Journal of Oral Hygiene & Health
ISSN: 2332-0702

Karamifar et al., J Oral Hyg Health 2016, 4:2
DOI: 10.4172/2332-0702.1000204

Research Article Open Access

Craniofacial Structures in Short-statured Patients in Shiraz, Iran, 2009

Karamifar AA[1], Danaie SM[2], Motamedi MHK[3*], Nazari MS[4] and Davari M[1]

[1]Semnan University of Medical Sciences, Semnan, Iran
[2]Shiraz University of Medical Sciences, Shiraz, Iran
[3]Baqiyatallah University of Medical Sciences, Tehran, Iran
[4]Tehran Azad University of Dentistry, Tehran, Iran

Abstract

Objective: The aim of this research was to study the craniofacial structures in Short-Statured patients in Shiraz, 2009.

Materials and Methods: The method of this study is descriptive. The case group consists of 178 (90 girls - 88 boys) Short-Statured patients who referred to Endocrinology Department of Shiraz Namazi Hospital and a private office to consult about short-stature and growth problems. Considering the skeletal age, they had been categorized as two solid groups, familial short statured (76 total: 38 girls, 38 boys), and un-familial short-statured consisting of other causes of short-stature (102 total: 52 girls, 50 boys). For craniofacial structural evaluation, 50 Short-statured patients (25 boys and 25 girls) were compared to two normal groups divided according to their malocclusion. 147 patients (74 girls, 73 boys) with normal growth but class II malocclusion as group 1, and group 2 of 184 patients (90 girls, 94 boys) with normal growth but class II malocclusion.

Results: Evaluation of craniofacial indexes of short-statured patients indicated that the male short-statured patients have significantly shorter cranial base length and more convex profile (P<0.05) in compare with the group of normal growth and class 1 malocclusion. Comparing to normal class I, the female short-statured patients have significantly shorter cranial base length and have more convex profile and more vertical growth pattern (P<0.05).

Conclusion: Evaluation of craniofacial indexes showed that short-statured patients have more convex profile and more vertical growth.

Keywords: Craniofacial; Short-stature

Introduction

Owing the fact that Short-stature is one of the important signs of abnormal growth, in order to evaluate a short-statured child, it is essential to know the modality of a normal growth. For this purpose, several growth indicators have been using such as body fitness, skeletal growth, dental development and puberty [1,2]. Some of the important indicators are evaluation of skeletal growth and child's growth pattern assessment based on gender and age [3]. However, children in same calendar age do not have same biological age with similar growth rate. Considering the growth pattern, a child showing the reduction of growth rate, will be considered as an abnormal individual in terms of growth situation [2]. Some studies show that patients with short-statured problem have the bone age lower than normal [4]. According to the present knowledge, a child is considered as a growth stunting when the stature is below the 3% of average growth percentage curve or becoming lower than 2SD under the average growth length [3]. Short-stature can be occurred normally or can be presented primary or secondary to the other causes; but the majority of causes are related to growing tissue problems like chromosomal disorders, reducing the intra-uterus growth and skeletal dysplasia. In pathologic (secondary) type, malnutrition and different organ disorders such as lowering growth hormone, hypothyroidism, and rachitisme, etc. are considered as causing factors, however, short statured situation in this type is a sign of malnutrition known as "Nutritional Dwarfism". On time treatment of background disorder of a child can let the growth rate to modify to a normal pattern [3].

One of the most common craniofacial disorders is class II malocclusion caused by mandibular growth deficiency. This mandibular growth deficiency can be due to general growth declination, and if these conditions do not receive the proper treatment at a proper time, patients will be forced to pay for expensive orthodontic and surgery costs. Accordingly, it is suggested that patients take the advantage of growth factor functions by receiving the preliminary treatments, consequently, not only for designing the normal jaw relation but for reducing the high expenses of future treatments. Furthermore, several studies show that the functional orthopedic treatments should be done prior to puberty in order to have the most efficiency through puberty growth spurt period [5-8].

It is worth noting that the child's physical growth rate plays an important role to predict the disorder treatment future, considering the type and severity of that disorder, can indicate some growth deficiencies in a child as well. Up until now, several studies has been carried out to evaluate the mandibular and cranial base morphology and determine the correlation between development and dental eruption; and, all reported that the appropriate time of dentofacial therapy is relevant to determination of growth periods. Knowing the fact that an individual calendar age is not that qualified scale to assess the growth potential, it is more suggested to take the absolute advantage of proper treatments by knowing the exact time of puberty growth spurt [9].

Spinal developmental evaluation is the most useful index to

***Corresponding author:** Mohammad Hosein Kalantar Motamedi, Professor, Trauma Research Center, Baqiyatallah University, Iran, Tel: 00982122616946; E-mail: motamedical@yahoo.com

Received March 17, 2016; **Accepted** May 02, 2016; **Published** May 09, 2016

Citation: Karamifar AA, Danaie SM, Motamedi MHK, Nazari MS, Davari M (2016) Craniofacial Structures in Short-statured Patients in Shiraz, Iran, 2009. J Oral Hyg Health 4: 204. doi: 10.4172/2332-0702.1000204

determine the bone maturity. The idea of lateral cephalometric cliché changes simultaneously through the growth is completely accepted [3,8]; and, morphological changes through the body of spinal column during puberty can be used to assess the bone maturity and bone age [4]. Lamparski, in a study on the neck spinal vertebrae showed the effect of CVM (Cervical Vertebral Maturation) method on evaluation of skeletal age [10]. O'Reilly and Yannielo compared the sextuplet phases of the growth of neck vertebrae introduced by Lamparski with mandibular development and found out a correlation between phases of CVM and mandibular growth that indicates the puberty [11]. In 1995, Hassel and Farman brought forward a new index of CVM containing six phases like before, which was based on the lateral view of the second, third and fourth vertebrae. Based on those scholars' viewpoints, some vertebral metamorphosis like a notch on the inferior ridge of vertebrae and its eminence can determine the skeletal age and the remaining time of growth [12]. On the other hand, studies have shown that the high response time to correction devices like functional appliances designed for jaw disorders is in puberty period [13-15]. Therefore, application of a credible biological index attaining to determination of the growth spurt in mandible can be as a definite diagnostic tool for justification and accomplishment of treatment plan of class II malocclusion patients with lower grade of growth in mandible. There have been several researches carried out to show the high correlation between lateral cephalometric and mandibular growth so far, however, up until now, this correlation has not been tested for short-statured patients. The aim of this study is to determine the size and position of mandible in short-statured patients utilizing lateral cephalometric x-ray without extra ray absorption. The ideal point is to determine the size and position of the mandible and skeletal maturity without absorbing extra x-ray in short-statured patients. This is the fact that treatment of this type of patients needs adequate of knowledge and proficiency about craniofacial growth and application of different treatment plans. Besides, in this study, it has been attempted to evaluate the craniofacial structures of short-statured patients, and compare them with the normal structures and class II malocclusion cases.

Materials and Methods

This study is type of a quantitative descriptive research. 178 (90 girls, 88 boys) patient referring to Endocrinology Department of Namazi Hospital in Shiraz and a private office asking consultation for short-statured and growth problems were chosen as a case group. The stature under the 5% of the NCHS's (National Center for Health Statistics) [16] growth curve was considered as an entrance criterion to this study. While patients would be known as short-statured, they would be examined with para-clinical examinations as well. When the diagnostic examination reported the short-statured problem certainly, the patients signed informed consent for orthodontic examination and oral examinations got conducted and checked for their malocclusion. In case of seeing dento-alveolar problems, regarding to evaluation of alveolar growth by orthodontist, patients were sent to take lateral cephalometric x-ray by their consent. All the radiographies were taken in the Natural Head Position (NHP) by the Proline-CC Cephalostat (KV=85 2002 CA and CM) and PM (Planmeca o-y) devices at a Radiology clinic. The patients first categorized into two familial and non-familial groups. Also, patients were categorized to several groups by calendar age and by different developmental stage of lateral cephalometric radiology. Then after, patient with short-statured problem categorized in two solid groups. Group 1 was consisting of 76 (38 girl, 38 boy) individuals with familial short-statured problems. Group 2 was consisting of 102 (52 girls, 50 boys) individuals with un-familial short-statured problems with other causes of this problem based on the equal skeletal and calendar age to group 1. Lateral cephalometric developmental phases were determined based on Farman and Hassel method. The data gathered for each individual got recorded. For skeletal age determination, 6 phases were indicated by Farman and Hassel [12]. After preparing lateral cephalometric clichés of 50 short-statured patients, for craniofacial evaluation, the number of 13 point including S, N, A, B, POG, ME, GO, GN, ANS, PNS, CO, PO and OR, and SNA, SNB, ANB, S-N-POG, Y-axis, Basal, FMA, GO-GN-SN angles, and the SN plane length in two dimensions vertical and sagittal were measured. For further precision and calibration of the data gathered for each patients, all the radiographies were analyzed and recorded by just one person. Results from data analysis of the evaluation of morphological characteristics of the patients were compared with two normal control groups 1 and 2 from Shiraz that had 11 to 13 years old. The normal group 1 consisted of 147 (74 girls, 73 boys) individuals with normal growth state and class I malocclusion and the normal group 2 consisted of 184 (90 girls, 94 boys) individuals with normal growth state and class II malocclusion.

The criteria considered as normal group 1 were consisted of a straight or slightly convex profile, class I occlusal relation, normal over jet and over bite, crowding less than 5 millimeters, normal ANB (1-4 Degree) and normal Wit's (-1±1). The criteria considered as normal group 2 were consisted of class II malocclusion without sign of short-stature problem, convex profile, molar and canine class II relations and the over jet more than 4 millimeters. In order to survey the discrepancies between short-statured craniofacial indexes and normal individuals which had class I and II malocclusion, in age group 12-13, the two-sample t-test method was used. Also, for testing the normality of the distribution of the craniofacial indexes the one-sample Kolmogrov-Smirnov test was used. For statistical analysis the meaningful level of 0.05 was considered. Cephalometry diagram is associated here (Figure 1).

Results

Among 76 familial short-statured patients (38 girls, 38 boys), the highest frequency in girls was related to the 11-year-old age group with the value of 6 (7.9%) and 12-year-old age group with the value of 6 (7.9%) and in boys the highest frequency was related to the 14-year-old age group with the value of 6 (9.2%).

Also, the least frequency in girls was related to two age groups of 14 and 17-year-old each of them with the value of 2 (2.6%) and in boys was related to 10 and 11-year-old age group each of them with the value of 2 (2.6%). In un-familial short-statured patients' evaluations, the results are as below. Among 102 (52 girls 51% and 50 boys 49%) short-statured patients, the highest frequency for girls was related to 8-year-old age group with the value of 8 (8.7%) and for boys the highest frequency was related to 15-year-old age group with the value of 8 (8.7%). The least frequency for girls was related to 17-year-old age group with the value of 3 (2.9%) and in boys the least frequency was related to 11-year-old age group with the value of 3 (2.9%).

Lateral cephalometric evaluations of familial short-statured patients (38 girls, 38 boys) showed that the highest frequency for girls was related to phase 2 with the value of 9 individuals (11.8%) and the least frequency was related to phases 5 and 6 individuals with the value of 5 (6.6%). The highest frequency for boys was related to phase 2 with the value of 8 individuals (10.5%) and the least frequency was related to phase 6 with the value of 4 individuals (5.3%) (Table 1).

Lateral cephalometric evaluations of un-familial short-statured

Citation: Karamifar AA, Danaie SM, Motamedi MHK, Nazari MS, Davari M (2016) Craniofacial Structures in Short-statured Patients in Shiraz, Iran, 2009. J Oral Hyg Health 4: 204. doi: 10.4172/2332-0702.1000204

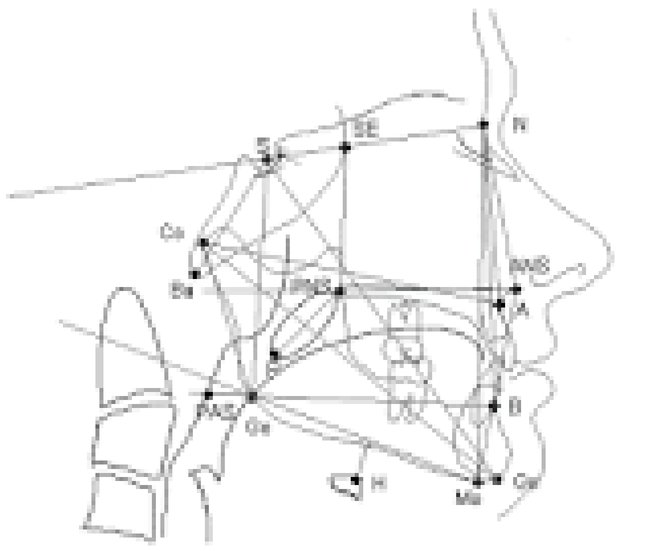

Figure 1: Cephalometry picture.

	CMW group						
Sex	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Female	6 (7.9%)	9 (11.8%)	6 (7.9%)	7 (9.2%)	5 (6.6%)	5 (6.6%)	38 (50%)
Male	7 (9.2%)	8 (10.5%)	6 (7.9%)	6 (7.9%)	7 (9.2%)	4 (5.3%)	38 (50%)
Total	13 (17.1%)	17 (22.4%)	12 (15.8%)	13 (17.1%)	12 (15.8%)	9 (11.8%)	76 (100%)

Table 1: Distribution of frequency of developmental stages according to lateral cephalometry radiography in assessment of patients with familial short-stature.

patients (52 girls, 50 boys) showed that the highest frequency for girls was related to phase 1 with the value of 13 individuals (12.7%) and the least frequency was related to phases 3, 4 and 6 individuals with the value of 7 (6.9%). The highest frequency for boys was related to phase 1, 2 and 3 with the value of 10 individuals (9.8%) and the least frequency was related to phase 4 and 6 with the value of 6 individuals (5.9%) (Table 2).

Craniofacial evaluation of short-statured patients showed that the short-statured boys have meaningful shorter cranial base length and more convex profile compared to the individuals with normal growth and class I malocclusion ($P<0.05$). In addition, class II malocclusion with downward and posterior mandibular rotation was seen significantly in this group of patients ($P<0.05$). Short-statured boys have shorter cranial base length significantly in compare to the individuals with normal growth and class II malocclusion ($P<0.05$); however in class II malocclusion individuals, mandible positioned posterior and vertical growth pattern is higher ($P<0.05$) (Table 3).

Craniofacial evaluation of short-statured patients showed that the short-statured girls have significantly shorter cranial base length with more forward position maxilla compared to the normal growth individuals with class I malocclusion ($P<0.05$), however the position of the mandible in cranial base is normal ($P=0.33$). In addition, class II malocclusion and vertical growth pattern were more frequently seen among girls ($P<0.05$). The short-statured girls have shorter cranial base

	CMW group						
Sex	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Female	13 (12.7%)	9 (8.8%)	7 (6.9%)	7 (6.9%)	9 (8.8%)	7 (6.9%)	52 (51%)
Male	10 (9.8%)	10 (9.8%)	10 (9.8%)	6 (5.9%)	8 (7.8%)	6 (5.9%)	50 (49%)
Total	23 (22.5%)	19 (18.6%)	17 (16.7%)	13 (12.7%)	17 (16.7%)	13 (12.7%)	102 (100%)

Table 2: Distribution of frequency of developmental stages according to lateral cephalometry in patients with short-stature with other than familial etiologic.

length and more front side maxilla in compare to the normal growth individuals with class II malocclusion ($P<0.001$). Normal patients significantly have the more posterior mandibular position, but vertical growth pattern of patients with class II malocclusion is higher ($P<0.001$) (Table 3).

Discussion

Craniofacial indexes' evaluations in two vertical and sagittal dimensions showed that short-statured boys compared to normal growth group with class I malocclusion, in spite of having a similar growth pattern, have shorter anterior cranial base length and more convex profile due to the downward and posterior rotation of the mandible. However, the vertical growth pattern rate is lower in compare to the normal growth group with class II malocclusion. It can be concluded that the functional appliances are more efficient in these types of patients. Craniofacial indexes' evaluations in two vertical and sagittal dimensions showed that short-statured girls compared to normal growth group with class I malocclusion have shorter anterior cranial base length, more convex profile and more vertical growth pattern. However, because the convexity is more related to the front sided maxillary bone, using maxillary growth control appliances like head-gear is more efficient.

Patients with deficiency in anterior part of the pituitary gland are more facing to craniofacial complex growth disorders. Familial short statured patients' evaluations in sagittal dimension showed that short-statured children have shorter anterior cranial base length in compare to the normal growth groups [17]. Moreover, based on this study, short statured boys have posterior sided mandible with more convex profile. This result is similar to the study conducted by Spiegel et al. [18] and Konfino et al. [19]. Spiegel et al. [18] showed that either boy or girls with hormonal deficiencies show more discrepancies to evaluate the linear facial measurements and have growth delay in mandible. They had shown that in short-statured boys all the linear measurements such as posterior face length, anterior cranial base length, posterior cranial base length and total cranial base length have been decreased. Short statured girls' anterior cranial base lengths were normal but posterior cranial base growth faced to delay. Spiegel et al. [18]'s study is more of significant because it evaluates different craniofacial structures in relation to different endocrine disorders. Their study showed that even idiopathic short statured patients seems to have discrepancies in growth and development such as decrease in posterior face length and delay in growth in spite of skeletal growth rate. Their study showed that open bite disorder has been seen in almost all of the patients with different endocrine disorders. However, in this study open bite situation was seen only in girls ($p<0.001$) which can be the result of the decrease in condylar growth, although the general mandibular growth was normal.

Also, Konfino et al. [19] in study on number of 10 short-statured patients have shown that the cranial base length is shorter and mandible is in the posterior position. Moreover, more tendency to have vertical

	Controls					
	Patients		Cl.II		Cl.I	
Parameters	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
SN	67.44	70.48	71.5***	73.8***	69.3*	72.6**
SNA	84.6	84.36	82.7***	83.8	82.3**	83.6
SNB	78.56	79.88	77.2*	77.3***	79.1	80.4
ANB	5.12	4.48	5.5	6.5***	3.2***	3.2**
S-N-Pog	79.16	78.88	77.4***	78.4	80.3	81.3***
y-axis	60.64	60.24	62.3***	61.8***	58.3***	59.2*
Basal angle	29.12	27.6	26.3***	29.2*	24.9***	27.3
FMA	29.16	27.28	25.1***	28.9*	24.4***	26.7
Go-Gn-SN	37.04	33.6	34.3***	35.1**	33.8***	33.5

* significant at level <0.05

** significant at level <0.01

*** significant at level <0.001

Table 3: Comparison of craniofacial indexes of boys and girls with short-stature in proportion to persons with normal growth and class I & II malocclusion.

growth was reported. Cranial base length shortening speaking, the result of their study is matched with the results of the present study, which can be the consequence of the early synchondrosis of cranial base in short-statured patients. However, in terms of the growth pattern, the results were reverse, means in short-statured boys, decrease in vertical growth was not seen. Accordingly, it seems that condylar growth has not been affected, so that using growth inducing devices like functional appliances is more effectual in the case group study of short- statured boys.

In present study, there has not been seen a significant difference between SNA angle degree of short-statured boys and the normal growth group, so, this result is in inconsistency with Konfino et al. [19] and Spiegel et al. [18] reports. It seems decrease in cranial base length followed by early synchondrosis has no impact on anterior part of the maxillary bone but it impacts on maxillary vertical growth since it caused the open bite situation. Also, the study conducted by Kjellberg et al. [20] in 2000 on 48 patients with or without short-statured situation showed that mandible was in posterior position in short-statured patients, also, they had shown that the maxillary bone was in the posterior position in short-statured patients which is in contrast to the present study. In present study, in the case group not only the maxillary bone was not located at the posterior position, but also was at the anterior position more obvious and more significant in girls rather than boys though. Therefore, it seems that in short-statured girls of our group study, mandible bone has not been affected considerably. Hence, vertical evaluation of short-statured boys compared to normal growth group with class I malocclusion showed that short-statured boys had similar growth pattern, which was contrary to Speigel et al. [18], Konfino et al. [19] and Kjellberg et al. [20] reports. In studies mentioned above, lack of growth had perceptible effect on condylar growth, while in the present study, condylar growth has not been affected. Evaluations in sagittal dimension showed that short-statured girls compared to normal growth group with class I malocclusion had shortage in cranial bas length. Also, short-statured girls had more convex profile that is matched with the result reported by Konfino et al. [19]. Speigel et al. [18] had reached to the similar results; as well as they found out that in girls, mandibular position was slightly posterior but it was statistically non-significant. Evaluation in vertical dimension showed that short-statured girls compared to normal growth group with class I malocclusion had more vertical growth pattern that confirmed the result reported by Speigel et al. [18] and Konfino et al. [19].

Evaluations in sagittal dimension showed that the normal growth group with class II malocclusion had more convex profile with more retro gnathic chin position. Also, class II malocclusion patients have more vertically growth pattern, which means despite of tendency of short-statured patients to have vertical growth, decrease in mandibular growth and convex profile, the effect of short-stature on facial growth pattern and profile is not as much as class II malocclusion. Nonetheless, in short-statured patients the anterior cranial base length is significantly shorter as regards, this measurement in short-statured patients is significantly lower compared to class I malocclusion, so that this shortage can be referred to short-statured problem.

Evaluating in both sagittal and vertical dimensions in short-statured girls compared to normal growth group with class II malocclusion showed that anterior cranial base of short-statured girls are significantly shorter that class II malocclusion patients. Class II malocclusion patients have more retro gnathic mandible with more convex profile compared to short-statured girls although the values were not statistically significant. Moreover, girls with class II malocclusion had more vertical growth pattern rather than short-statured girls, which can be interpreted that the effect of short-statured problem is less than class II malocclusion by itself and does not cause exacerbation.

Conclusion

Craniofacial indexes evaluation showed that short-statured patients have more vertical growth pattern and more tendencies to have convex profile.

References

1. Reiter EO, Witt MF (1985) Physical growth and development. In Braham RL, Morris ME, eds. Textbook of Pediatric Dentistry. Baltimore: Wiliams & Wilkins, 2-23.
2. Tillmann V, Thalange NK, Foster PJ, Gill MS, Price DA, et al. (1998) The relationship between stature, growth, and short-term changes in height and weight in normal prepubertal children. Pediatr Res 44: 882-886.
3. Reiter EO, rosenfeld RG (2008) Normal and aberrant growth. In Larsen PR, Kronenberg Hm, Melmed S, et al, eds. Williams textbook of Endocrinology. Philadelphia: Saunders, (11thedn), 849-967.
4. Sato K, Mito T, Mitani H (2001) An accurate method of predicting mandibular growth potential based on bone maturity. Am J Orthod dentofacial Orthop 120: 286-293.
5. Hägg U, Pancherz H (1988) Dentofacial orthopedics in relation to chronological age, growth period and skeletal development. An analysis of 72 male patients

Citation: Karamifar AA, Danaie SM, Motamedi MHK, Nazari MS, Davari M (2016) Craniofacial Structures in Short-statured Patients in Shiraz, Iran, 2009. J Oral Hyg Health 4: 204. doi: 10.4172/2332-0702.1000204

with Class II division 1 malocclusion treated with the Herbst appliance. Eur J Orthod 10:169-176.

6. Sierra AM (1987) Assessment of dental and skeletal maturity. A new approach. Angle Orthod 57: 194-208.
7. McNamara JA Jr, Bookstein FL, Shaughnessy TG (1985) Skeletal and dental changes following functional regulator therapy on class II patients. Am J Orthod 88: 91-110.
8. Sato K, Mitani H (1998) Evaluation of growth potentialities of maxilla and mandible by use of TW2 method and ossification events in skeletal Class III. J Jpn Orthod Soc 57: 1-9.
9. Grave KC, Brown T (1976) Skeletal ossification and the adolescent growth spurt. Am J Orthod 69: 611-619.
10. Lamparski DA (1975) Skeletal Age Assessment Utilizing Cervical Vertebral. AJDO 47: 458-459.
11. O'Reilly MT, Yanniello GJ (1988) Mandibular growth changes and maturation of cervical vertebrae--a longitudinal cephalometric study. Angle Orthod 58: 179-184.
12. Hassel B, Farman AG (1995) Skeletal maturation evaluation using cervical vertebrae. Am J Orthod Dentofacial Orthop 107: 58-66.
13. McNamara JA Jr (1973) Neuromuscular and skeletal adaptations to altered orofacial region. AJDO 67: 578-606.
14. McNamara JA Jr, Bookstein FL, Shaughnessy TG (1985) Skeletal and dental changes following functional regulator therapy on class II patients. Am J Orthod 88: 91-110.
15. Baccetti T, Franchi L, Toth LR, McNamara JA Jr (2000) Treatment timing for Twin-block therapy. Am J Orthod Dentofacial Orthop 118: 159-170.
16. www.cdc.gov/growthcharts.
17. Thilander B (1995) Basic mechanisms in craniofacial growth. Acta Odontol Scand 53: 144-151.
18. Spiegel RN, Sather AH, Hayles AB (1971) Cephalometric study of children with various endocrine diseases. Am J Orthod 59: 362-375.
19. Konfino R, Pertzelan A, Laron Z (1975) Cephalometric measurements of familial dwarfism and high plasma immunoreactive growth hormone. Am J Orthod 68: 196-201.
20. Kjellberg H, Beiring M, Albertsson Wikland K (2000) Craniofacial morphology, dental occlusion, tooth eruption, and dental maturity in boys of short stature with or without growth hormone deficiency. Eur J Oral Sci 108: 359-367.