IRA-International Journal of Applied Sciences
ISSN 2455-4499; Vol.07, Issue 02 (2017)
Institute of Research Advances
Pg. no. 75-94
http://research-advances.org/index.php/IRAJAS

Evaluation of Craniofacial Morphology in Subjects with Down's Syndrome: A Cephalometric Study

Dr. Pradeep Subbaiah
Assistant Professor, Department of Orthodontics
JSS Dental College and Hospital, Mysore, Karnataka, India.

Type of Review: Peer Reviewed.
DOI: http://dx.doi.org/10.21013/jas.v7.n2.p4

How to cite this paper:
Subbaiah, P. (2017). Evaluation of Craniofacial Morphology in Subjects with Down's Syndrome: A Cephalometric Study. *IRA-International Journal of Applied Sciences* (ISSN 2455-4499), 7(2), 75-94. doi:http://dx.doi.org/10.21013/jas.v7.n2.p4

Down's syndrome is a disease entity in which the defect in mental development is associated in a unique way with a large number of physical defects.[1,2] It is a condition resulting from an extra chromosome 21 and thus the condition is also known as Trisomy 21. It is considered one of the most frequent genetic causes of mental retardation.[3]

The incidence of Down's syndrome is estimated to be between 1.6 to 2.5 per 1000 live births and increases with increase in maternal age.[4,59,10] Mongoloids usually exhibit retarded motor and language skills, with an IQ range from extremely low to 45-55. [6,711,12]

Cephalometry has now been firmly established as the most essential procedure for gaining knowledge of the complexities of dentofacial skeletal pattern. By utilizing cephalometric radiography, whereby description, morphologic outline, measurement and change in growth of the skull can be fairly accurately ascertained, it might be possible to observe some of the subtle

The present study is an attempt to determine cephalometrically whether the group of individuals with Down's syndrome have a distinctive craniofacial phenotype. The growth of the craniofacial area in the presence of the extra chromosome is also examined.

AIMS AND OBJECTIVES

- The aim of this study is to analyze cephalometrically the morphology of cranial base, midface and dental characteristics in subjects with Down's syndrome and compare the same with that of normal.
- To evaluate the growth of the cranial base and maxilla in subjects with Down's syndrome and to compare the same with that of normal.

Material and methods-

For the present study a sample of 32 (16 males and 16 females) patients with Down's syndrome ranging in age from 6 to 18 years were selected. The sample was further broken down into the following age groups: 6 to 12 years and 12 to 18 years. All the patients were verified trisomic Mongoloid by virtue of karyotype examination.[4,7] The consent form for the study was signed by the parents.
The control group consisted of 32 normal individuals (16 males and 16 females) and was balanced with the trisomy 21 group as far as possible for age and sex.
All the members of the control group had Class I or end to end molar relationships. The study was approved by the ethics committee of J.S.S. Dental College and Hospital.

The cephalometric analysis comprised of the following variables:

A) Skeletal measurements

		Male	Female
1)	NSBa	$130^0 \pm 6$	$130^0 \pm 6$
2)	S-N	83 mm $\pm$ 4	77 mm $\pm$ 4
3)	S-Ba	50 mm $\pm$ 4	46 mm $\pm$ 4
4)	Ba- N	120 mm $\pm$ 4	112 mm $\pm$ 5
5)	SNA	$82^0 \pm 4$	$82^0 \pm 4$
6)	Pal Pl – NSe	$5^0 \pm 2$	$5^0 \pm 2$
7)	N – ANS	60 mm $\pm$ 4	56 mm $\pm$ 3
8)	PNS – ANS	62 mm $\pm$ 4	57 mm $\pm$ 4

B) Dental Measurements

1)	U1–NA(^{0})	$22^0 \pm 6$	$22^0 \pm 6$
2)	U1–NA(mm)	4 mm $\pm$ 3	4 mm $\pm$ 3
3)	Pal pl–U1	33 mm $\pm$ 3	33 mm $\pm$ 3
4)	Pal pl–U6	28 mm $\pm$ 3	25 mm $\pm$ 2
5)	U1–SN	$104^0 \pm 6$	$104^0 \pm 6$
6)	U1–Palpl	$112^0 \pm 6$	$112^0 \pm 6$

Table: 1Distribution of the subjects by Age, Sex and Group

Age	**Sex**	**Group**		**Total**
		Down's Syndrome (DS)	**Normal (N)**	
6-12 years	Male (M)	8	8	16
	Female (F)	8	8	16
12-18 years	Male (M)	8	8	16
	Female (F)	8	8	16
Total (T)		16	16	32

Table 2: Mean NSBa values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	133.5000	2.9277	126.1250	4.7940	129.8125	5.4064
	F	140.0000	2.6186	128.3750	3.3354	134.1875	6.6655
	T	136.7500	4.2973	127.2500	4.1553	132.0000	6.3703
12-18 yrs	M	138.0000	3.2071	129.7500	6.7771	133.8750	6.6621
	F	140.2500	1.8323	132.1250	2.8504	136.1875	4.7919
	T	139.1250	2.7779	130.9375	5.1700	135.0313	5.8281
Total	M	135.7500	3.7683	127.9375	5.9718	131.8437	6.3149
	F	140.1250	2.1871	130.2500	3.5684	135.1875	5.8001
	T	137.9375	3.7583	129.0938	4.9797	133.5156	6.2462

Tests of Between -Subjects Effects

A) F_{groups}: 85.396; P< .000 (S), F_{ages}: 10.032; P< .002 (S), F_{sex}: 12.208; P< .001 (S)
F_{groups}x F_{ages}:.470; P< .496 (NS), F_{groups}x F_{sex}: 1.161; P< .286 (NS)

F_{ages}x F_{sex}: 1.161; P< .286 (NS), F_{groups}x F_{ages}x F_{sex}: 1.306; P< .258 (NS)

Between the groups a significant difference was observed in the mean NSBa values of DS and Normal individuals where DS had higher value (F=85.393; P<.000). Between age groups also a significant difference was observed (F=10.032; P<.002) where 12-18 year group had higher value than 6-12 year. Between sex groups also a significant difference was observed (F=12.208; P<.001) where males had higher NSBa value as compared to females. All the interaction effects were found to be non significant.

Table 3: Mean SNA values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	78.6250	5.5016	79.8750	5.7925	79.2500	5.4955
	F	78.7500	4.2003	80.6250	1.5980	79.6875	3.2191
	T	78.6875	4.7289	80.2500	4.1231	79.4688	4.4358
12-18 yrs	M	80.2500	2.1876	81.8750	4.1209	81.0625	3.2958
	F	80.7500	2.1876	81.1250	3.1820	80.9375	2.6450
	T	80.5000	2.1292	81.5000	3.5777	81.0000	2.9403
Total	M	79.4375	4.1307	80.8750	4.9649	80.1563	4.5516
	F	79.7500	3.3961	80.8750	2.4461	80.3125	2.9669
	T	79.5938	3.7232	80.8750	3.8500	80.2344	3.8120

Tests of Between -Subjects Effects

B) F_{groups}: 1.741; P< .192 (NS), F_{ages}: 2.487; P< .120 (NS), F_{sex}: .026; P< .873 (NS)
F_{groups}x F_{ages}:.084; P< .773 (NS), F_{groups}x F_{sex}: .026; P< .873 (NS)

F_{ages}x F_{sex}: .084; P< .773 (NS), F_{groups}x F_{ages}x F_{sex}: .233; P< .631 (NS)

Between the groups, ages and sex non significant differences were observed in the mean SNA values. All the interaction effects were also found to be non significant.

Table 4: Mean Palpl-NSe values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	6.1250	2.1002	7.0000	5.1270	6.5625	3.8117
	F	15.9750	28.6995	5.3750	2.3261	10.6750	20.4172
	T	11.0500	20.3053	6.1875	3.9365	8.6188	14.5980
12-18 yrs	M	5.7500	2.4928	6.2500	3.0119	6.0000	2.6833
	F	6.6250	2.1998	7.0000	1.7728	6.8125	1.9397
	T	6.1875	2.3157	6.6250	2.4187	6.4062	2.3398
Total	M	5.9375	2.2351	6.6250	4.0804	6.2813	3.2551
	F	11.3000	20.2471	6.1875	2.1670	8.7437	14.4006
	T	8.6187	14.4291	6.4062	3.2215	7.5125	10.4306

Tests of Between- Subjects Effects

C) F_{groups}: .710; P< .403 (NS), F_{ages}: .710; P< .403 (NS), F_{sex}: .879; P< .353 (NS)
F_{groups}x F_{ages}:.1.018; P< .317 (NS), F_{groups}x F_{sex}: 1.219; P< .274 (NS)

F_{ages}x F_{sex}: .395; P< .532 (NS), F_{groups}x F_{ages}x F_{sex}: 1.167; P< .285 (NS)

Between the groups, ages and sex non significant differences were observed in the mean Palpl-NSe values. All the interaction effects were also found to be non significant.

Table 5: Mean U1-NA(^{0}) values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	22.7500	3.9551	25.1250	10.5212	23.9375	7.7758
	F	37.2500	5.4968	24.3750	6.7175	30.8125	8.9086
	T	30.0000	8.8015	24.7500	8.5362	27.3750	8.9362
12-18 yrs	M	35.6250	7.5958	24.1250	3.4821	29.8750	8.2371
	F	39.1250	3.8707	28.5000	13.6172	33.8125	11.1189
	T	37.3750	6.0978	26.3125	9.8639	31.8438	9.8312
Total	M	29.1875	8.8560	24.6250	7.5884	26.9063	8.4371
	F	38.1875	4.6935	26.4375	10.5891	32.3125	10.0272
	T	33.6875	8.3374	25.5313	9.1086	29.6094	9.5877

D) Tests of Between -Subjects Effects

E) F_{groups}: 18.044; P< .000 (S), F_{ages}: 5.417; P< .024 (S), F_{sex}: 7.928; P< .007 (S)
F_{groups}x F_{ages}:2.291; P< .136 (NS), F_{groups}x F_{sex}: 3.503; P< .066 (NS)

F_{ages}x F_{sex}: .585; P< .448 (NS), F_{groups}x F_{ages}x F_{sex}: 4.408; P< .040 (S)

Between the groups a significant difference was observed in the mean U1-NA(^{0}) values of DS and Normal individual where DS had higher value (F=18.044; P<.000). Between age groups also a significant difference was observed (F=18.044; P<.024) where 12-18 year group had higher value than 6-12 year Between sex groups also a significant difference was observed (F=7.928; P<.007) where females had higher U1-NA(^{0}) value as compared to males. In 6-12 years normal group females had lower value than males whereas in others females had higher value than males. All the other interaction effects were found to be non significant.

Table 6: Mean U1-SN values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	102.2500	6.5629	105.3750	10.0561	103.8125	8.3604
	F	112.5000	9.5019	105.3750	7.5012	108.9375	9.0515
	T	107.3750	9.5000	105.3750	8.5703	106.3750	8.9578
12-18 yrs	M	118.6250	8.5513	106.6250	6.5452	112.6250	9.6186
	F	119.7500	4.5277	104.1250	6.5124	111.9375	9.7192
	T	119.1875	6.6354	105.3750	6.4382	112.2813	9.5182
Total	M	110.4375	11.2129	106.0000	8.2219	108.2188	9.9312
	F	116.1250	8.1066	104.7500	6.8166	110.4375	9.3634
	T	113.2813	10.0490	105.3750	7.4563	109.3281	9.6396

Tests of Between -Subjects Effects

F) F_{groups}: 17.037; P< .000 (S), F_{ages}: 9.508; P< .003 (S), F_{sex}: 1.342; P< .252 (NS)
F_{groups}x F_{ages}:9.508; P< .003 (S), F_{groups}x F_{sex}: 3.279; P< .076 (NS)

F_{ages}x F_{sex}: 2.302; P< .135 (NS), F_{groups}x F_{ages}x F_{sex}: .748; P< .391 (NS)

Between the groups a significant difference was observed in the mean U1-SN values of DS and Normal individual where DS had higher value (F=17.037; P<.000). Between age groups also a significant difference was observed (F=9.508; P<.003) where 12-18 year group had higher value than 6-12 year. Between sex groups a non significant difference was observed (F=1.342; P<252). There was a significant difference in the mean value of 12-18 year of DS and Normal as compared to 6-12 year of DS and Normal. In DS group the values were higher in 12-18 year age than 6-12 year, whereas values were almost same in Normals. All the other interaction effects were found to be non significant.

Table 7: Mean U1-Palpl values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	111.5000	5.5291	113.3750	7.7448	112.4375	6.5724
	F	123.0000	6.7401	119.0000	7.3095	121.0000	7.0993
	T	117.2500	8.4103	116.1875	7.8334	116.7187	8.0130
12-18 yrs	M	127.5000	9.4567	117.5000	6.9898	122.5000	9.5499
	F	129.1250	3.3991	113.1250	4.2237	121.1250	9.0545
	T	128.3125	6.9159	115.3125	6.0191	121.8125	9.1808
Total	M	119.5000	11.1475	115.4375	7.4384	117.4688	9.5478
	F	126.0625	6.0494	116.0625	6.5163	121.0625	8.0038
	T	122.7813	9.4314	115.7500	6.8862	119.2656	8.9252

Tests of Between -Subjects Effects

G) F_{groups}: 17.721; P< .000 (S), F_{ages}: 9.301; P< .003 (S), F_{sex}: 4.629; P< .036 (S)
F_{groups}x F_{ages}:12.770; P< .001 (S), F_{groups}x F_{sex}: 3.159; P< .081 (NS)

F_{ages}x F_{sex}: 8.850; P< .004 (S), F_{groups}x F_{ages}x F_{sex}: .000; P< .2985 (NS)

Between the groups a significant difference was observed in the mean U1-Palpl a values of DS and Normal individual where DS had higher value (F=17.721; P< .000). Between age groups also a significant difference was observed (F=9.301; P< .003) where 12-18 year group had higher value than 6-12 year. Between sex groups also a significant difference was observed (F=4.629; P< .036) where females had higher U1-Palpl value as compared to males.

There was a significant difference in the mean value of 12-18 year of DS and Normal as compared to 6-12 year of DS and Normal (F=12.770; P< .001). In DS group the values are higher in 12-18 year age than 6-12 year, whereas values are almost same in Normal.

There was a significant difference in the mean value of 12-18 year of males and females as compared to 6-12 year of males and females (F=18.850; P< .004). In 6-12 year group females had higher value than males, whereas in 12-18 year group males had higher value than females.

Table 8: Mean SN values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	60.0000	2.6726	67.6250	3.0208	63.8125	4.8058
	F	59.1250	2.7999	66.0000	1.8516	62.5625	4.2264
	T	59.5625	2.6825	66.8125	2.5617	63.1875	4.4969
12-18 yrs	M	64.6250	3.8149	70.8750	3.0443	67.7500	4.6404
	F	60.7500	2.5495	67.8750	3.3991	64.3125	4.6864
	T	62.6875	3.7188	69.3750	3.4809	66.0313	4.9087
Total	M	62.3125	3.9786	69.2500	3.3764	65.7813	5.0592
	F	59.9375	2.7195	66.9375	2.8159	63.4375	4.4789
	T	61.1250	3.5628	68.0937	3.2761	64.6094	4.8848

Tests of Between -Subjects Effects

H) F_{groups}: 89.556; P< .000 (S), F_{ages}: 14.913; P< .000 (S), F_{sex}: 10.130; P< .002 (S)
F_{groups}x F_{ages}:.146; P< .704 (NS), F_{groups}x F_{sex}: .002; P< .966 (NS)

F_{ages}x F_{sex}: 2.206; P< .143 (NS), F_{groups}x F_{ages}x F_{sex}: .34; P< .583 (NS)

I) Between the groups a significant difference was observed in the mean SN values of DS and Normal individual where DS had higher value (F=89.556; P< .000). Between age groups also a significant difference was observed (F=14.913; P< .000) where 12-18 year group had higher value than 6-12 year. Between sex groups also a significant difference was observed (F=10.130; P< .002) where male had higher SN value as compared to female. All the interaction effects were found to be non significant.

Table 9: Mean S-Ba values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	42.3750	2.6152	43.2500	1.8323	42.8125	2.2277
	F	41.5000	4.3425	42.5000	1.8516	42.0000	3.2660
	T	41.9375	3.4923	42.8750	1.8212	42.4063	2.7808
12-18 yrs	M	44.2500	3.1053	48.2500	3.9551	46.2500	4.0083
	F	41.7500	1.8323	45.0000	1.8516	43.3750	2.4461
	T	43.0000	2.7809	46.6250	3.4230	44.8125	3.5780
Total	M	43.3125	2.9375	45.7500	3.9412	44.5313	3.6366
	F	41.6250	3.2223	43.7500	2.2061	42.6875	2.9231
	T	42.4688	3.1519	44.7500	3.3020	43.6094	3.4022

Tests of Between -Subjects Effects

J) F_{groups}: 10.319; P< .002 (S), F_{ages}: 11.481; P< .001 (S), F_{sex}: 6.741; P< .012 (S)
F_{groups}x F_{ages}: 3.580; P< .064 (NS),F_{groups}x F_{sex}: 048; P< .827 (NS)

F_{ages}x F_{sex}: 2.109; P< .152 (NS), F_{groups}x F_{ages}x F_{sex}: .095; P< .759 (NS)

Between the groups a significant difference was observed in the mean S-Ba values of DS and Normal individual where DS had higher value (F=10.319; P< .002). Between age groups also a significant difference was observed (F=11.481; P< .001) where 12-18 year group had higher value than 6-12 year. Between sex groups also a significant difference was observed (F=6.741; P< .012) where male had higher S-Ba value as compared to female. All the interaction effects were found to be non significant.

Table 10: Mean Ba-N values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	94.7500	3.3700	99.2500	4.7434	97.0000	4.6043
	F	96.1250	3.5632	98.1250	3.5229	97.1250	3.5754
	T	95.4375	3.4248	98.6875	4.0779	97.0625	4.0556
12-18 yrs	M	102.0000	5.3184	108.1250	5.3033	105.0625	6.0274
	F	97.5000	3.8914	93.7500	33.7586	95.6250	23.2948
	T	99.7500	5.0662	100.9375	24.4962	100.3437	17.4108
Total	M	98.3750	5.7023	103.6875	6.6805	101.0313	6.6792
	F	96.8125	3.6737	95.9375	23.2965	96.3750	16.4115
	T	97.5938	4.7848	99.8125	17.3120	98.7031	12.6487

Tests of Between -Subjects Effects

F_{groups}: .496; P< .484 (NS), F_{ages}: 1.085; P< .302 (NS), F_{sex}: 2.185; P< .145 (NS)
F_{groups}x F_{ages}:.107; P< .745 (NS), F_{groups}x F_{sex}: .965; P< .330 (NS)

F_{ages}x F_{sex}: 2.304; P< .135 (NS), F_{groups}x F_{ages}x F_{sex}: .343; P< .561 (NS)

Between the groups, ages and sex a non significant differences were observed in the mean Palpl-NSe values. All the interaction effects were also found to be non significant.

Table 11: Mean N-ANS values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	44.1250	3.9438	45.0000	3.8914	44.5625	3.8117
	F	42.3750	2.9731	45.6250	5.2082	44.0000	4.4272
	T	43.2500	3.4928	45.3125	4.4530	44.2813	4.0738
12-18 yrs	M	48.5000	2.6186	52.5000	2.0000	50.5000	3.0551
	F	44.2500	2.8158	51.7500	2.9641	48.0000	4.7749
	T	46.3750	3.4230	52.1250	2.4732	49.2500	4.1426
Total	M	46.3125	3.9449	48.7500	4.8922	47.5313	4.5436
	F	43.3125	2.9602	48.6875	5.1732	46.0000	4.9644
	T	44.8125	3.7540	48.7188	4.9529	46.7656	4.7834

Tests of Between -Subjects Effects

F_{groups}: 20.727; P< .000 (S), F_{ages}: 33.536; P< .000 (S), F_{sex}: 3.185; P< .080 (S)
F_{groups}x F_{ages}:.4.618; P< .036 (S), F_{groups}x F_{sex}: 2.930; P< .092 (NS)

F_{ages}x F_{sex}: 1.275; P< .264 (NS), F_{groups}x F_{ages}x F_{sex}: .107; P< .744 (NS)

Between the groups a significant difference was observed in the mean N-ANS values of DS and Normal individual where DS had lower value (F=20.727; P< .000). Between age groups also a significant difference was observed (F=33.536; P< .000) where 12-18 year group had higher value than 6-12 year. Between sex groups a non significant difference was observed (F=3.185; P< .080). There is a significant difference in the mean value of 12-18 year of DS and Normal as compared to 6-12 year of DS and Normal (F=.4.618; P< .036). In Normal group the value was much higher in 12-18 group than 6-12 year group as compared to that of DS. All the other interaction effects were found to be non significant.

Table 12: Mean PNS-ANS values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	40.7500	1.3887	45.5000	2.2678	43.1250	3.0523
	F	38.1250	2.7999	47.2500	2.9641	42.6875	5.4738
	T	39.4375	2.5290	46.3750	2.7049	42.9063	4.3653
12-18 yrs	M	44.5000	2.4495	54.7500	2.7646	49.6250	5.8637
	F	42.6250	3.2043	51.5000	3.3806	47.0625	5.5794
	T	43.5625	2.9205	53.1250	3.4230	48.3438	5.7788
Total	M	42.6250	2.7295	50.1250	5.3650	46.3750	5.6611
	F	40.3750	3.7216	49.3750	3.7749	44.8750	5.8737
	T	41.5000	3.4078	49.7500	4.5791	45.6250	5.7721

Tests of Between -Subjects Effects

F_{groups}: 147.572; P< .000 (S), F_{ages}: 64.105; P< .000 (S), F_{sex}: 4.878; P< .031 (S)

F_{groups}x F_{ages}:3.735; P< .058 (NS), F_{groups}x F_{sex}: 1.220; P< .274 (NS)

F_{ages}x F_{sex}: 2.448; P< .123 (NS), F_{groups}x F_{ages}x F_{sex}: 4.480; P< .039 (S)

Between the groups a significant difference was observed in the mean PNS-ANS values of DS and Normal individual where Normal had higher value (F=147.572; P< .000). Between age groups also a significant difference was observed (F=64.105; P< .000) where 12-18 year group had higher value than 6-12 year. Between sex groups also a significant difference was observed (F=4.878; P< .031) where male had higher PNS-ANS value as compared to female.

Table 13: Mean U1-NA(mm) values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	4.1875	1.3076	5.7500	4.5277	4.9688	3.3190
	F	9.0000	2.3905	4.8750	2.7484	6.9375	3.2755
	T	6.5937	3.1049	5.3125	3.6463	5.9531	3.3944
12-18 yrs	M	8.0000	4.6599	5.0000	1.5119	6.5000	3.6878
	F	10.2500	3.0119	4.2500	2.4928	7.2500	4.0906
	T	9.1250	3.9644	4.6250	2.0290	6.8750	3.8500
Total	M	6.0938	3.8480	5.3750	3.2838	5.7344	3.5378
	F	9.6250	2.7049	4.5625	2.5552	7.0937	3.6488
	T	7.8594	3.7314	4.9688	2.9236	6.4141	3.6303

Tests of Between -Subjects Effects

F_{groups}: 14.306; P< .000 (S), F_{ages}: 1.455; P< .233 (NS), F_{sex}: 3.164; P< .081 (S)
F_{groups}x F_{ages}:4.434; P< .040 (S), F_{groups}x F_{sex}: 8.076; P< .006 (S)

F_{ages}x F_{sex}: .636; P< .429 (NS), F_{groups}x F_{ages}x F_{sex}: .773; P< .383 (NS)

Between the groups a significant difference was observed in the mean U1-NA(mm) a values of DS and Normal individual where DS had higher value (F=14.306; P< .000).

Between age groups also a significant difference was observed (F=1.455; P< .233) where 12-18 year group had higher value than 6-12 year. Between sex groups a non significant difference was observed (F=3.164; P< .081).

There is a significant difference in the mean value of 12-18 year of DS and Normal as compared to 6-12 year of DS and Normal (F=4.434; P< .040). In DS group the values are higher in 12-18 year age than 6-12 year, whereas values are almost same in Normals.

There is a significant difference in the mean value of male and female of DS as compared to male and female of Normal (F=8.076; P< .006). In DS group females had higher value than males whereas in Normal males had higher value than females.

Table 14:Mean Palpl-U1 values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	20.5000	2.1381	24.2500	2.7124	22.3750	3.0523
	F	19.7500	1.6690	24.2500	1.8323	22.0000	2.8752
	T	20.1250	1.8930	24.2500	2.2361	22.1875	2.9231
12-18 yrs	M	23.0000	3.3381	31.5000	2.9761	27.2500	5.3479
	F	22.3750	5.1530	26.7500	5.3117	24.5625	5.5374
	T	22.6875	4.2066	29.1250	4.8287	25.9062	5.5262
Total	M	21.7500	3.0000	27.8750	4.6458	24.8125	4.9477
	F	21.0625	3.9407	25.5000	4.0497	23.2813	4.5311
	T	21.4063	3.4628	26.6875	4.4536	24.0469	4.7690

Tests of Between -Subjects Effects

F_{groups}: 38.455; P< .000 (S), F_{ages}: 19.067; P< .000 (S), F_{sex}: 3.233; P< .078 (NS)
F_{groups}x F_{ages}:1.843; P< .80 (NS), F_{groups}x F_{sex}: .982; P< .326 (NS)

F_{ages}x F_{sex}: 1.843; P< .180 (NS), F_{groups}x F_{ages}x F_{sex}: 2.048; P< .158 (NS)

Between the groups a significant difference was observed in the mean Palpl-U1 values of DS and Normal individual where DS had lower value (F=38.455; P< .000). Between age groups also a significant difference was observed (F=19.067; P< .000) where 12-18 year group had higher value than 6-12 year. Between sex groups a non significant difference was observed. All the interaction effects were found to be non significant.

Table 15: Mean Palpl-U6 values of male and female subjects belonging to different age group in Down's syndrome and Normal groups along with the results of F test

Age groups	Sex	DS		Normal		Overall	
6-12 yrs		Mean	S.D	Mean	S.D	Mean	S.D
	M	15.2500	2.0529	17.8750	2.0310	16.5625	2.3936
	F	17.6250	2.1339	17.0000	1.3093	17.3125	1.7405
	T	16.4375	2.3656	17.4375	1.7115	16.9375	2.0936
12-18 yrs	M	19.8750	1.1260	25.3750	3.7009	22.6250	3.8794
	F	19.5000	4.2762	23.6250	3.3780	21.5625	4.2890
	T	19.6875	3.0270	24.5000	3.5402	22.0937	4.0589
Total	M	17.5625	2.8745	21.6250	4.8287	19.5938	4.4203
	F	18.5625	3.4053	20.3125	4.2225	19.4375	3.8766
	T	18.0625	3.1412	20.9687	4.5115	19.5156	4.1250

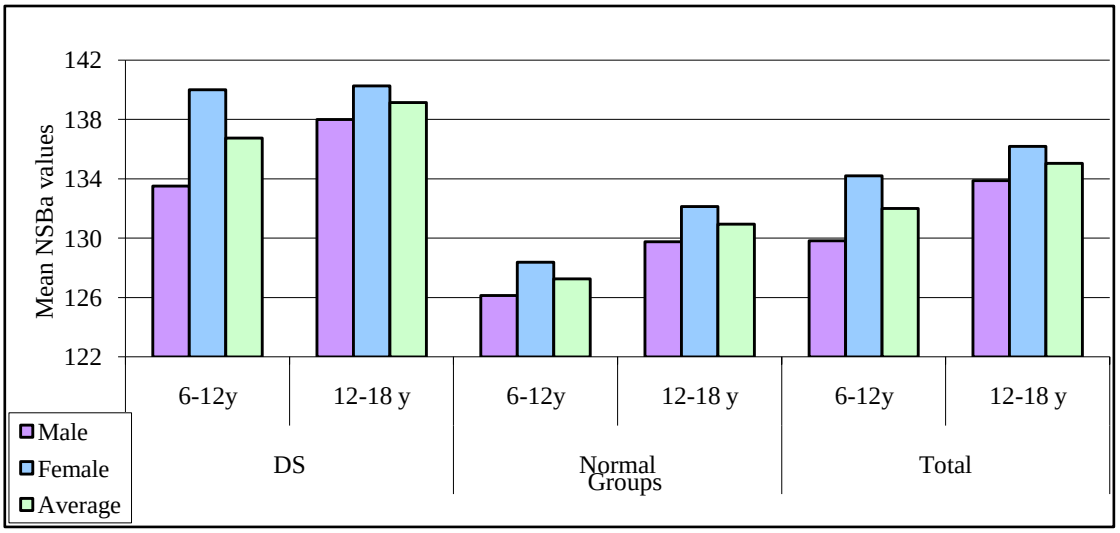
Tests of Between -Subjects Effects

K) F_{groups}: 18.241; P< .000 (S), F_{ages}: 57.419; P< .000 (S), F_{sex}: .053; P< .816 (NS)
F_{groups}x F_{ages}:7.848; P< .007 (S), F_{groups}x F_{sex}: 2.887; P< .095 (NS)

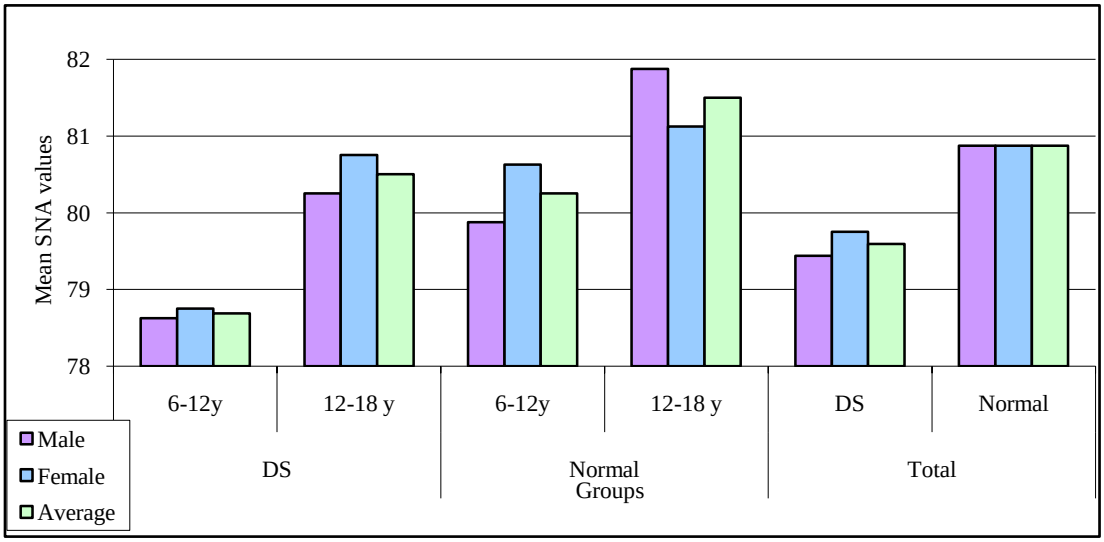
F_{ages}x F_{sex}: 1.774; P< .188 (NS), F_{groups}x F_{ages}x F_{sex}: .475; P< .494 (NS)

Between the groups a significant difference was observed in the mean Palpl-U6 values of DS and Normal individual where DS had higher value (F=18.241; P< .000). Between age groups also a significant difference was observed (F=57.419; P< .000) where 12-18 year group had higher value than 6-12 year. Between sex groups a non significant difference was observed (F=.053; P< .816). There is a significant difference in the mean value of 12-18 year of DS and Normal as compared to 6-12 year of DS and Normal (F=4.434; P< .040). In Normal group the values were higher in 12-18 year age than 6-12 year, whereas values were almost same in DS group.

Graph 1: Mean NSBa values for Male and Female Subjects belonging to Down's syndrome and Normal group



Graph 2: Mean SNA values for Male and Female Subjects belonging to Down's syndrome and Normal group



DISCUSSION

This cephalometric study on subjects with Down's syndrome was based on a sample of 64 subjects, 32 subjects of Down's syndrome and 32 Normal individuals in age group of 6 – 18 years. None of them had previous history of any orthodontic treatment.

The age range for the sample size was divided into two groups 6-12 years and 12-18 years. 6-12 years represented the mixed dentition period and 12-18 years represented the permanent dentition. The two groups were analyzed to compare the growth changes in Down's syndrome subjects with that of normal. Strict criteria for inclusion were used in this study.

Various cephalometric points, planes, angles and linear measurements were used in this study to evaluate the cranial base and maxilla to cranium relationships and dental characteristics of Down's syndrome subjects.

Cranial base relationships

A significant difference in the mean NSBa values of Down's syndrome and the normal group was found in the study. The study showed that there was a flatter cranial base in Down's syndrome group.

Results showed that the NSBa angle was on average more obtuse in Down's syndrome individuals when compared to that of normal. Hence presenting a flat cranial base in Down's syndrome group. Our results were in agreement with the results of Brandies,[830] Burwood.[925] Burwood showed that Down's syndrome group had disproportionate increase in the basal angle relative to their cranial capacity, which is in agreement with Alonso Tosso.[10] According to Burwood Boogard's basal angle may therefore be used as a confirmatory sign in the radiological diagnosis of Down's syndrome.[9]

Maxillary teeth to other structures

The significant difference in the mean value of Palpl-U1 was observed between the Down's syndrome group and normal. The distance between the palatal plane and upper incisors was less in Down's syndrome group as compared to normal and the increase in this distance with age was found to be more in normal as compared to Down's syndrome. The reason for decreased eruption of upper incisors can be due to the macroglossia and tongue protrusion seen in Down's syndrome group, which results in relative intrusion of the upper incisors.

The eruption of upper molars was also found to be less in Down's syndrome group when compared to normal. The finding was in agreement with that of Spitzer.[2]

According to Brandies the Down's syndrome cranium was not found to be microcephalic at birth but showed lack of growth. The Down's syndrome child could not keep pace with the normal child and with age all Down's syndrome child appeared microcephalic.[11]

An early aging in Down's syndrome which was unique to the condition and appreciably in advance of the normal was suggested by Pozsonyi.[12]

Frosted found that the overall size of the craniofacial complex was smaller in Down's syndrome at 4 years of age and remained smaller into adulthood. Down's syndrome individual remain different throughout growth but did have growth at the same rate and in same direction as in normal group.[1]

CONCLUSION

From this cephalometric study of the comparison of cranial base, midface and dental characteristics between individuals with Down's syndrome and normal, we made the following conclusion:

1. There was significant difference found in the NSBa value between the Down's syndrome group and normal. The cranial base was significantly flatter in Down's syndrome group.

2. The length of the anterior cranial base was found to be diminished in individuals with Down's syndrome when compared with normal. The growth of cranial base in Down's syndrome was less than that of normal.
3. The entire skull base length was found to be significantly decreased in individuals with Down's syndrome.
4. The SNA value in Down's syndrome was found to be similar to that of normal group. This showed that there was no difference in the position of the maxilla in both the groups.
5. The inclination of palatal plane was similar in Down's syndrome and normal and remained unchanged with age.
6. The upper anterior facial height was also found to be less in Down's syndrome group and the difference in upper anterior facial height between Down's syndrome and normal increased with age.
7. The length of the palate was significantly less in Down's syndrome group when compared with that of normal.
8. The upper incisors were more proclined and protruded in Down's syndrome group and the proclination of upper incisors increased with age in Down's syndrome group.
9. The distance between the upper incisors and palatal plane was found to be less in Down's syndrome group when compared to that of normal.
10. The upper molars were also found to be intruded in Down's syndrome group.

REFERENCES

1. Forstad W A, Cleal J F, Melosky L C. Craniofacial complex in the trisomy 21 syndrome. Archs. Oral. Biol 1971; 16: 707-22.
2. Spitzer R, Rabinowitch J Y, Wybar K C. A study of the abnormalities of the skull, teeth and lenses in mongolism. Canad M A J 1961; 84: 567-72.
3. Quintanilla J S, Biedma B M, Rofrigues M Q. Cephalometrics in children with Down's syndrome. PediatrRadiol 2002; 32: 635-43.
4. Jensen G M, Cleall J F, Yip A S. Dentoalveolar morphology and developmental changes in Down's syndrome (trisomy 21). Am J Orthod 1973; 64: 607-18.
5. Hutchinson, Cockburn. Practical pediatric problems. 6th ed. P G Publications. 1986.
6. Fink G B, Madaus W K, Walker G F. A quantitative study of the face in Down's syndrome. Am. J. Orthod 1975; 67: 540-43.
7. Kaplan, Sadock. Comprehensive textbook of psychiatry. 6th ed. Williams & Wilkins.
8. Brandies H F, Schmid R G, Brandies E F. Craniofacial development in patients with Down's syndrome from birth to 14years of age. Eurp J Orthod 1986; 8: 35-42.
9. Burwood R J, Gordon I R S, Taft R D. The skull in mongolism. ClinRadiol 1973; 24: 475-80.
10. Tosso A A, Gias N L, Vallejo H G, Tomas L M. Cephalometric study of the cranial base in 133 cases of Down's Syndrome. Rev StomatolChirMaxillofac. 1985; 86: 234-40
11. Brandies H F. Cephalometric comparison between children with and without Down's syndrome. Eur J Orthod 1988; 10: 255-63.
12. Pozsonyi J, Gibson D, Zarfas D E. Skeletal maturation in mongolism (Down's syndrome). J Pediat 1964; 64: 75-78.