

Evaluation of Hard Tissue Cephalometric Norms for Maharashtra Population using Downs Analysis

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Abstract

Aim: Based on Downs analysis, the present study aims to evaluate hard tissue cephalometric norms for the Maharashtra population.

Materials and Methods: The digital lateral cephalograms of 100 subjects with Maharashtra ethnicity within the age range of 18–30 years with normal occlusion were obtained. Downs analysis was performed using Dolphin software. The obtained values were statistically analyzed to evaluate hard tissue norms for the Maharashtra population.

Results: Statistically significant differences were observed in hard tissue norms between Maharashtra population and Caucasian norms.

Conclusion: Ethnic differences exist between Maharashtra population and Caucasian population, which should be considered when formulating an orthodontic treatment plan.

Key words: Caucasians, Cephalometrics, Downs, Ethnic group, Hard tissue

INTRODUCTION

Downs (1948) was among the pioneers who established cephalometric standards to be used as guidance for treatment planning for orthodontic patients.^[1] A cephalometric radiograph in diagnosis and treatment planning is an essential tool in orthodontics to assist research workers and orthodontic clinicians.^[2]

Various cephalometric analysis for orthodontic treatment has been designed, but these cephalometric norms were specific to one ethnic group White subjects of European American ancestry. Cephalometric norms derived from the Caucasian population are routinely used for investigations.

As these norms show a great degree of variation when applied to different ethnic groups, it becomes necessary to establish the norms for every ethnic group with a standard method for effective orthodontic treatment (all articles).

One of the commonly used hard tissue analyses is Downs analysis given by D. W. Downs.^[1] Since India is a subcontinent with a large number of racial subgroups and several religious and interracial mixtures, it was proposed, therefore, to study only the individuals derived from Maharashtra origin using Downs analysis (Nanda).

Thus, the present study was designed to derive norms for the Maharashtra population, which would be comparable in diagnosis and treatment planning to the Holdaway cephalometric analysis.

Aim

The aim of the study is to evaluate the mean cephalometric norms for Downs analysis in the Maharashtra population.

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Objective

The objective of the study is as follows:

1. To evaluate the mean cephalometric norms for Downs analysis in the Maharashtrian population
2. To compare standards derived with the earlier established norms for other population.

MATERIALS AND METHODS

Source of Data

The sample of 100 subjects was selected, 50 males and 50 females were included. The sample was selected based on age, sex, and straight pleasing profile. A signed informed consent form was taken in Marathi and English language.

Selection Criteria for Subjects

Inclusion criteria

The following criteria were included in this study:

1. Subject should be Maharashtrian origin traced back to two generations
2. The age range of 18–30 years
3. Permanent dentition
4. Class I molar relation
5. Class I skeletal jaw bases
6. Normal overjet and overbite.

Exclusion criteria

The following criteria were excluded from the study:

1. Previous or current orthodontic treatment
2. Severe crowding
3. Missing tooth other than the third molar
4. Obvious periodontal disease
5. Evidence of previous trauma/surgery
6. Facial asymmetry or deformity
7. Presence of deciduous/retained teeth
8. Presence of any pathological conditions
9. Presence of deciduous or over retained teeth.

Initially, each subject was thoroughly examined clinically according to inclusion and exclusion criteria. A digital lateral cephalometric radiograph was taken of all subjects. Downs cephalometric analysis was performed and studied.

Radiographic Unit Detail

The Pax-I (PCH2500), Vatech Global, digital radiographic unit from the Department of Oral Medicine and Dental Radiology, Bharati Vidyapeeth Dental College and Hospital, Sangli, was used to take the lateral digital cephalometric radiographs of the subjects involved in the study [Figure 1].

Cephalometric Tracing

The digital radiographs obtained from Pax-I machine were then transferred to Dolphin Imaging 11.9 Software (Dolphin Imaging and Management Solutions, Chatsworth,



Figure 1: Patient position for lateral cephalogram

Calif.). In our study, Downs cephalometric analysis was performed and studied [Figures 2 and 3].

Statistical Analysis

- The measurements were statistically analyzed by calculating their means and standard deviations
- Then, the means of the Maharashtrian population were compared with means of the Caucasian population with the help of unpaired *t*-test
- A comparison was also made between males and females within the present study.

RESULTS

Facial Angle

In our study, the mean value was 86.64 while in Caucasian population was 87.8. The mean difference was -1.10 which was statistically significant ($P \leq 0.001$).

Angle of Convexity

In our study, the mean value was 4.72 while in Caucasian population was 0.0. The mean difference was 4.70 which was statistically significant ($P \leq 0.001$).

AB Plane Angle

In our study, the mean value was -4.26 while in Caucasian population, the angle was -4.6 . The mean difference was 0.33 which was statistically insignificant ($P = 0.353$).

Mandibular Plane Angle

In our study, the mean value was 22.40 while in Caucasian population, the angle was 21.9. The mean difference was 0.50 which was statistically insignificant ($P = 0.338$).

Y-Axis

In our study, the mean value was 59.97 while in Caucasian, it was 59.4. The mean difference was 0.57 which was statistically insignificant ($P = 0.583$).

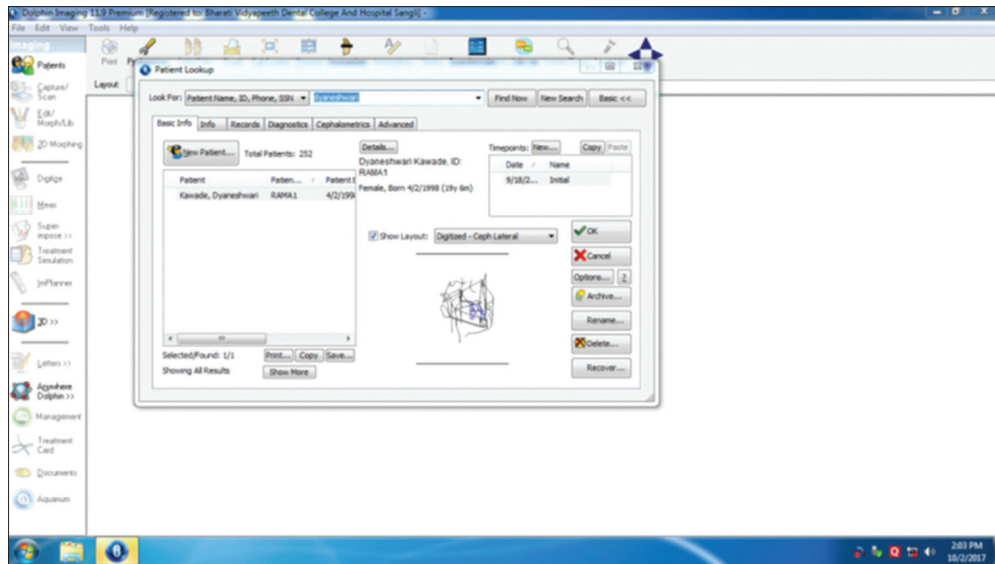


Figure 2: Dolphin Imaging 11.9 Software

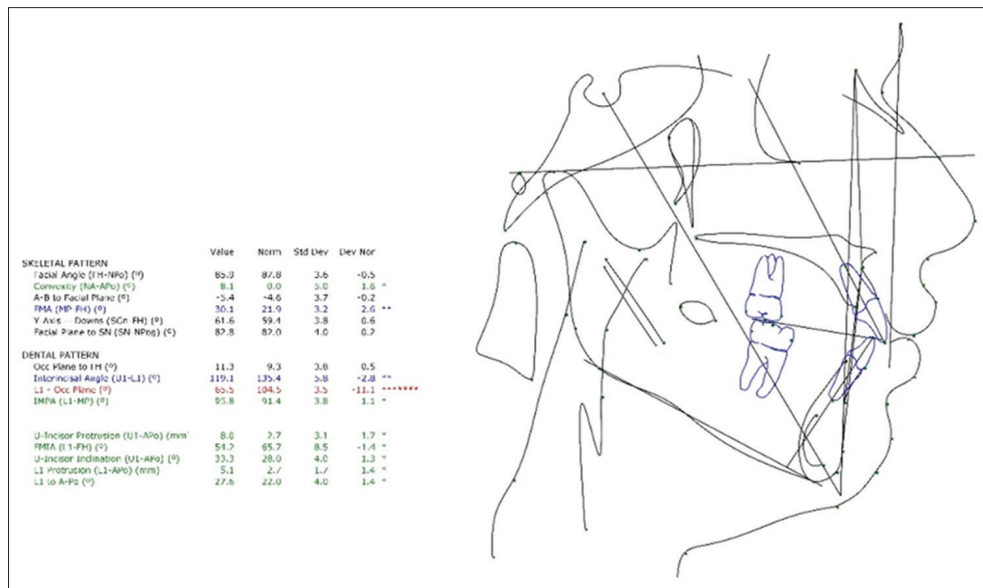


Figure 3: Downs analysis tracing

SN-Npog

In our study, the mean value was 81.07 while in Caucasian, it was 82. The mean difference was -0.92 which was statistically insignificant ($P = 0.444$).

Occlusal Plane Angle

In our study, the mean value was 9.65 while in Caucasian, it was 9.3. The mean difference was 0.35 which was statistically insignificant ($P = 0.685$).

Interincisal Angle

In our study, the mean value was 121.8 while in Caucasian, it was 135.4. The mean difference was -13.54 which was statistically significant ($P \leq 0.001$).

Incisor Mandibular Plane Angle

In our study, the mean value was 97.01 while in Caucasian, it was 91.4. The mean difference was 5.61 which was statistically significant ($P \leq 0.001$).

Protrusion of Max Incisors

In our study, the mean value was 8.65 mm while in Caucasian, it was 2.7 mm. The mean difference was 5.95 which was statistically significant ($P \leq 0.001$).

Frankfort Mandibular Incisor Angle (FMIA)

In our study, the mean value was 97.01 while in Caucasian, it was 91.04. The mean difference was -7.91 which was statistically significant ($P \leq 0.001$).

Degree of Maxillary Incisor Protrusion

In our study, the mean value was 27.86 while in Caucasian, it was 28. The mean difference was -0.137 which was statistically insignificant ($P = 0.835$).

Linear Measurement for Lower Incisor Protrusion

In our study, the mean value was 3.60 mm while in Caucasian, it was 2.7 mm. The mean difference was 0.91 which was statistically significant ($P \leq 0.001$).

Angular Measurement for Lower Incisor Protrusion

In our study, the mean value was 27.40 while in Caucasian, it was 22. The mean difference was 5.40 which was statistically significant ($P \leq 0.001$).

DISCUSSION

In a country like India, where the intra-country variation in the population is found to a great extent morphogenetically as well as linguistically, developing a specific normative

standard for the entire population can be erroneous in nature.^[3]

Hard tissue comparative analysis such as Burstone analysis^[4] and Steiner analysis^[5] has been performed by many authors. In our study, we used Downs analysis for analyzing hard tissues of the Maharashtra group.

The mean value for Indian adults was not similar in most of the measurable parameters when compared to the means of downs norms. Cephalometric studies on Indian adult ethnic group indicate there were some measurable skeletal and dental differences when compared to the Caucasian population. Facial angle, interincisal angle, FMIA, and lower incisor protrusion showed more variation compared to other variables. Indian adults showed a more convex profile when compared with Caucasians. The interincisal angle was more acute in Indians than in Caucasians, which revealed that Indians have more proclined teeth when compared with Caucasians. FMIA was greater which indicated that the degree of lower incisor in

Comparison of boys versus Caucasian

Parameter	Number of samples	Mean	SD	Downs value	Mean difference	t-value	P-value
FH-NPo (°)	50	86.34	2.72	87.8	-1.41	-3.74	0.001
NA-Apo (°)	50	4.32	13.21	0.0	4.32	2.29	0.026
AB-NA (°)	50	-4.20	3.29	-4.6	0.39	0.842	0.404
FMA (°)	50	22.51	5.37	21.9	0.61	0.803	0.426
Y-axis	50	62.42	10.21	59.4	3.02	2.072	0.044
SN-NPog	50	83.76	7.07	82	1.76	1.743	0.088
OP-FH (°)	50	8.58	3.04	9.3	-0.71	-1.645	0.107
U1-L1 (°)	50	123.43	18.11	135.4	-11.96	-4.625	0.001
L1-OP (°)	50	64.74	11.90	104.5	-39.75	-23.375	0.001
IMPA (°)	50	96.89	15.04	91.4	5.49	2.557	0.014
U1-Apo (mm)	50	8.63	14.39	2.7	5.93	2.885	0.006
L1-FH (°)	50	59.11	8.22	65.7	-6.58	-5.599	0.001
U1-Apo (°)	50	27.17	6.55	28	-0.82	-0.883	0.382
L1-Apo (mm)	50	3.55	1.91	2.7	0.85	3.137	0.003
L1-Apo (°)	50	26.43	4.84	22	4.43	6.408	0.001

SD: Standard deviation

Comparison of girls versus Caucasian

Parameter	Number of samples	Mean	SD	Downs value	Mean difference	t-value	P-value
FH-NPo (°)	50	87.04	3	87.8	-0.75	-1.7	0.082
NA-Apo (°)	50	5.12	15.46	0.0	5.12	2.35	0.023
AB-NA (°)	50	-4.3	3.88	-4.6	-0.75	-1.7	0.082
FMA (°)	50	22.30	5.21	21.9	0.46	0.54	0.58
Y-axis	50	57.57	9.94	59.4	-1.83	-1.30	0.199
SN-NPog	50	78.44	14.86	82	-3.55	-1.69	0.097
OP-FH (°)	50	10.69	11.70	9.3	1.39	0.84	0.403
U1-L1 (°)	50	120.30	20.66	135.4	-15.10	-5.16	0.001
L1-OP (°)	50	67.25	9.90	104.5	-37.24	-26.58	0.001
IMPA (°)	50	97.14	13.82	91.4	5.74	2.93	0.005
U1-Apo (mm)	50	8.68	14.38	2.7	5.98	2.94	0.005
L1-FH (°)	50	56.47	9.91	65.7	-9.22	-6.57	0.001
U1-Apo (°)	50	28.53	6.53	28	0.538	0.58	0.563
L1-Apo (mm)	50	3.65	4.01	2.7	0.95	1.68	0.098
L1-Apo (°)	50	28.34	6.04	22	6.34	7.42	0.001

SD: Standard deviation

Comparison of all subjects versus Caucasian							
Parameter	Number of samples	Mean	SD	Downs value	Mean difference	t-value	P-value
FH-NPo (°)	100	86.69	2.87	87.8	-1.10	-3.811	0.001
NA-Apo (°)	100	4.72	14.29	0.0	4.72	3.290	0.001
AB-NA (°)	100	-4.26	3.58	-4.6	0.33	0.933	0.353
FMA (°)	100	22.40	5.26	21.9	0.50	0.962	0.338
Y axis	100	59.97	10.31	59.4	0.57	0.551	0.583
SN-NPog	100	81.07	11.92	82	-0.92	-0.769	0.444
OP-FH (°)	100	9.65	8.61	9.3	0.35	0.407	0.685
U1-L1 (°)	100	121.8	19.40	135.4	-13.54	-6.947	0.001
L1-OP (°)	100	66.01	10.95	104.5	-38.48	-34.94	0.001
IMPA (°)	100	97.01	14.36	91.4	5.61	3.891	0.001
U1-Apo (mm)	100	8.65	14.31	2.7	5.95	4.140	0.001
L1-FH (°)	100	57.78	9.17	65.7	-7.91	-8.588	0.001
U1-Apo (°)	100	27.86	6.54	28	-0.137	-0.209	0.835
L1-Apo (mm)	100	3.60	3.13	2.7	0.91	2.87	0.005
L1-Apo (°)	100	27.40	5.54	22	5.40	9.699	0.001

SD: Standard deviation

relation to basal bone was more in Indians and L₁-APog was also greater which revealed that lower incisors were more protruded when compared with Caucasian population.^[1]

Even there were some measurable changes with the neighboring country like Bangladesh. The angle of convexity was straight when compared to Downs. The mandibular plane angle was increased when compared with Downs, which was decreased.^[6]

The study done in Korea by Douglas Bowman and Lewis Klapper revealed that the profile was more convex, the interincisal angle was increased in relation to the Caucasian population while mandibular plane angle was same as that of Caucasians.^[7]

Cephalometric evaluation of Mexican Americans done by Carlos J. Garcia using Downs and Steiner analysis showed increased facial convexity with protruded upper and lower incisors, and the interincisal angle was also decreased which stated that the incisors were proclined in relation to the Caucasian population. Thus, their results were comparable to our study.^[8]

SUMMARY AND CONCLUSION

According to Downs analysis carried out in this study, Maharashtrian adults had a more convex profile.

Dentally having protruded upper and lower anterior teeth with proclined upper and lower incisors and increased FMIA which indicated that the degree of lower incisor in relation to basal bone was more in Indians when compared with Caucasian.

It is legitimate and important for those undertaking orthodontic treatment for patients of the Maharashtrian population to use cephalometric norms for the Maharashtrian population.

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