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EFFECT OF CHIN-CUP THERAPY ON THE CRANIOCERVICAL ANGULATION

El-Mehy, Gh.*

ABSTRACT

Skeletal Class III is a common orthodontic problem, so, the effect of chin-cup therapy on craniocervical angulation was evaluated in this study. Eleven orthodontic female patients were selected with skeletal Class III malocclusion. Their ages ranged from nine to eleven years. Patients was treated by chin-cup appliance for about two years. Pre and post treatment cephalometrics was taken. Craniocervical angulation was recorded through certain cephalometric measurements. Statistical analysis revealed that, there was a significant changes of most of the measurements with increase of craniocervical angulation. It could be concluded that, chin-cup therapy could affect craniocervical angulation.

INTRODUCTION

Chin-cup have been used in interceptive procedures for correction of incipient CIII skeletal malocclusion for many year[1]. This therapy attempts to retard or redirect the growth of the mandible to obtain a better anteroposterior relationship between the two jaws. The previous studies[2,3,4,5,15], confirmed the ability of chin-cup force to alter mandibular growth pattern. Its effect on the growing human mandible has clinically shown variable results. The variability took place with regard to individual differences in growth amount, direction, velocity and morphology of the mandible during the actual period of the therapy[15].

The presence of a relationship between the posture of the head and the cervical column and the form of the facial skeleton has been well established through studies on children and adults [9]. A natural head posture characterized

* Lecturer of Orthodontics, Faculty of Dentistry, Tanta University

by a large craniocervical angulation is seen on the average, in connection with a vertical development with large anterior and facial dimension and large inclination of the mandibular plane [6].

It was reported that changes is craniocervical inclination are associated with the true rotation of the mandible as determined by structure-based superimposition[7,8]. Solow and Siersbaek[9] predicted that, a large craniocervical angulation is related to vertical facial development and backward rotation of the mandible, while a small craniocervical angulation would be expected in subjects with more horizontal facial development and forward rotation of the mandible.

On the other hand, EL-Kadi [10] revealed that, there was a significant decrease occurred in the craniocervical angulation after using activator appliance in growing patients with skeletal CII malocculusion. Also, Tecco et al., [17] concluded that there was a decrease in craniocervical angulations after treatment by rapid maxillary expansion in mouth breathing girls.

It was demonstrated that tempromandibular dysfunction was seen in connection with a marked forward inclination of the upper cervical spine and an increased craniocervical angulation[16]. So, the information of the effect of chin-cup as a simple orthopedic appliance on craniocervical angulation was manadatory in patients with skeletal. CIII malocclusion.

The purpose of this current work was to evaluate the effect of chin-cup on the craniocervical angulation in skeletal Class III patients.

Materials and Methods

This current study was carried out on eleven orthodontic patients attending at the Department of Orthodontics, Faculty of Dentistry, Tanta University seeking for orthodontic treatment. All patient was Class III skeletal malocclusion, their ages ranged from 9-11 years. They were treated by occipital pull chin-cup appliance for two years 14-16 hours/day. The force level was 500-600 gm.

The selected patients was free from any congenital anomalies of the head and neck, without any previous orthodontic treatment or orthognathic surgery and without any systemic disease affect craniofacial complex. For each patient enrolled in this study pre and post treatment cephalometric radiographs were taken in the natural head position. A 0.5 mm lead wire suspending a weight was mounted in front of the X-ray cassette, in order to indicate the true vertical on the film [11].

The cephalometric radiographs were traced and the following measurements were recorded (figure. 1).

CV_2 ap-CV_4ip (cm): the length of the cervical column, between the apex of the odontoid process of the second cervical vertebrae (CV_2 ap) and the most posterior and inferior point of the corpus of the fourth cervical vertebrae (CV_4 ip) [6].

CVT-EVT: the cervical lordosis angle between the cervical vertebrae tangent (CVT) and the EVT (the lower part of the cervical spine the line through CV_4ip and CV_6ip of the six cervical vertebrae)[12].

CVT-FH: the inclination of the cervical column in relation to the Frankfort horizontal line [13].

CVT-FML: angle between cervical vertebrae tangent and the formen magnum line (FML) [6].

CVT-HOR: the inclination of the cervical column to the true horizontal line [HOR=the line perpendicular to the true vertical line (VER)] [14].

CVT-ML: the head position in relation to the cervical column. Angle between CVT and the mandibular plane "ML" (Go-Gn) [14].

CVT-RL: the head position in relation to the cervical column. Angle between CVT and the ramus plane tangent line on the posterior contour of the ramus ascending (RL) [14].

CVT-NSL: the angle between CVT and sella-nasion line [14].

OPT-CVT: the inclination of the two cervical reference lines to each other. The angle between the odontoid process tangent OPT and CVT[14].

OPT-FH: the inclination of the cervical column in relation to the Frankfort plane [13].

OPT-FML: the angle between OPT and the foramen magnum line (FML) [6].

OPT-HOR: the inclination of the cervical column to the true horizontal line (HOR) [14].

OPT-ML: the head position in relation to the cervical column angle between OPT and ML line [14].

OPT-RL: the angle between OPT line and RL line [14].

OPT-NSL: the angle between OPT line and N-S line [14].

The craniocervical angulation (the position of the head in relation to the cervical column) was expressed by the angles between the craniofacial reference lines, OPT and CVT. Cervical inclination in relation to true horizontal was expressed by OPT-HOR and CVT-HOR. The relation of the mandibular plane

and the tangent of the ramus to the cervical inclination was expressed by CVT-ML, CVT-RL, OPT-ML and OPT-RL respectively [9]. The cephalometric X-ray for each patient was traced twice in different time, and the average of each variable was recorded for statistical analysis.

The data was collected and statistically analyzed by using T-test (as a parametric analysis) and Mann-Whitny U-Test (as a non parametric analysis).

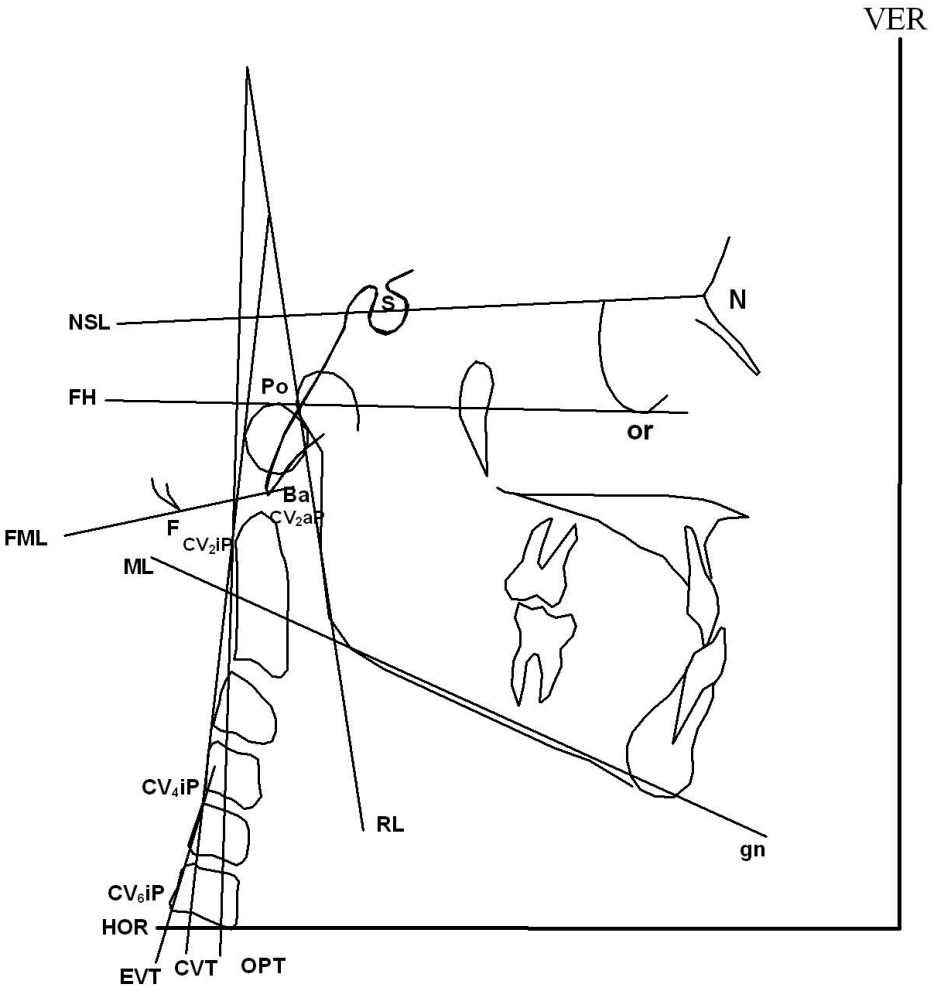

Figure (1): Cephalometric reference points and planes to measure craniocervical angulation

RESULTS

Descriptive statistics including, mean and standard deviation for pre and post treatment measurements was demonstrated in table (1).

The test of significance of the effect of treatment on all of the measurements was illustrated in table (2) and figure (2). It was revealed that there was a non significant change of both CV2ap-CV4ip and OPT-HOR (P=0.05). While, there was a highly significant difference (P=0.001) of the remaining measurements and for CVT-HOR, CVT-ML and OPT-FH the probability level of significance was P=0.01. The results was confirmed by the non parametirc U-test which demonstrated similar values.

Table (1): Mean and standard deviation of all measurements pre and post treatment

Measurements	Pre treatment		Post treatment	
	Mean	**S.D.**	**Mean**	**S.D.**
CV2 AP-CV4 ip	5.66	0.14	5.94	0.29
CVT-EVT	6.27	1.42	12.09	1.70
CVT-FH	89.64	3.59	95.36	4.37
CVT-FML	95.73	2.57	104.73	4.69
CVT-HOR	81.73	4.05	86.45	4.29
CVT-ML	69.64	3.91	74.27	4.67
CVT-RL	17.01	1.34	11.73	1.61
CVT-NSL	97.54	2.51	105.00	1.95
CVT-OPT	4.18	1.16	7.01	1.26
OPT-FH	88.18	4.06	93.09	4.39
OPT-FML	93.36	4.01	101.64	2.94
OPT-HOR	86.18	8.28	90.81	7.91
OPT-ML	63.64	2.87	68.27	2.01
OPT-RL	13.27	2.45	7.82	1.53
OPT-NSL	95.36	2.41	102.18	2.23

SD= standard deviation
N=11

Table (2): Tests of significance for the effect of the treatment of all measurements

Measurements	T-test		U-test	
	t-value	P.	Z-value	P
CV2 AP-CV4 ip	1.79	0.088ns	1.65	0.098ns
CVT-EVT	8.71	0.000**	3.97	0.001**
CVT-FH	3.36	0.003**	3.09	0.002**
CVT-FML	5.57	0.001**	3.95	0.000**
CVT-HOR	2.65	0.013*	2.57	0.010*
CVT-ML	2.53	0.020*	2.370	0.18*
CVT-RL	-8.32	0.000**	-3.97	0.001**
CVT-NSL	7.79	0.001**	3.92	0.000**
CVT-OPT	5.43	0.001**	3.63	0.001**
OPT-FH	2.71	0.013*	2.67	0.011*
OPT-FML	5.52	0.000**	3.69	0.000**
OPT-HOR	1.34	0.194ns	1.65	0.102ns
OPT-ML	4.38	0.000**	3.27	0.001**
OPT-RL	-6.25	0.004**	-3.26	0.006**
OPT-NSL	6.87	0.000**	3.82	0.000**

ns=non significant at P=0.05 ** Significant at P=0.001
* Significant at P=0.01

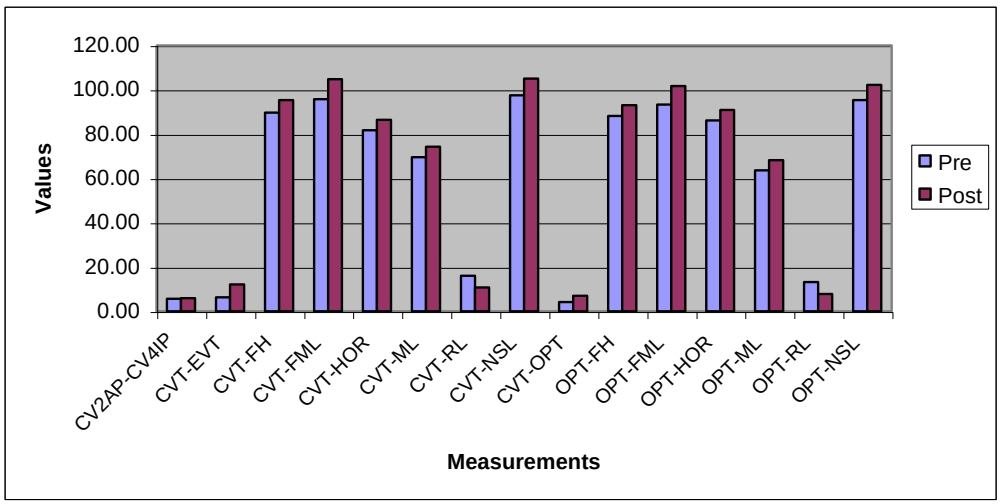

Figure (2): Mean values of different measurements pre and post treatment

DISCUSSION

The purpose of this study was to evaluate the changes in the craniocervical angulation in response to chin-cup as a simple treatment of female patients with developing skeletal class III malocclusion.

The results of this study revealed that there was a significant increase occurred in the cranio-cervical angulation after using the chin-cup for two years. This results was approved by T-test and for more assurance and confidence U-test was performed and produced the same results. This might be due to the average backward rotation of the mandible (clock-wise rotation) as a result of chin-cup effect on the growth direction. These results in a agreement with and supported by many of the investigators[7,9,18,19].

Abol-Azm et al.,[20] proved that there was a synchoronization of the growth occurred between the skeletal units of the cranial base, mandible and the cervical vertebrae for reaching the ultimate size of the craniofacial and cervical structure.

Solow and Siersback-Neilsen[7] revealed that the changes in craniocervical angulation and cervical inclination were associated with the degree and direction of the true mandibular rotation. It was seen that, an increase in crainocervical angulation was associated with backward or less than average forward growth rotation of the mandible. Also Wendel et al.,[21] found that large change in the direction and amount of cranial flexure angle after treatment by chin-cup.

The cervical inclination in relation to true horizontal which was expressed by OPT-HOR showed non significant change, this is supported by other different study[10] in which OPT HOR and CVT-HOR showed controversy in the significant results.

Concerning CVT-RL and OPT-RL showed a significant decrease, this might be due to the variability of remodeling response of the mandible as documented by Mitani and Fukazawa[4] and Graber et al.,[22].

CONCLUSION

Chin-cup therapy could affect the growth and development of the craniofacial component with the resultant increase in craniocervical angulation.

RECOMMENDATION

Further investigation is recommended with increasing sample size and other treatment modalities of skeletal CIII. Thus the clinician becomes aware of

the effect of managing young patients with prognathic mandible on the entire craniofacial complex.

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