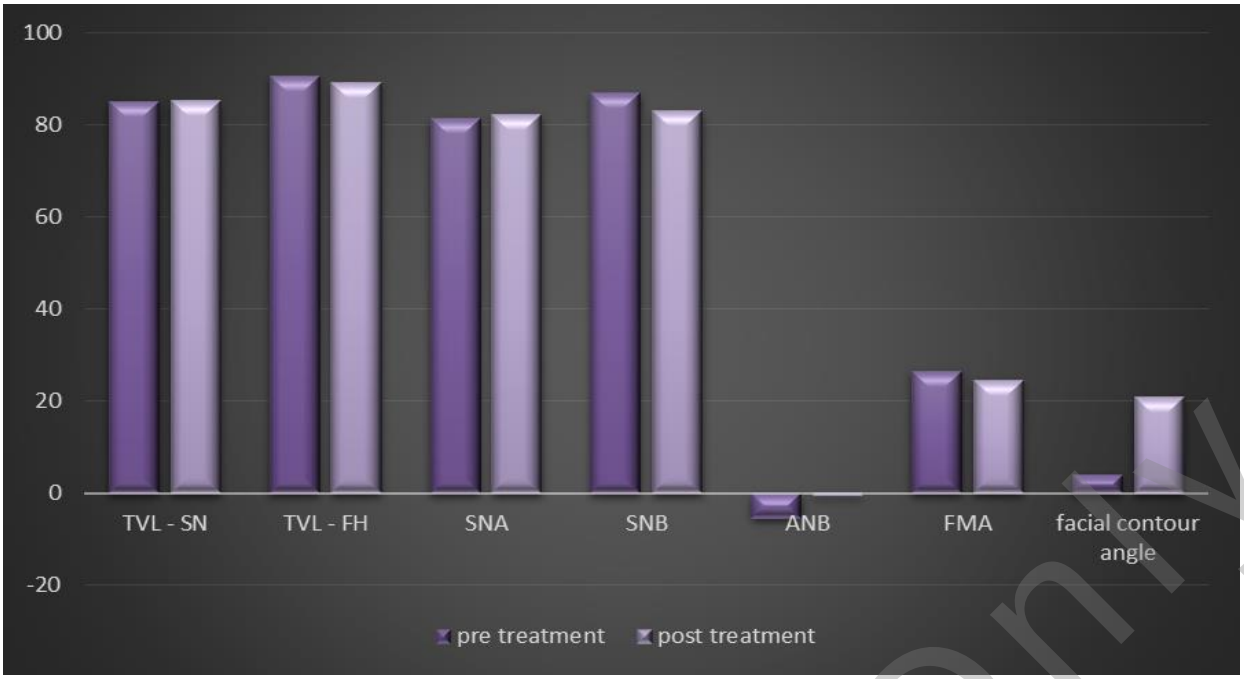
			Class 3	.53846	0.969
		Class 3	Class 1	-8.92308*	0.001***
			Class 2	-.53846	0.969



Graph I: COMPARISON OF CHANGE IN NATURAL HEAD POSITION OF CONVENTIONAL ORTHODONTICALLY TREATED SKELETAL CLASS I PATIENTS



Graph II: COMPARISON OF CHANGE IN NATURAL HEAD POSITION OF LEFORT I SET BACK IN SKELETAL CLASS II PATIENTS



Graph III: COMPARISON OF CHANGE IN NATURAL HEAD POSITION OF BSSO SET BACK IN SKELETAL CLASS III PATIENTS

DISCUSSION

In general, the long-term evaluation of head position, based on measurement of the S-N line to the true vertical (SN/Vert) is complicated due to the possible outcome of growth. Athanasious et al[14] evaluated the reproducibility of superimposition on different cranial structures and confirmed that superimposition on cranial base structures had the greatest reproducibility. From then, the concept of natural head posture (NHP) was introduced into the orthodontic literature and many studies have advocated its use in cephalometric analysis.[15]

According to the studies conducted by Lundberg, 1970[16] and Wenzel A et al[23] it has been suggested that orthognathic surgery can result in persistent postsurgical head extension or flexion depending on the surgery performed. Some authors like Philips et al 1991[17] stated that their head and neck posture showed no significant short- or long-term changes in any of the patients who underwent surgery.

This study was conducted in order to evaluate the changes in natural head position between the patients underwent Class I conventional orthodontic treatment, skeletal Class II Lefort I osteotomy and skeletal Class III with BSSO set back.

In the present study, the patients who had conventional orthodontic treatment showed no change in NHP from pretreatment to post treatment.(Table I) These results were in comparison with the study conducted by Dohyun Cho et al 2015[18] where skeletal Class III patients were compared with skeletal Class I patients. They stated that most of the Class I patients who had received conventional orthodontic treatment showed a minimal or no change in their NHP. When the results were subjected to statistical analysis, the significant difference was observed only with facial contour angle with p value 0.0056 other parameters like ANB and Frankfort horizontal plane have showed no significant differences from pre to post treatment. This is could be due to a dental change which does not change any skeletal structure to change head posture and the same was observed with Cho et al.[18]

When the comparison was done between Class I and Class II patients, the significant difference was observed only with facial contour angle with p value 0.005. This significant difference was in comparison with the study conducted by

Hedayati et al[19] where they observed changes in the craniofacial posture index.

When comparison was done between Class I and Class III patients the significant difference was observed between SNB (p=0.030), ANB (p=0.000) and facial contour angle (p=0.002). These results were approximating to the results of Cho et al[18] where the changes were significant for SNB (p=0.000), ANB (p=0.000), Frankfort horizontal plane (p=0.030) and facial contour angle (p=0.000).

In the present study, patients who underwent Lefort I superior impaction had the statically significant changes in NHP after surgery(Table II) with SNA (p=0.011), SNB (p=0.000) and Frankfort horizontal plane (p=0.018). When comparison was done between Class II and Class I patients the significant difference was observed only with facial contour angle (p=0.002). (Table IV). When comparison was done between Class II and Class III patients the significant difference was observed with SNB (p=0.002) and ANB (p=0.002).

The patients who had undergone BSSO orthognathic surgery showed significant changes in their NHP. (Table III) These results in the present was in accordance with the study conducted by Cho et al[18] and Hedayati et al[19] In the present study, the statically significant changes observed was SNB (p=0.003), ANB (p=0.000) and facial contour angle (p=0.006). When comparison was done between Class III and Class I patients the significant difference was observed SNB (p=0.030), ANB (p=0.000) and facial contour angle (p=0.002). (Table IV) When comparison was done between Class III and Class II patients, the significant difference was observed with SNB (p=0.002) and ANB (p=0.002). This change in head posture was explained by Bjork et al[20], which is due the relationship between the form of the cranial base and craniofacial morphology was often masked by the posture of the head on the cervical vertebra.

Muto et al.[21] has also observed head extension after mandibular setback surgery and change of jaws relationship from Class III to Class I. According to Hunt et al[22] orthognathic patients experienced psychosocial benefits as a result of orthognathic surgery, including improved self-confidence, body and facial images, and social adjustment. Wenzel et al[23] mentioned the psychosocial factors that stimulate patients to lift their heads; this reinforces the changes in head position from the biologic changes.

Limitations of the study:

1. The amount of changes in NHP and prediction of change was not assessed.
2. The airway spaces and muscle activities after orthognathic surgeries were not assessed.

CONCLUSION

1. Most of the Class I patients who had received conventional orthodontic treatment showed a minimal or no change in their NHP, but some Class III patients who had undergone mandibular setback surgery showed a change in their NHP, which tended toward head extension.
2. Patients who have undergone Class II Lefort I surgery had shown the changes in their Natural head position by showing the differences in their SNA, SNB and Frankhort horizontal plane angle and head flexion.
3. Patients who went through Class III mandibular set back also showd changes in Natural Head Position, but the differences were in their SNB, ANB and facial contour angle.

REFERENCES

1. SolowB, Sandham A. Craniocervical posture a factor in the development and functionof Dentofacial structures. EurJOrthod,2002;24:447–56.
2. Cooke MS. Five year reproducibility of natural head posture: A longitudinal study. Am J Orthod Dentofacial Orthod. 1990;97:489-94.
3. Peng L, Cooke MS. Fifteen year reproducibility of natural head posture: A longitudinal study. Am J Orthod Dentofacial Orthod.1991;116:82-5.

4. Lundstrom A. Orientation of profile radiographs and photos intended for publication of case reports. Proc Finn Dent Sot1981;77:105-11.
5. Ellis D 3rd, McNamara JA Jr. Cephalometric reference planes—sella nasion vs Frankfort horizontal. Int J Adult Orthodon Orthognath Surg 1988;3:81-7.
6. Proffit WR, Phillips C, Douvartzidis N. A comparison of outcomes of orthodontic and surgical-orthodontic treatment of Class II malocclusion in adults. Am J Orthod Dentofacial Orthop. 1992;101:556–65.
7. Naveen Bansal, Jeetinder Singla, Gurmeet Gera, Monika Gupta, Gurpreet Kaur. Reliability of natural head position in orthodontic diagnosis: A cephalometric study. Contemporary Clinical Dentistry, Apr-Jun 2012.
8. Moorrees CFA, Tandarts MEV, Lebret LML, Glatky CB, Kent RL Jr, Reed RB. New norms for the mesh diagram analysis.Am J Orthod 1976;69:57-71.
9. Cooke MS. Cephalometric analyses based on natural head posture of Chinese children in Hong Kong [Ph.D. thesis]. University of Hong Kong [submitted], 1986.
10. Spradley FL, Jacobs JD, Crowe DP. Assessment of the anteroposterior soft-tissue contour of the lower facial third in the ideal young adult. Am J Orthod 1981;79:316-25.
11. Sugawara J, Kawamura H. Principle and practice of contemporary surgical orthodontics. Osaka, Japan: Tokyo Rinsho Shuppan; 2000.
12. Vig PS, Rink JF, Showfety KJ. Adaptation of head posture in response to relocating the center of mass: a pilot study. Am J Orthod 1983;83:138-42.
13. McLaughlin RP. Facial and dental planning for orthodontists and oral surgeons. St Louis: Mosby; 2004. 95-6.
14. Athanasiou AE. Orthodontic Cephalometry. St Louis: Mosby-Wolfe; 1995. p. 134-5.
15. Bjern R. A comparison between the Frankfort horizontal and the sella turcica-nasion as reference plane in cephalometric analysis. Acta Odontol Scand 1957;15:1-12.
16. Brynolf F, M Lundberg, The Soft-Tissue Facial Profile Before and After Surgical Correction of Mandibular Protrusion. Acta Odontologica Scandinavica, 1969: 28(2) 157-177.
17. Phillips C. The effect of orthognathic surgery on head posture. Eur J Orthod. 1991 Oct;13(5):397-403.
18. Dohyun Cho, Dong-Soon Choi, Insan Jang, Bong-Kuen. Changes in natural head position after orthognathic surgery in skeletal Class III patients. Am J Orthod Dentofacial Orthop 2015;147:747-54.
19. Z Hedayati, Maryam P, Farbod Z. Comparison of Natural Head Position in Different Anteroposterior Malocclusions. J Dent (Tehran). 2013 May; 10(3): 210–220.
20. Bjork A. Some biological aspects of prognathism and occlusion of the teeth. Angle Orthod. 1951 Jan;21(1):3-27.
21. Muto T, Yamazaki A, Takeda S, Sato Y. Effect of bilateral Sagittal split osteotomy setback on the soft palate and pharyngeal airway space. Int J Oral Maxillofac Surg. 2008 May;37(5):419-23.
22. Hunt OT, Johnston CD, Hepper PG, Burden DJ. The psychosocial impact of orthognathic surgery: a systematic review. Am J Orthod Dentofacial Orthop 2001;120:490-7.
23. Wenzel A, Williams S, Ritzau M. Changes in head posture and nasopharyngeal airway following surgical correction of mandibular prognathism. Eur J Orthod 1989;11:37-42.