

A Comparison of Angle's Class I And Class II Div.1 Malocclusion With Normal Occlusion in Maharashtrian Population Using Sassouni's Plus Analysis.

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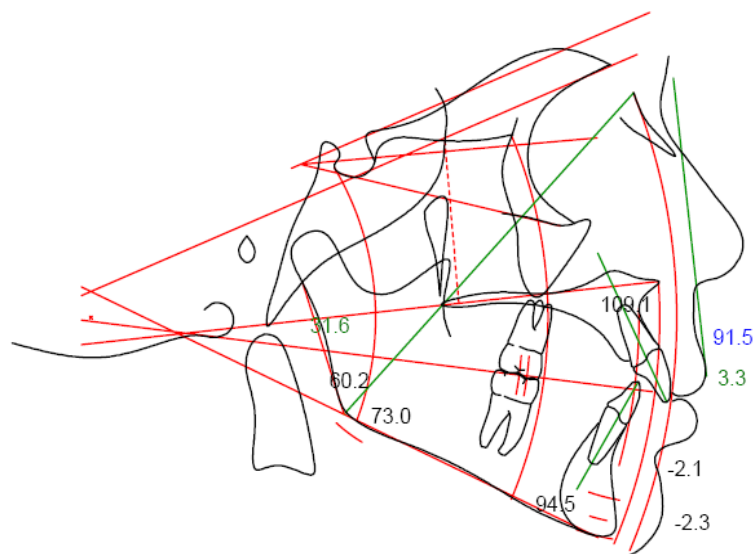
Abstract: As there is no study and data of the Sassouni's plus analysis available on the Maharashtrian subjects the study is undertaken to compare Sassouni's plus analysis in individuals with class I and class II div.1 malocclusion with control group of normal occlusion and to establish the norms for Maharashtrian population

I. Introduction

The sense of beauty is one acquired by education and environment. Therefore it is as variable with the same individual at different times and among individuals as it is related to geographic and cultural variations. It is known that variations exist in craniofacial morphology, especially among different racial and ethnic groups. Hence, each racial group should have its own cephalometric norms, and should be treated accordingly. The Archial analysis is a unique system that was first developed in 1955 by Dr. Viken Sassouni. This analysis stresses the use of individualized data, rather than dogmatic values established in a foreign population. The purpose of this study is to assess the facial balance, by evaluating the contribution of the teeth and jaws to the existing facial proportions. Dr. Bestile added a few measurements to this system, in order to make it more practical and simplified. This modified system has 11 key components, and is named 'Sassouni Plus Analysis'.

Aim

To compare Sassouni's plus analysis in individuals with class I and class II div.1 malocclusion with control group of normal occlusion and to establish the norms for Maharashtrian population



Sassouni's Plus Analysis

Objectives

- To evaluate Sassouni's plus analysis in normal occlusion.
- To evaluate Sassouni plus analysis in angles class I malocclusion.
- To evaluate Sassouni plus analysis in angles class II div.1 malocclusion.
- To compare Angle's class I malocclusion with normal occlusion.

- To compare Angle's class II div.1 malocclusion with normal occlusion.
- To compare Angle's class II div.1 malocclusion with class I malocclusion.
- To compare values of control group to the Caucasian norms.

II. Material, Method & Design

Study Area

- The study will be performed on the patients in the Department of Orthodontics & Dentofacial Orthopedics, V.S.P.M's dental college and research centre.
- The lateral cephalogram shall be processed at Dept. of Oral Medicine Diagnosis and Radiology V.S.P.M's Dental College and Research Centre.

Study Period

- The study would be conducted over a period of 18 months.

Study Type

- The study is comparative in nature.

Study Design

- It is a cross sectional study.

Randomization & Intervention

- No randomization.
- No intervention

Sample Size

Minimum of 90 subjects will be taken as sample size. It shall consist of equal no. of male and female subject. Each group shall have 30 subjects

Study Group

The total sample size will be divided into 3 groups:

- Group I. (subjects having good well balanced profile and Angle's class I molar relation with normal occlusion)
- Group II. (patients having Angle's class I malocclusion)
- Group III. (patients having Angle's class II division 1 malocclusion)

Control Group

Group I will be the control group.

Statistical Analysis

Suitable Statistical analysis would be carried out after collection and analysis of the data.

Selection Criteria

Patients of all the groups would be selected on the basis of following criteria:

- The age group of the patient shall be from 18-25 years from both sexes.
- The patient should have full complement of teeth, irrespective of the 3rd molars.
- The subject's grand parents should be Maharashtrian.
- All selected subjects will be explained about the project and their written consent shall be taken prior to conducting the study.

Patients of Group I will be selected on the basis of:

- Clinical facial photographs will be taken of subjects with balanced facial profile and will be approved by a panel of 3 individuals.
- Permanent dentition with Angles Class I Molar relationship.
- Normal occlusion.

Patients of Group II will be selected on the basis of:

- Permanent dentition with Angles Class I malocclusion.

Patients of Group III will be selected on the basis of:

- Permanent dentition with Angles Class II Div 1 malocclusion.

Exclusion Criteria

- Contraindication to investigative tests
- No prosthetic treatment
- History of previous orthodontic treatment done.
- History of surgical procedures in the orofacial region or pertaining to the study.

Design

A Lateral cephalogram will be taken for each subject of every group. All lateral cephalograms shall be standardized to avoid measurement errors. All lateral cephalograms will be taken on a digital unit and tracing will be done manually by the investigator. The data obtained from the tracings, will be computed and compared by statistical evaluation and analysis. .

The Arcs that are constructed are as follows:

1. **Anterior Arc:** With the point of compass set on point O, draw an arc from nasion through all four planes. In a well balanced facial profile, this arc should pass through ANS, the tip of maxillary incisor, and pogonion. If both ANS and pogonion are anterior or posterior to the Anterior Arc simultaneously, it is customary to draw a second Anterior Arc starting at ANS and passing as far as the level of pogonion. It is called simply as the ANS Arc.
2. **Basal Arc:** The Basal Arc is used to evaluate the apical bases or “basal arches” of the maxilla and mandible . From centre O construct an arc extending from A-point to the level of B-point.
3. **Midfacial Arc:** It is used to identify the status of the maxillary dentition . From centre O construct an arc from Te to the occlusal plane . In normal dentition the mesial surface of the maxillary first permanent molar should be tangent to the Midfacial Arc.
4. **Posterior Arc:** It is used to evaluate the relative position of the mandible . From centre O construct an arc from Sp down to the mandibular plane. It should normally pass through gonion.

III. Results

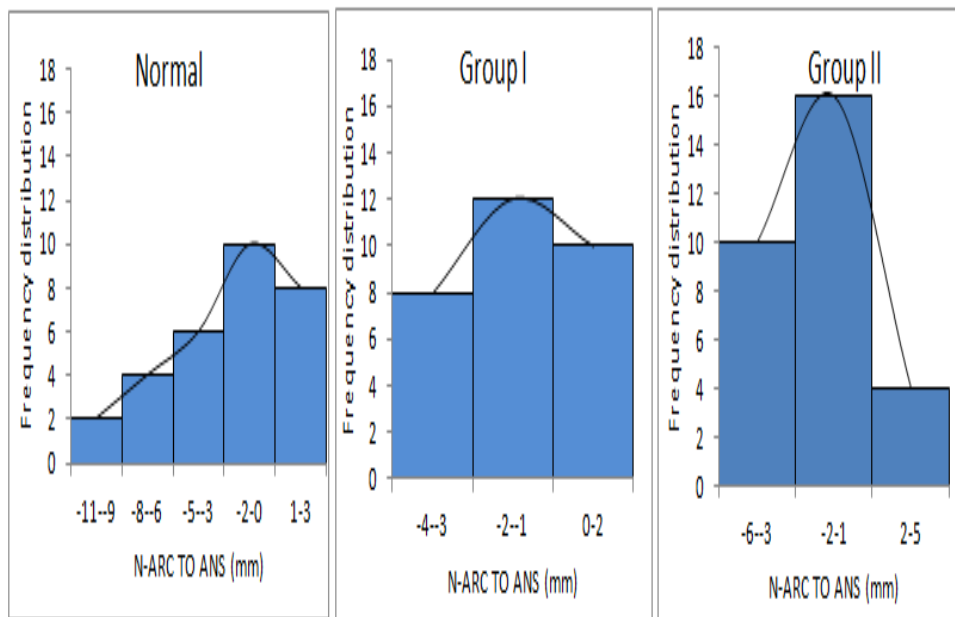


Figure 1: Frequency plots for N-ARC to ANS distance for the three study groups.

The distribution of N-ARC to ANS distance in mm for the three study groups is shown in Figure 1. For Normal subjects, the mean distance was 2.47mm behind the N-arc with standard deviation of 3.54mm. The maximum subjects had distance in the range of -2 to 0 mm. For Group I, the mean distance was 1.2 mm behind the N-arc with standard deviation of 1.94. The modal occurrence was in the range -2 to -1. In case of Group II, the mean obtained was 2.07 mm in behind the N-arc and standard deviation of 3.29. The maximum number of cases had distance in the range -2 to -1 mm. To determine if the mean N-ARC to ANS distance varies significantly across groups, one-way ANOVA was used, which resulted into a *p* value of 0.2541 (Table I), indicating insignificant differences across.

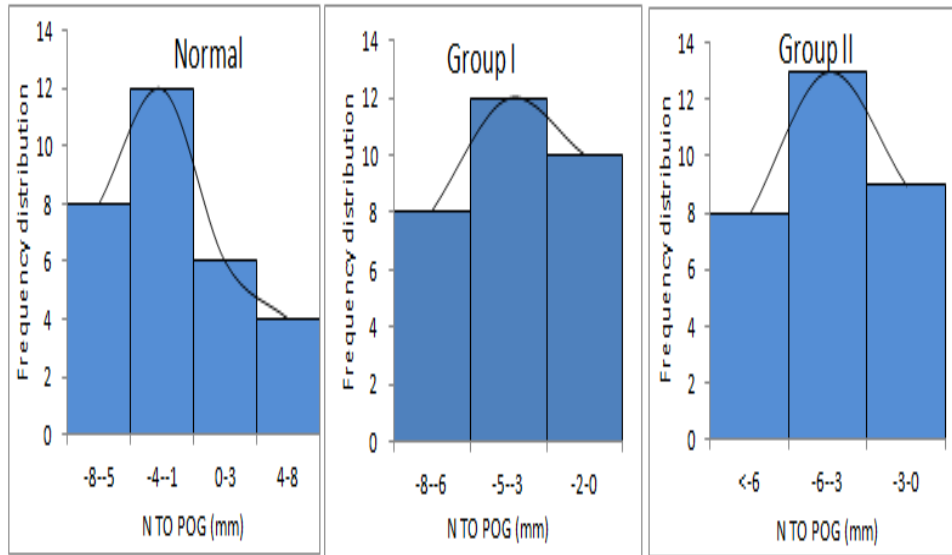


Figure 2: Frequency plots for N to POG distance for the three study groups.

The distribution of N to POG distance in mm for the three groups is shown in Figure 2. In case of Normal subjects, the mean distance was 2.4 mm behind the N-arc with standard deviation of 4.15 mm. The maximum occurrences were observed in the range -4 to -1 mm. For Group I, the mean N to POG distance was 3.73 mm behind the N-arc with standard deviation of 2.79 mm. The maximum occurrences were in -5 to 3 mm. In Group II, the mean distance was 5.47 mm behind the N-arc with standard deviation of 3.76 mm. The maximum occurrences were in the range -6 to -3 mm. To determine if the mean parametric value differ significantly across three groups, one-way ANOVA was used. The test suggested significant difference across the groups with p -value of 0.0059 (Table I). Further to know which group(s) contributed to this significance, pair-wise significance testing was performed across the groups. It was observed that the mean difference between Normal & Group II as well as Group I & Group II indicated significant difference with p -values 0.0040 and 0.0475 respectively (Table II). While the mean parametric difference between Normal & Group I was insignificant ($p=0.1506$).

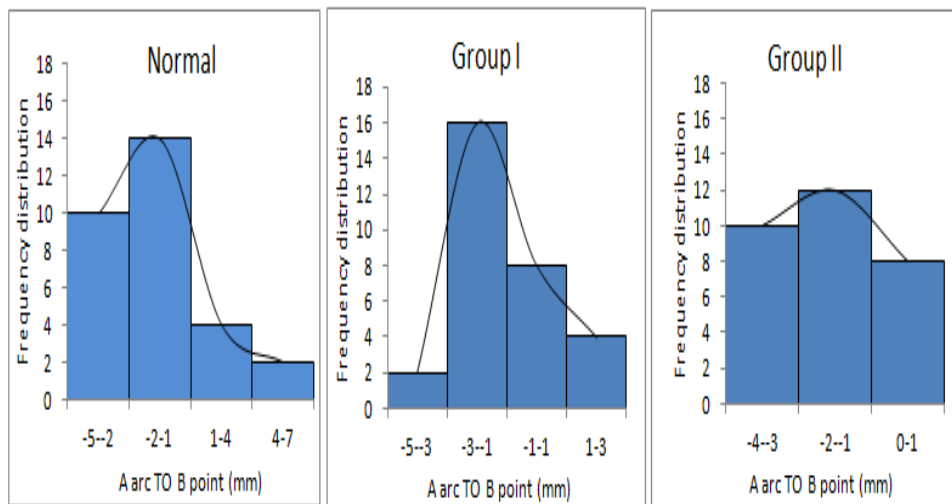


Figure 3: Frequency plots for A arc to B point distance for the three study groups.

As regards distance between A arc to B point, the distribution patterns for the three groups are shown in Figure 3. For Normal group, the mean distance observed was 1.53 mm behind the A-arc with standard deviation of 2.73 mm. The maximum occurrences were in the range -2 to -1 mm. In Group I, the mean distance observed was 1.5 behind the A-arc with standard deviation of 1.74 mm. The modal range was -3 to -1 mm. While in Group II, the mean distance observed was 1.67 mm behind the A-arc with standard deviation of 1.52 mm. The maximum number cases ranged between -2 to -1 mm. To determine if there exist significant difference

in the mean A arc to B point distance across these groups, one-way ANOVA was performed which indicated insignificant difference across the groups ($p=0.9468$) as shown in Table I.

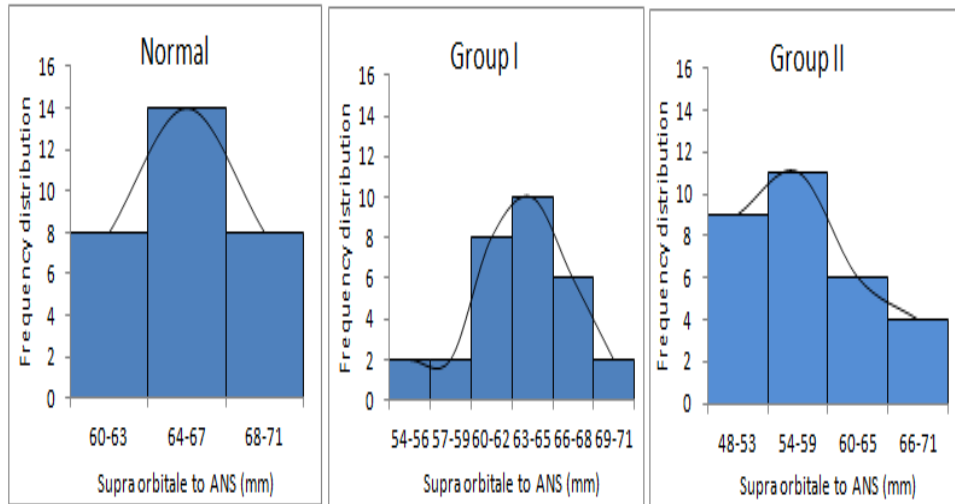


Figure 4: Frequency plots for Supraorbitale to ANS distance for the three study groups.

The distribution of distance (in mm) between Supraorbitale and ANS for the three groups is shown in Figure 4. In Normal samples, the mean distance observed was 65.13 mm with a standard deviation of 2.78 mm. The maximum number of cases had distance in the range of 64 to 67 mm. For Group I, the mean distance was 63.07 mm with standard deviation of 4.04 mm. The maximum occurrences were in the range 63 to 65 mm. In Group II, the mean distance was 57.2 mm with standard deviation of 7.26 mm. The maximum frequency of occurrence was in the range 54-59 mm. To determine if the mean Supraorbitale to ANS distance differ significantly across three groups, one-way ANOVA was performed which yielded a p -value of 0.000 indicating significant difference across the groups (Table I). In order to know which group(s) contributed to this significance, pair wise significance testing was performed with the results as shown in Table II. It is evident that all the three comparisons showed significant differences in mean with p -values less than 0.05.

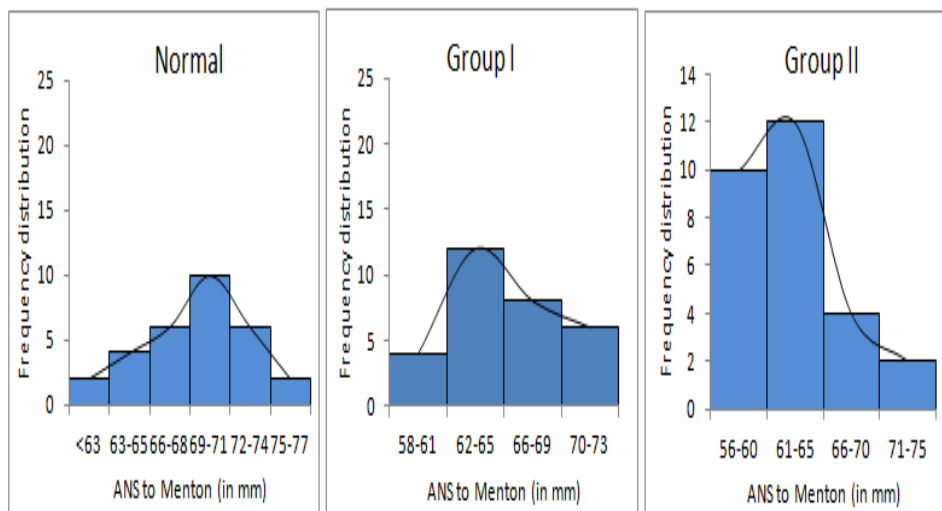


Figure 5: Frequency plots for ANS to Menton distance for the three study groups.

The frequency distribution of distance between ANS and Menton across three groups is shown in Figure 5. The mean distance for Normal group was 68.8 mm with standard deviation of 4.27 mm. The maximum cases were observed in the range of 69 to 71 mm. For Group I, the mean distance was 67.13 mm with standard deviation of 4 mm. The modal occurrences were in the range of 62 to 65 mm. For Group II, the mean distance was 60.07 mm with standard deviation of 6.12 mm. Most of the cases were in the range of 61 to 65 mm. The significance of difference of mean ANS to Menton distance was studied across three groups, which was found significant with $p=0.000$ (Table I). This significant difference was contributed by Group II, as

revealed through comparisons Normal vs Group II and Group I vs Group II with both having p -values of 0.000 (Table II).

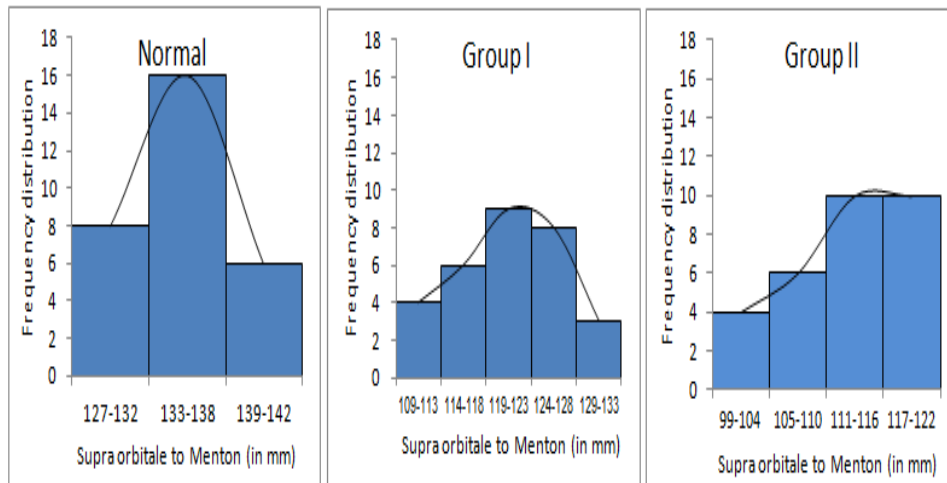


Figure 6: Frequency plots for Supra orbitale to Menton distance for the three study groups.

The distribution of Supraorbitale to Menton distance for the three groups is shown in Figure 6. In case of Normal group, the mean distance was 133.27 mm with standard deviation of 4.65 mm. The maximum occurrences were in the range 133 to 138 mm. For Group I, the mean distance was 123.47 mm with standard deviation of 7.31 mm. The modal range was 119 to 123 mm. In Group II, the mean distance was 112.4 mm with standard deviation of 7.09 mm and maximum occurrences were in the range 111 to 122 mm. The significance analysis across three groups yielded a p -value of 2.2e-16 indicating statistical significance. To determine which group(s) contributed to this difference, pair wise comparison of groups was performed which showed statistical significance across all the comparisons. The mean distance between each group was much different from each other as indicated by p -values less than 0.05.

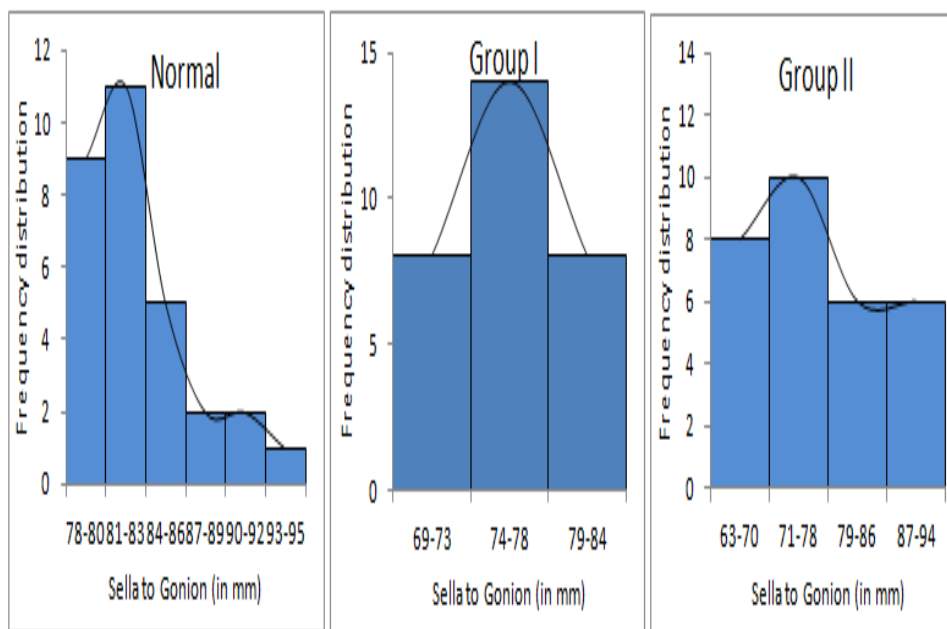


Figure 7: Frequency plots for Sella to Gonion distance for the three study groups.

The distribution of Sella to Gonion distance in three groups is shown in Figure 7. The mean distance in Normal group was 83 mm with standard deviation of 4.62 mm. The maximum occurrences were in the range 81 to 83 mm. For Group I, the mean distance was 76.07 mm with standard deviation of 5.17 mm. The maximum occurrences were in the range 74 to 78 mm. For Group II, the mean difference was 76.8 mm with standard deviation of 9.03 mm. Maximum cases were in the range of 71 to 78 mm. The mean parametric difference

across the three groups was found statistically significant with $p=0.001$ (Table I). The difference was mainly contributed by higher mean distance in Normal group. As a result the pair wise comparisons Normal vs Group I and Normal vs Group II showed significant difference with p -values 0.000 and 0.0017 respectively.

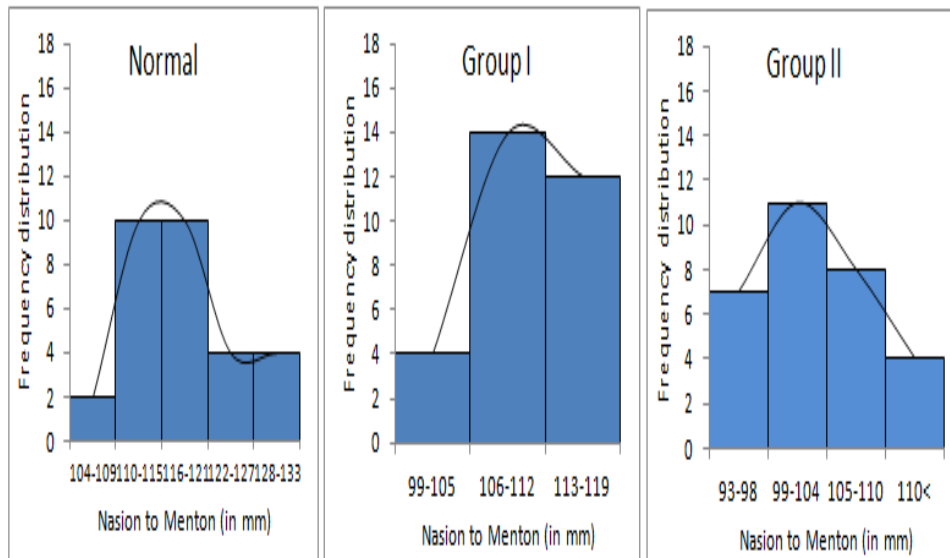


Figure 8: Frequency plots for Nasion to Menton distance for the three study groups.

The distribution of distance between Nasion to Menton for three groups is shown in Figure 8. The mean distance in Normal group is 117.53 mm with standard deviation of 7.11 mm. The maximum occurrences were in the range 110 to 121 mm. For Group I, the mean distance was 110.4 mm with standard deviation of 6.63 mm. The modal interval was 106 to 112 mm. For Group II, the mean distance was 102.4 mm with standard deviation of 7.87 mm. The maximum occurrences ranged between 99 to 104 mm. The statistical significance analysis for mean distance across three groups resulted into a p -value of 0.000, indicating significant difference across the groups. Pair wise analysis was carried out to determine the group(s) resulting into significance. Table II reveals that all the three comparisons are statistically significant with $p < 0.001$, suggesting that the mean distance across all the three groups is statistically different.

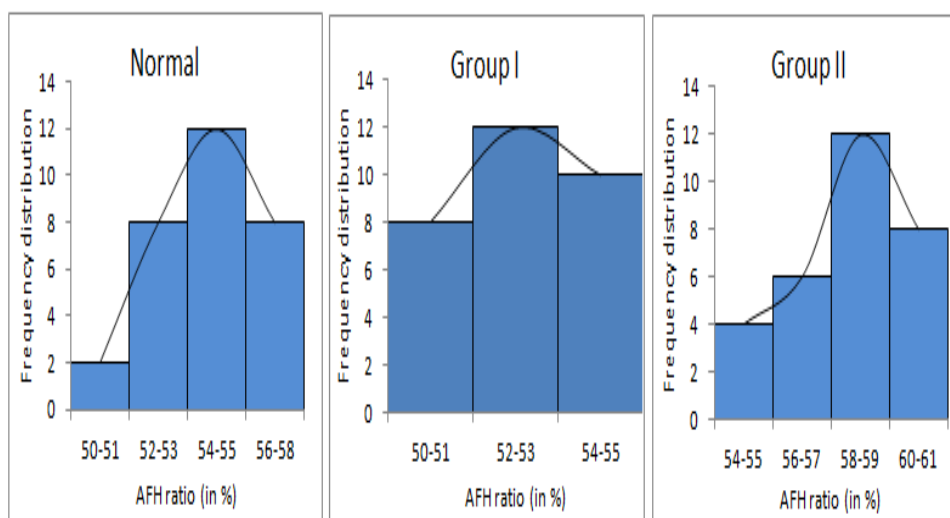


Figure 9: Frequency plots for AFH ratio for the three study groups.

The frequency distribution of AFH ratio in three groups is shown in Figure 9. The mean AFH ratio in case Normal group was 54.67 with standard deviation of 2.34. Maximum cases were in the range of 54 to 55 percent. For Group I, the mean AFH ratio was 52.73 with standard deviation of 1.68 and maximum occurrences in the range 52 to 53 percent. While in Group II, the mean AFH percent was 58.07 with standard deviation of 2.08. Maximum cases had AFH ratio in the range 58 to 59 percent. The significance analysis revealed statistically significant difference in percent across the three groups with p -value of 0.000 (Table I). Pair wise

analysis resulted into significant difference in all the three comparisons with p -value less than 0.0001 (Table II). In other words, the mean AFH percent is statistically different across all the groups.

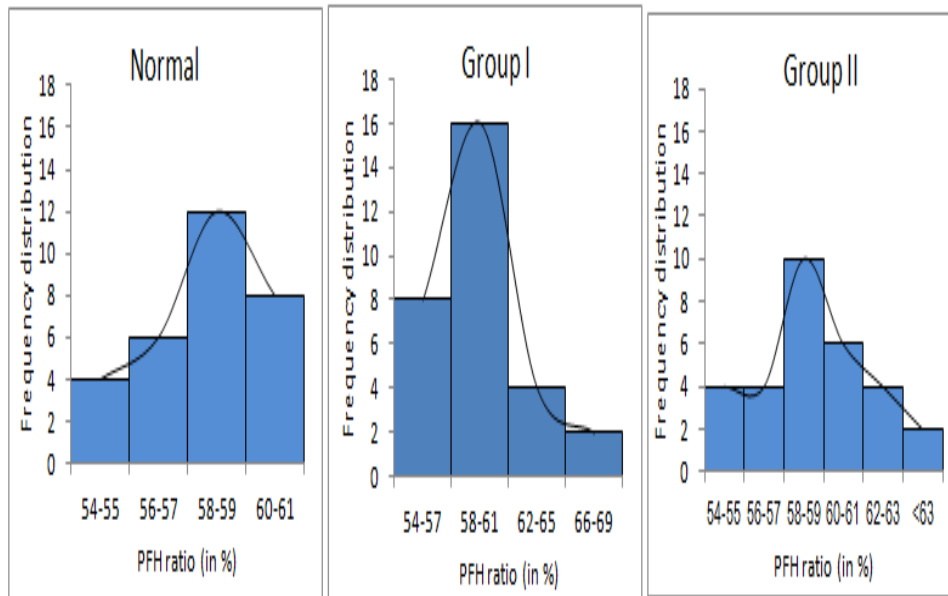


Figure 10: Frequency plots for PFH ratio for the three study groups.

The distribution of PFH ratio in all the three groups is shown in Figure 10. In Normal group, the mean PFH ratio was 58.07 with standard deviation of 2.08. The maximum cases had PFH ratio in the range 58 to 59%. In Group I, the mean PFH ratio was 59.07 with standard deviation of 3.55. Maximum cases had ratio value in the range 58 to 61%. For Group II, the mean PFH ratio was 59.10 with standard deviation of 3.01. The maximum cases had percent PFH in the range 58 to 59%. The mean PFH percent was tested for statistical significance across three groups, which yielded a p -value of 0.3668 (Table I) indicating insignificance of difference between the three groups as regards percent PFH.

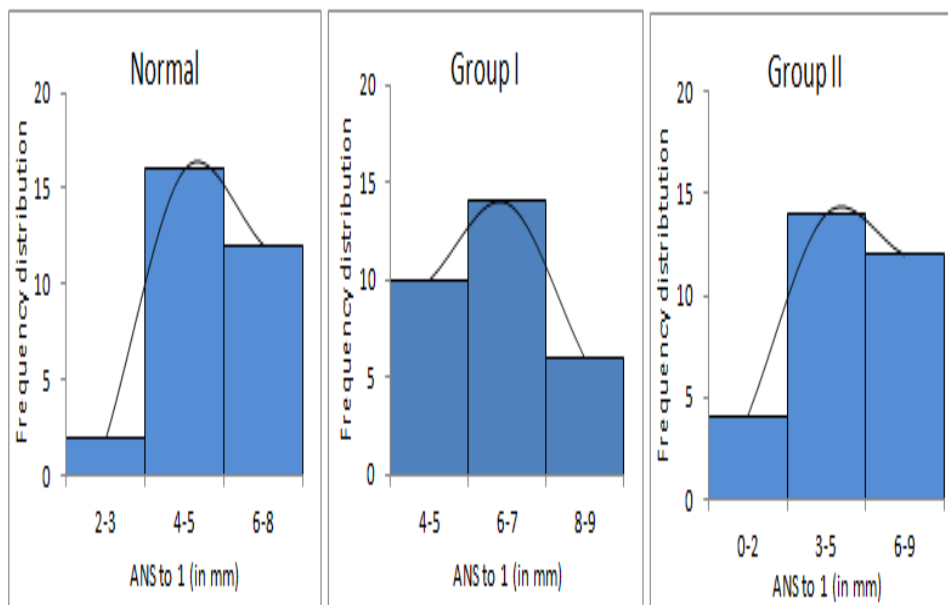


Figure 11: Frequency plots for ANS to 1 distance for the three study groups.

The distribution of ANS to 1 for the three groups has been shown in Figure 11. In Normal group, the mean distance was 5.93 mm with standard deviation of 1.8 mm. The maximum occurrences were in the range of 4 to 5 mm. For Group I, the mean distance was 6.33 mm with standard deviation of 1.69 mm. The modal occurrences were in the range 6 to 7 mm. While for Group II, the mean distance was 4.93 mm with standard

deviation of 2.94 mm. Maximum cases in the group had occurrences in the range 3 to 5 mm. Statistical significance analysis revealed significant difference across the three groups as indicated by the p -value of 0.0365 (Table I). The pair wise analysis revealed that the mean distance between the comparison Group I & Group II was statistically significant with $p = 0.0212$ (Table II).

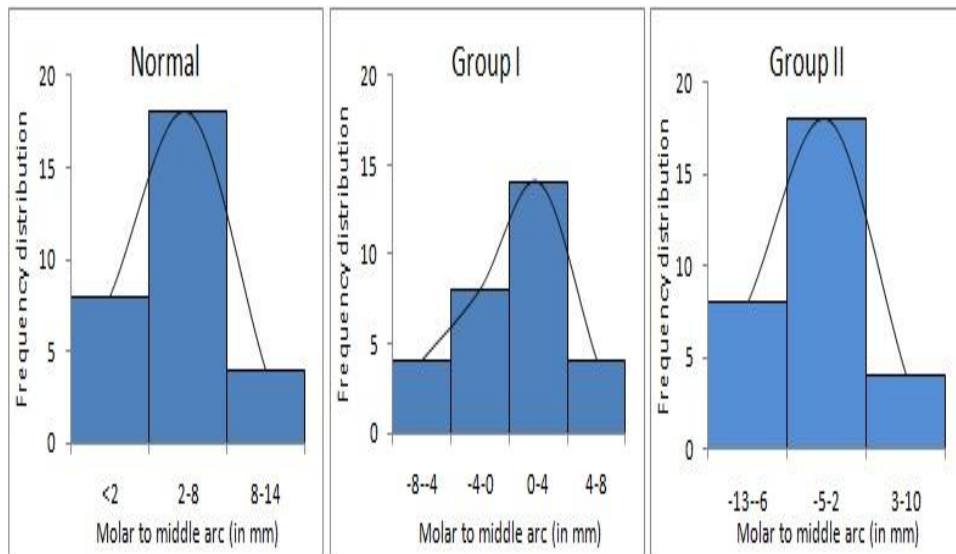


Figure 12: Frequency plots for Molar to middle arc distance for the three study groups.

The distribution of Molar to middle arc for three groups is shown in Figure 12. For Normal group, the mean distance was 2.23 mm with standard deviation of 5.99 mm, with maximum occurrences in the range 2 to 8 mm. While in Group I, the mean distance was 0.47 mm with standard deviation of 3.79 mm. The modal occurrence was in the range 0 to 4 mm. In Group II, the mean distance was 1.93 mm behind the Middle-arc with standard deviation of 6.72 mm. Maximum cases were in the range -5 to -2 mm. Three groups showed significant difference across with p -value of 0.0194 (Table I). The difference was contributed by the comparison Normal vs Group I with p -value of 0.014 (Table II).

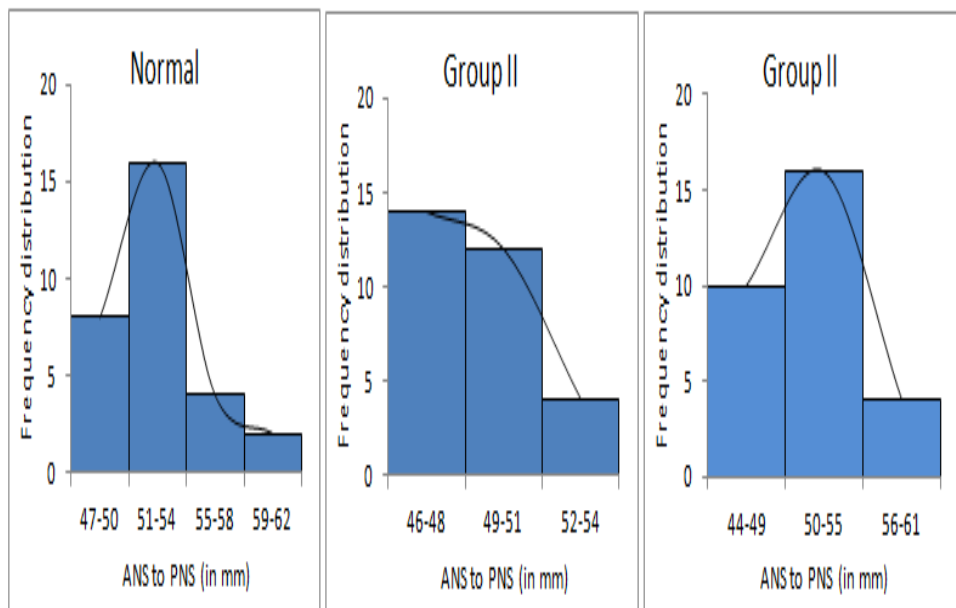


Figure 13: Frequency plots for ANS to PNS distance for the three study groups.

The distribution of ANS to PNS distance was obtained for three groups as shown in Figure 13. For Normal group, the mean distance was 50.73 mm with standard deviation of 3.92 mm. Maximum cases had occurrences in the range 51 to 54 mm. For Group I, the mean distance was 48.93 mm with standard deviation of 2.33 mm. The modal occurrences were in the range 46 to 48 mm. For Group II, the mean distance was 49.67

mm with standard deviation of 5.14 mm. Maximum cases had distance in the range 50 to 55 mm. The difference in the mean distance across the three groups was statistically insignificant as indicated by *p*-value of 0.2159 (Table I).

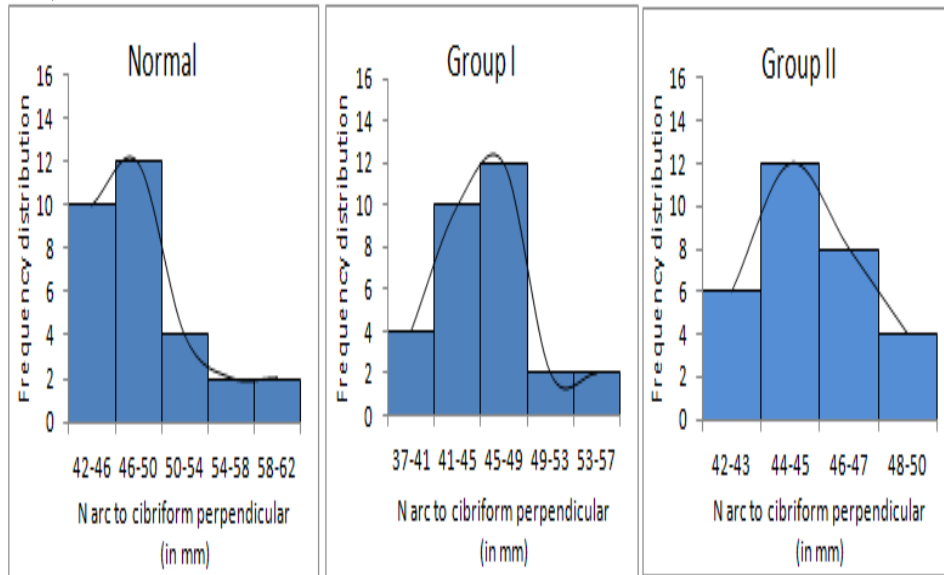


Figure1 4: Frequency plots for N arc to cibriform perpendicular distance for the three study groups.

The distribution of N arc to cibriform perpendicular for the three groups is shown in Figure 14. In Normal group, the mean distance was 47.7 mm with standard deviation of 4.69 mm. The modal range was 46 to 50 mm. For Group I, the mean distance was 44.6 mm with standard deviation of 4.26 mm. Modal occurrence was in the range 45 to 49 mm. In case of Group II, the mean distance was 46.2 mm with standard deviation of 2.73 mm. The significance analysis yielded a *p*-value of 0.0133 indicating significant difference in mean distance across three groups. Pair wise comparison revealed that the significance was caused by Group I having lowest mean distance. The *p*-value for the comparison Normal vs Group I was 0.0096 (Table II), which resulted into overall significance.

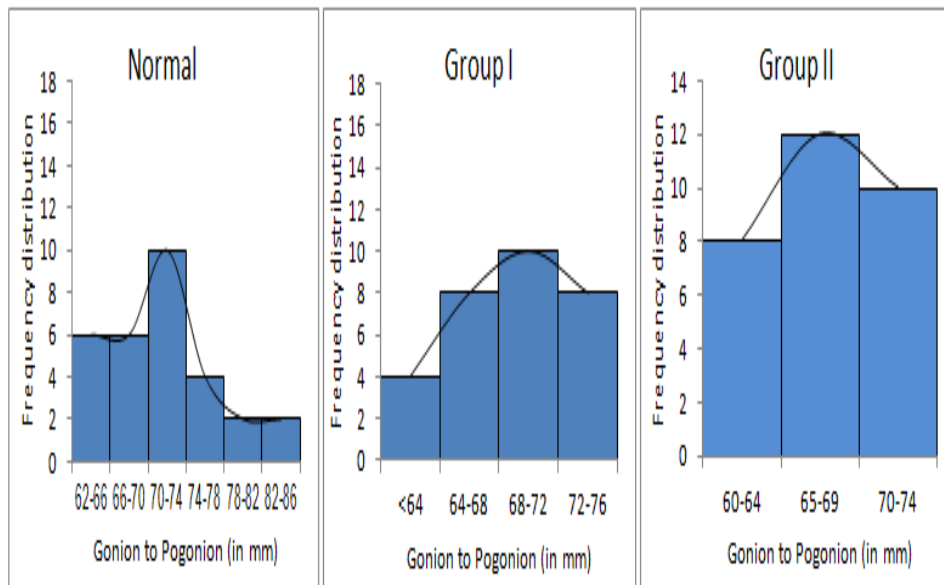


Figure 15: Frequency plots for Gonion to Pogonion distance for the three study groups.

The frequency distribution for the distance between Gonion and Pogonion for the three groups is shown in Figure 15. The mean distance for Normal group was 71.23 mm with standard deviation of 6.04 mm. Maximum cases had distance in the range of 70 to 74 mm. For Group I, the mean distance was 68.43 mm with standard deviation of 3.85 mm. Maximum cases had distance in the range 68 to 72 mm. While for Group II, the mean distance was 65.87 mm with standard deviation of 5.05 mm. Majority of the cases had distance in the

range 65 to 69 mm. The significance analysis yielded a p -value of 0.004 (Table I) indicating significant difference in the groups. Pair wise analysis revealed statistical significance across all the three comparisons with p -value less than 0.05 (Table II).

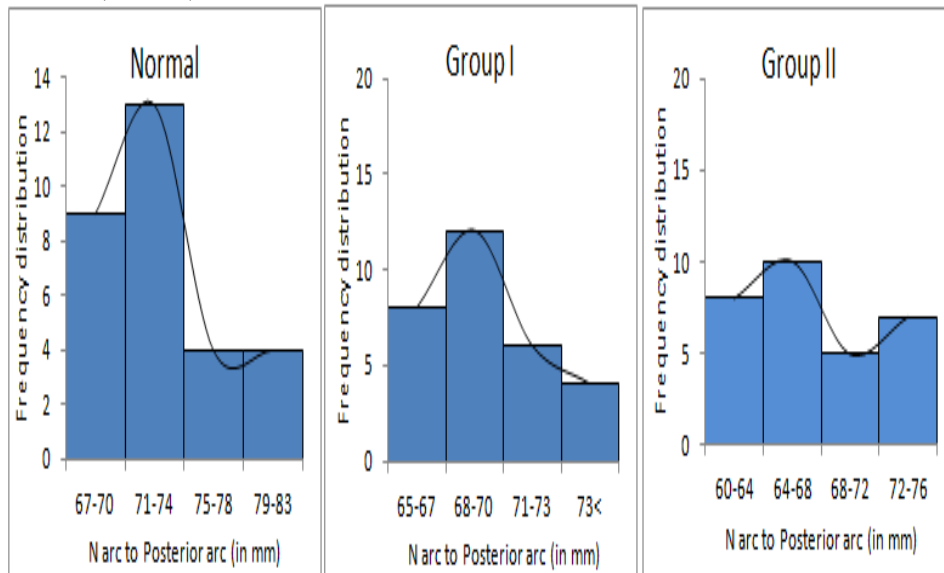


Figure 16: Frequency plots for N arc to Posterior arc distance for the three study groups.

The distribution of N arc to Posterior arc for the samples in three groups was obtained as shown in Figure 16. The mean distance for the Normal group was 72.2 mm with standard deviation of 4.87 mm. The modal range was 71 to 74 mm. For Group I, the mean distance was 70.13 mm with standard deviation of 3.88 mm. Maximum cases had distance between 68 to 70 mm. While in Group II, the mean distance was 66.9 mm with standard deviation of 4.74 mm. The modal range was 64 to 68 mm. The mean distance across the three groups differed significantly with p -value of 0.001 (Table I). The pair wise comparison revealed that the difference is contributed mainly by Group II which showed significant difference of mean with Normal and Group I with p -value of 0.0001 and 0.0054 respectively (Table II).

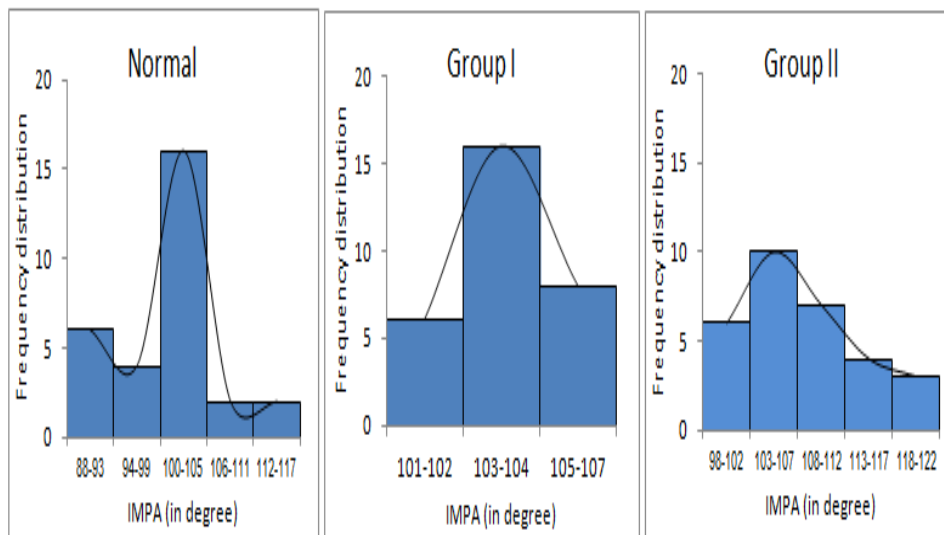


Figure 17: Frequency plots for IMPA for the three study groups.

The distribution of IMPA for the samples in three groups is shown in Figure 17. The mean IMPA in Normal group was 99.93 degrees with standard deviation of 6.61 degrees. The modal occurrences were in the range 100 to 105 degrees. In Group I, the mean IMPA was 103.93 degrees with standard deviation of 2.15 degrees. Maximum cases had IMPA in the range of 103 to 104 degrees. For Group II, the mean IMPA was 107.8 degrees with standard deviation of 6.87 degrees. The difference in the IMPA degree across three groups was found statistically significant with p -value of 0.000 (Table I). Pair wise group analysis for IMPA revealed

that all the three comparisons had significant difference with $p < 0.05$. In other words, the mean IMPA degree for all the three groups differed from each other significantly.

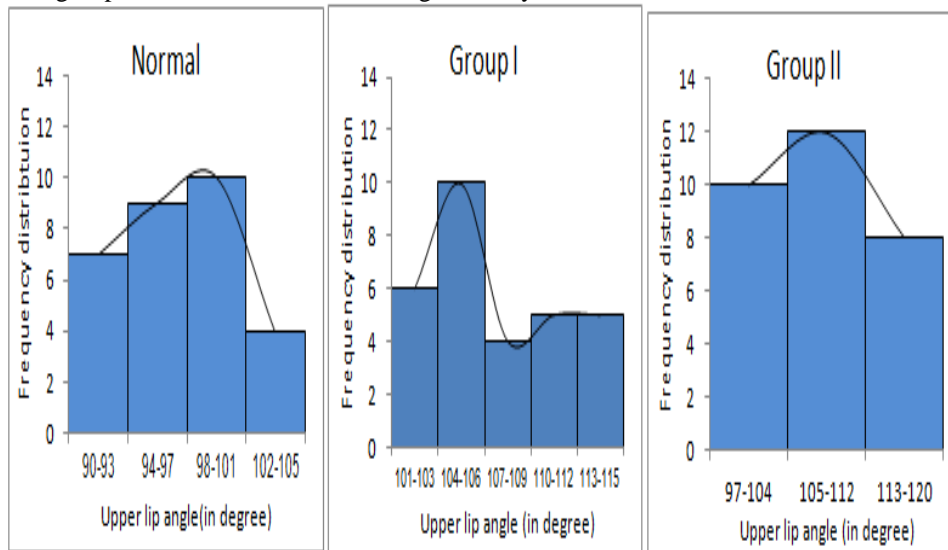


Figure 18: Frequency plots for upper lip angle for the three study groups.

The distribution of upper lip angle in degrees for the samples in three groups is shown in Figure 18. The mean angle in Normal cases was 97 degrees with standard deviation of 4.07. Maximum cases in this group had angle in the range 98 to 101. For Group I, the mean angle was 107.2 degrees with standard deviation of 5.55 degrees. The modal range was found to be 104 to 106 degrees. In case of Group II, the mean angle was 106.87 degrees with standard deviation of 8.08 degrees. The difference in the mean angle across the groups was found to be statistically significant with p -value of 0.000 (Table I). The pair wise comparison revealed that Normal group contributed to the significance as observed through comparisons Normal vs Group I and Normal vs Group II with p -value less than 0.001 (Table II).

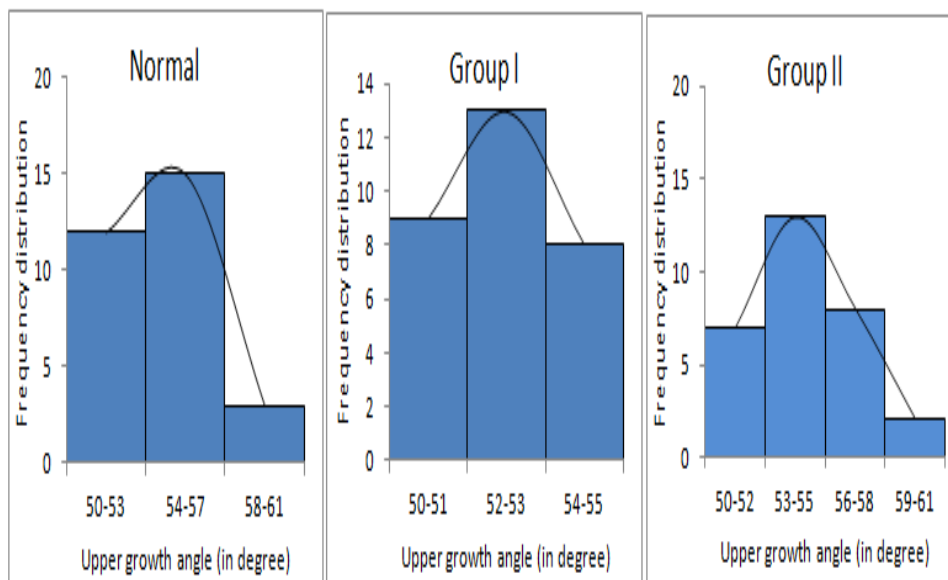


Figure 19: Frequency plots for upper growth angle for the three study groups.

The distribution of upper growth angle in three groups is shown in Figure 19. The mean upper growth angle in Normal group was 53.93 degrees with standard deviation of 2.64 degrees. The modal range was 54 to 57 degrees. For Group I, the mean upper growth angle was 51.8 degrees with standard deviation of 1.83 degrees. The maximum number of cases had angle in the range 52 to 53 degrees. In case of Group II, the mean angle was 53.87 degrees with standard deviation of 2.7 degrees. The difference in the mean upper growth angle was statistically significant across the three groups with p -value of 0.001. Pair wise analysis revealed that the difference was contributed mainly by Group I having the mean angle on a lower

side. The p -value for the comparisons Normal vs Group I and Group I vs Group II were 0.0006 and 0.0011 respectively as shown in Table II.

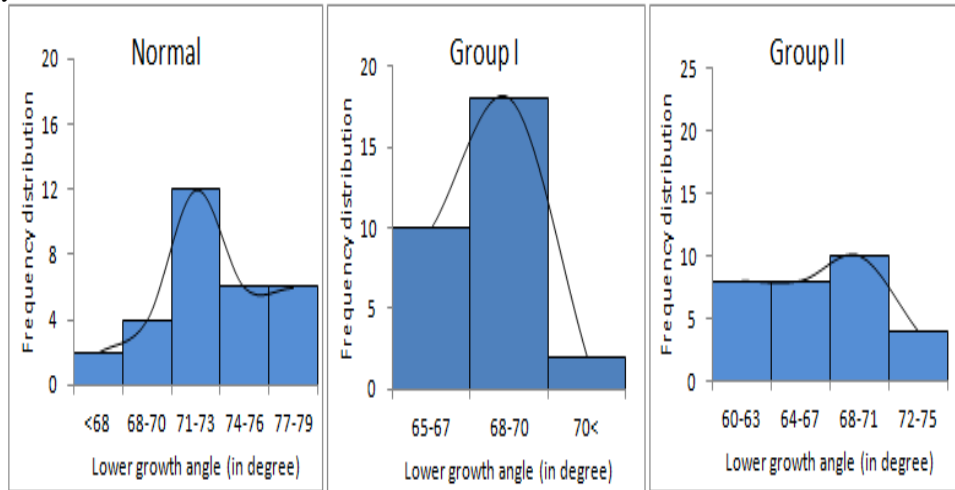


Figure20: Frequency plots for lower growth angle for the three study groups.

The distribution of Lower growth angle for the three groups is shown in Figure 20. The mean angle for the Normal group was 72.93 degrees with standard deviation of 3.94 degrees. The modal range was 71 to 73 degrees. For Group I, the mean angle was 68.67 degrees with standard deviation of 3.38 degrees. Maximum cases in the group had angle in the range of 68 to 70 degrees. In case of Group II, the mean angle was 66.8 degrees with standard deviation of 4.19 degrees. Maximum cases had angle in the range of 68 to 71 degrees. The difference in the mean lower growth angle across three groups was found to be statistically significant with p -value of 0.0000 (Table I). The difference was mainly due to higher mean angle in Normal group which is reflected through the comparisons Normal vs Group I and Normal vs Group II with p -values less than 0.001 (Table II).

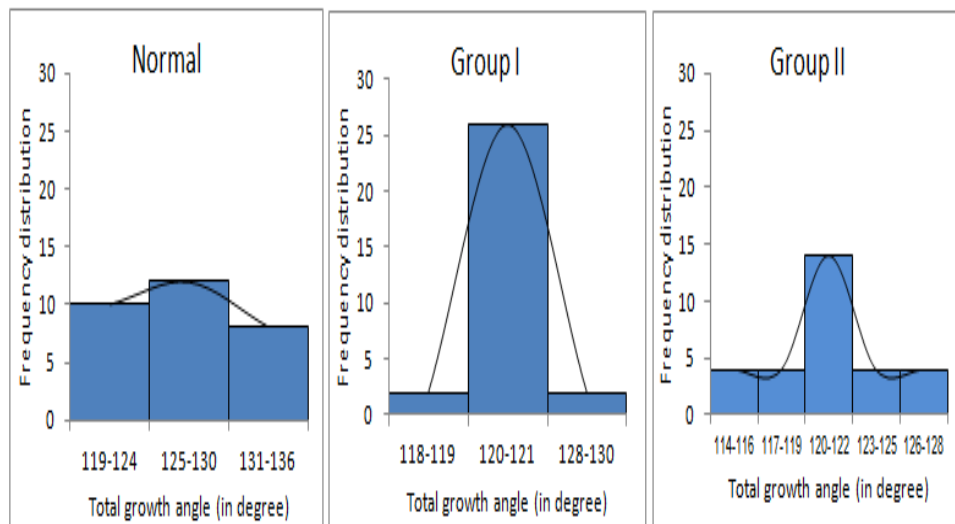


Figure21: Frequency plots for total growth angle for the three study groups.

The distribution of total growth angle in three study groups is shown in Figure 21. The mean angle in Normal group was 126.87 degrees with standard deviation of 4.95 degrees. The cases were almost uniformly distributed in the range 119 to 136. For Group I, the mean angle was 120.53 degrees with standard deviation of 2.62 degrees. The modal range was 120 to 121 degrees. For Group II, the mean angle was 120.67 degrees with standard deviation of 3.85 degrees. The modal occurrence was in the range of 120 to 122 degrees. The difference in the mean total angle closure was found to be statistically significant across all the three groups as indicated by p -value of 0.000 (Table I). The pair wise comparison revealed that Normal group contributed to significant difference as evident through pair wise comparisons Normal vs Group I and Normal vs Group II with p -values less than 0.001.

Table I: Significance testing for each parameter using one-way ANOVA

Parameter	Mean and SD			p-value	Remark
	Normal	Group I	Group II		
N - ARC TO ANS (in mm)	-2.47±3.54	-1.2±1.94	-2.07±3.29	0.2541	
N TO POG (in mm)	-2.4±4.15	-3.73±2.79	-5.47±3.76	0.0059	***
A arc TO B point (in mm)	-1.53±2.73	-1.5±1.74	-1.67±1.52	0.9468	
Supra orbitale to ANS (in mm)	65.13±2.78	63.07±4.04	57.2±7.26	0.0000	*
ANS to Menton (in mm)	68.8±4.27	67.13±4	60.07±6.12	0.0000	*
Supra orbitale to Menton (in mm)	133.27±4.65	123.47±7.31	112.4±7.09	< 2.2e-16	*
Sella to Gonion (in mm)	83±4.62	76.07±5.17	76.8±9.03	0.0001	*
Nasion to Menton (in mm)	117.53±7.11	110.4±6.63	102.4±7.87	0.0000	*
AFH ratio (in %)	54.67±2.34	52.73±1.68	58.07±2.08	0.0000	*
PFH ratio (in %)	58.07±2.08	59.07±3.55	59.10±3.01	0.3668	
ANS to I (in mm)	5.93±1.8	6.33±1.69	4.93±2.74	0.0365	****
Molar to middle arc (in mm)	2.23±5.99	0.47±3.79	-1.93±6.72	0.0194	****
ANS to PNS (in mm)	50.73±3.92	48.93±2.33	49.67±5.14	0.2159	
N arc to cibriform perpendicular (in mm)	47.7±4.69	44.6±4.26	46.2±2.73	0.0133	****
Gonion to Pogonion (in mm)	71.23±6.04	68.43±3.85	65.87±5.05	0.0004	**
N arc to Posterior arc (in mm)	72.2±4.87	70.13±3.88	66.9±4.74	0.0001	*
IMPA (in degree)	99.93±6.61	103.93±2.15	107.8±6.87	0.0000	*
Upper lip angle (in degree)	97±4.07	107.2±5.55	106.87±8.08	0.0000	*
Upper Growth Angle (in degree)	53.93±2.64	51.8±1.83	53.87±2.7	0.0010	**
Lower Growth Angle (in degree)	72.93±3.94	68.67±3.38	66.8±4.19	0.0000	*
Total growth angle (in degree)	126.87±4.95	120.53±2.62	120.67±3.85	0.0000	*

* $p < 0.0001$; ** $p < 0.001$; *** $p < 0.01$; **** $p < 0.05$

Table II: Statistical significance in pair wise comparisons for each parameter

Parameter	p-values for different comparisons		
	Normal vs Group1	Normal vs Group2	Group1 vs Group2
N - ARC TO ANS (in mm)	0.0925	0.6520	0.2199
N TO POG (in mm)	0.1503	0.0040	0.0475
A arc TO B point (in mm)	0.9553	0.8163	0.6941
Supra orbitale to ANS (in mm)	0.0250	0.0000	0.0003
ANS to Menton (in mm)	0.1241	0.0000	0.0000
Supra orbitale to Menton (in mm)	0.0000	< 2.2e-16	0.0000
Sella to Gonion (in mm)	0.0000	0.0017	0.7012
Nasion to Menton (in mm)	0.0002	0.0000	0.0001
AFH ratio (in %)	0.0006	0.0000	0.0000
PFH ratio (in %)	0.1899	0.1899	1.0000
ANS to I (in mm)	0.3782	0.1010	0.0212
Molar to middle arc (in mm)	0.1785	0.0140	0.0953
ANS to PNS (in mm)	0.0358	0.3702	0.4809
N arc to cibriform perpendicular (in mm)	0.0096	0.1369	0.0896
Gonion to Pogonion (in mm)	0.0372	0.0004	0.0310
N arc to Posterior arc (in mm)	0.0745	0.0001	0.0054
IMPA (in degree)	0.0033	0.0000	0.0058
Upper lip angle (in degree)	0.0000	0.0000	0.8530
Upper Growth Angle (in degree)	0.0006	0.9233	0.0011
Lower Growth Angle (in degree)	0.0000	0.0000	0.0626
Total growth angle (in degree)	0.0000	0.0000	0.8761

IV. Discussion

Over the years, numerous cephalometric studies have been carried out, that have culminated in the formulation of a large number of cephalometric analyses. It can be said that a majority of the more commonly used analyses have originated in the western part of the world, with 'normal' samples comprising of Caucasian individuals. No studies have been done on Maharashtrian population to lay the norms and to compare these norms with the Caussain population **Sassouni Viken** in the year 1958, introduced the "sassouni's archial analysis" using a sample consisting of individuals of Caucasian descent. This analysis compares the maxillo-dento-mandibular structures within the craniofacial complex. Dr. Richard Bestile of Michigan in the year 1983 modified this analysis which he called as sassounis plus analysis. **Steiner** was the first to recognize that cephalometric standards for one ethnic group need not necessarily apply to other ethnic groups.

Therefore, the norms established for a given analysis using a Caucasian sample need not be ideally suited to evaluate skeletal and dental malocclusions in other ethnic or racial groups. Thus, the purpose of this study was to establish the norms using the sassouni plus Analysis for the local population. This was done to ensure that, when using this analysis, one would get a more accurate picture of the underlying dento-skeletal deformity in the local population. For this, a sample comprising of 30 individuals was selected. This was considered to be the "normal" group and was termed as Group I

In addition, this analysis was also carried out for 2 other groups. Each consisted of 30 individuals having Class I malocclusion and Class II division 1 malocclusion. This was done primarily to evaluate and compare the cephalometric values of these groups to that of the normal sample. These groups were categorized as Group II and group III respectively. Of the 11 components analyzed, skeletal AP alignment was the most variable. In the study, the Anterior nasal spine (ANS) from the chosen samples was behind the N arc. The position of the Pogonion (Pog) point was also behind of the N arc and the position of the B point was behind the A arc as compared to the original study. This suggested that the Maharashtrian population had a reduced jaw size as compared to the Caucasian population. This does not correlate to the original study which suggested that the Taiwanese had a protruded mandible.

In the skeletal vertical dimension in adults, according to Sassouni plus analysis, the LFH (lower facial height) is equal to the UFH (upper facial height) plus 10 mm. In the present study, the differences between the LFH and the UFH were 7.05 mm for group I 8.04 mm for group II and 13.83 mm for group III. These are less than that of the Sassouni standard. According to Sassouni plus analysis, these results mean either an open bite or a closed bite. However, in our clinical examination, we did not find any signs of this correlating the results same as that of the original study. The ratio of AFH (anterior facial height), the value was 54.67% for group I, 52.73% for group II and 58.07% for group III. These are comparable to the western standard (54-58%). In the PFH (posterior facial height) ratio, the value was 58.07% for group I 59.07% for group II and 59.07% for group III. In Sassouni plus analysis, the AFH ratio is utilized as a value which indicates the skeletal vertical dimension. In this study, the growth was neutral in all the groups. Thus the profile showed a clockwise rotation pattern which also reveals that the the mandible grows downward and backward. This was similar to the original study when compared.

In the maxillary incisor position, Sassouni found that if the ANS is on the N arc, the maxillary central incisor tip ranges from 0-3 mm ahead of the ANS arc. In the present study, the value was 7 mm for group I 8 mm for group II and 7 mm for group III, which shows that the maxillary central incisors are more proclined than in western populations. In Perng's study, he states that the profile of the Chinese in Taiwan is more protruding than that of Western profiles¹⁰. Results of the present study are comparable to the original study. In maxillary A-P length, the average distance from ANS to PNS was 50.73mm for group I 48.93 mm for group II and 49.67 mm for group III. The distance from the N arc to the Cr perpendicular was 47.7 mm for group I 44.6 mm for group II and 46.27 mm for group III. This means that the average maxillary A-P length in the present sample was greater than that of N arc to the Cr perpendicular.

In the study, neither the PNS was on the Cr perpendicular nor the ANS was on the anterior arc. The results showed the length of the maxillary A-P to be longer than that of the ANS to Cr perpendicular. The results were similar to the original study when compared. In the maxillary A-P position, there were no cases of ANS on the anterior arc, while the ANS was behind the anterior arc for the entire study group selected. This implies that in the Maharashtrians maxillary AP position seems to be relatively posteriorly positioned with reference to the cranial base. These results were similar to the original study when compared. As regards the position of the maxillary first molar, it is a mesial surface tangent to the adjusted midfacial arc. In the present study, the average maxillary first molar position was 2.23 mm for Normal group, 0.47 mm for group I, and 1.93 mm for group II behind the midfacial arc. This shows that there is a postural difference in the cranial base and the maxilla. It may result from a more advanced cranial base or a more retruded maxilla. It also may be due to the difference in tooth size and arch form. The mandibular A-P length, after age 12, becomes progressively larger than the length of Sp to N (anterior cranial base) as the mandibular growth is accelerated downward and forward from under the facial complex. Present study shows the same phenomenon in all the study groups compared. These results were same as that of the original study when compared.

As regards the mandibular A-P position, the position of the Pog point is behind the anterior arc with -2.4+- 4.15mm for group I -3.73+- 2.79mm for group II and -5.47+- 3.76 mm for group III. The difference between the cranial base length and the Pog to Go length was 12 mm for group I 8 mm for group II and 10 mm for group III that is, the position of Go is behind the posterior arc. This implies that in the Maharashtrian population the length of the mandible is small as compared to the Caussain population. These results did not match to the original study. In the mandibular incisor position, the result was 100° for group I 104° for group II and 108° for group III. In the western population the value is 90 ± 5 degrees". The position of the mandibular incisor is more ahead of that population. The mandibular incisors are more forwardly placed in the present study. These were the similar finding when compared to the original study

For the growth direction indicator, study showed the upper gonion angle to be 53.93 ± 2.64 degrees for group I 51.8 ± 1.83 degrees for group II and 53.87 ± 2.7 degrees for group III and the lower gonion angle to be 79.93 ± 3.94 degrees for group I 68.67 ± 3.38 degrees for group II and 66.8 ± 4.19 degrees for group III. This coincides with the findings of the previous study. In general, The present study showed that the Gonial angle in Maharashtrian population is smaller than that of westerners. The upper gonion angle of the Maharashtrian population is smaller than that of westerners. According to Sassouni plus analysis: (a)if the upper gonial angle is large, growth will be forward; (b)if the upper gonial angle is small, growth will be downward and backward; (c)if the lower gonial angle is large, growth will be downward; and (d)if the lower gonial angle is small, growth will be forward. Thus it can be concluded that the direction of mandibular growth is downward and backward.

For the upper lip angle, the value was 126.87 ± 4.95 degrees for group I 120.53 ± 2.62 degrees for group II and 120.67 ± 3.85 degrees for group III. These values are not comparable to the western standard which has a normal value of 104 degree. At this point, the western esthetic standard did not seem to agree with the Maharashtrian population. This finding is not similar when compared to the original study.

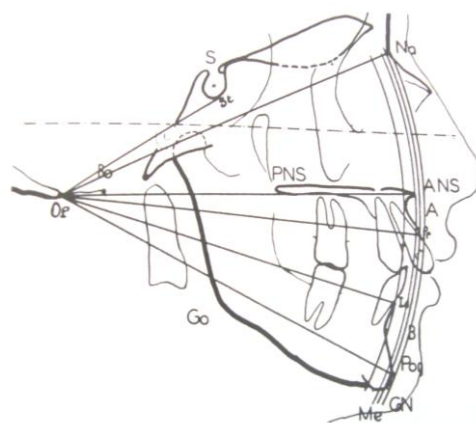
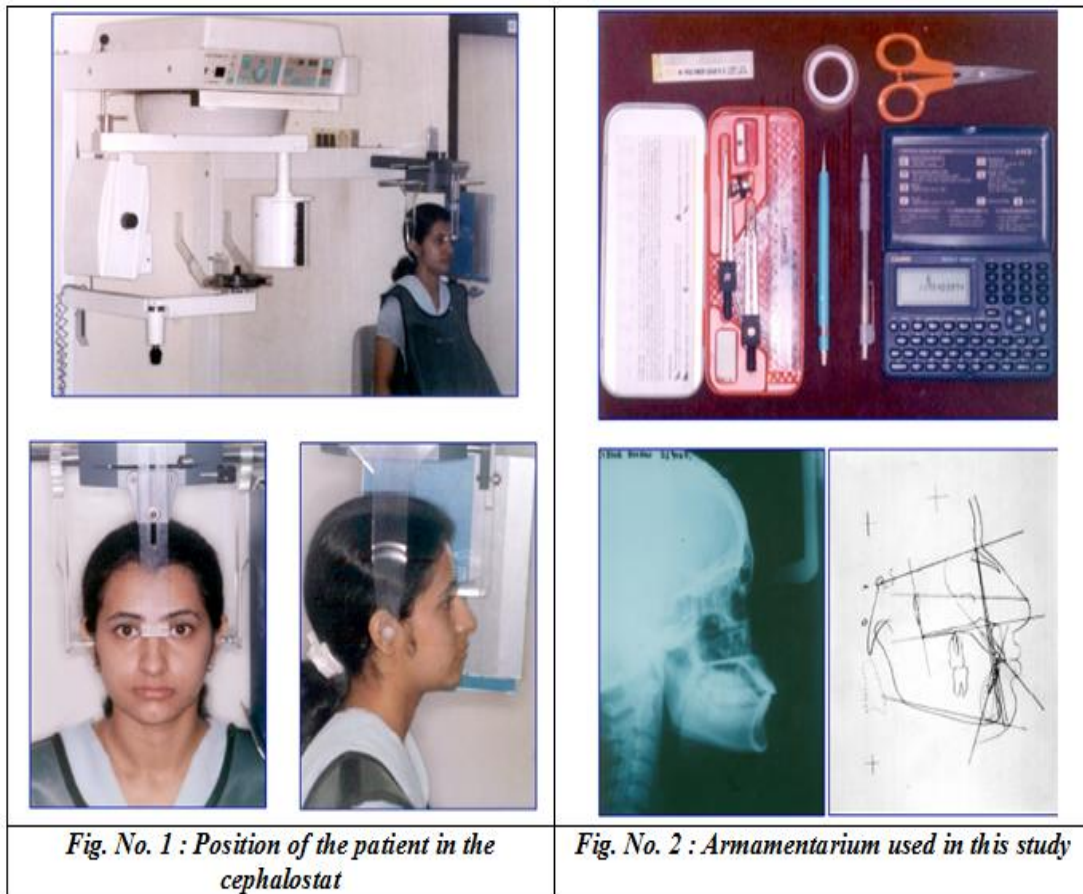


Fig. No.5 : Cephalometric land marks

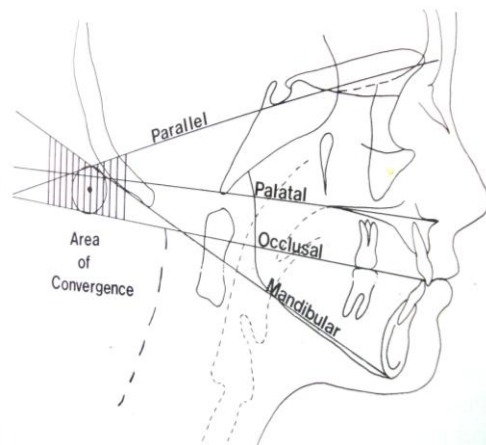


Fig. No.6 : Cephalometric lines or planes

V. Conclusion

Norms for the Maharashtrian population using Sassounis plus analysis have been laid down and compared to those in Angles class I and class II div.1 malocclusion. However, a cross sectional study on a larger population sample will confirm the norms for the Indian subjects.

VI. Summary

Cephalometric evaluation of the dentoskeletal facial characteristics of three groups was analyzed according to the Sassounis plus analysis.

Group I: Normal occlusion i.e. Class I molar relation and acceptable profile.

Group II: Class I malocclusion

Group III: Class II division 1 malocclusion.

30 cases were analyzed in group I, Group II and Group III

The mean, standard deviation and range were calculated for the angular and linear measurements for each group. Group I was used to establish cephalometric norms for the Sassounis plus Analysis within regards to the local population. Groups II and III were used for evaluation and comparison of the cephalometric values to those of Group I. For the comparison of Group II and Group III and with the normal group both the 't' and 'p' values were estimated.

From the present study, the following results were obtained:

1. The Anterior nasal spine (ANS) from the chosen samples was behind the N arc. The position of the Pogonion (Pog) point was also behind of the N arc and the position of the B point was behind the A arc as compared to the original study. This suggested that the Maharashtrian population had a reduced jaw size as compared to the Caucasian population.
2. In the present study, the differences between the LFH and the UFH were 7.05 mm for group I 8.04 mm for group II and 13.83 mm for group III. These are less than that of the Sassouni standard. According to Sassouni plus analysis, these results mean either an open bite or a closed bite. However, in the present study these findings were absent.
3. In the maxillary incisor position, Sassouni found that if the ANS is on the N arc, the maxillary central incisor tip ranges from 0-3 mm ahead of the ANS arc. In the present study, the value was 7 mm for group I 8 mm for group II and 7 mm for group III, which shows that the maxillary central incisors are more proclined than in western populations.
4. In maxillary A-P length, the average distance from ANS to PNS was 50.73mm for group I 48.93 mm for group II and 49.67 mm for group III. The distance from the N arc to the Cr perpendicular was 47.7 mm for group I 44.6 mm for group II and 46.27 mm for group III. This means that the average maxillary A-P length in the present sample was greater than that of N arc to the Cr perpendicular.
5. In the study, neither the PNS was on the Cr perpendicular nor the ANS was on the anterior arc. The results showed the length of the maxillary A-P to be longer than that of the ANS to Cr perpendicular.
6. In the maxillary A-P position, there were no cases of ANS on the anterior arc, while the ANS was behind the anterior arc for the entire study group selected. This implies that in the Maharashtrian, maxillary AP position seems to be relatively posteriorly positioned with reference to the cranial base.
7. As regards the position of the maxillary first molar, it is a mesial surface tangent to the adjusted midfacial arc. In the present study, the average maxillary first molar position was 2.23 mm for Normal group, 0.47 mm for group I, and 1.93 mm for group II behind the midfacial arc. This shows that there is a postural difference in the cranial base and the maxilla. It may result from a more advanced cranial base or a more retruded maxilla. It also may be due to the difference in tooth size and arch form
8. As regards the mandibular A-P position, the position of the Pog point is behind the anterior arc with -2.4+-4.15mm for group I -3.73+-2.79mm for group II and -5.47+-3.76 mm for group III. The difference between the cranial base length and the Pog to Go length was 12 mm for group I 8 mm for group II and 10 mm for group III that is, the position of Go is behind the posterior arc. This implies that in the Maharashtrian population the length of the mandible is small as compared to the Caussain population
9. In the mandibular incisor position, the result was 100° for group I 104° for group II and 108° for group III. In the western population the value is 90 ± 5 degrees". The position of the mandibular incisor is more ahead of that population. The mandibular incisors are more forwardly placed in the present study.
10. The present study showed the upper gonion angle to be 53.93+-2.64 degrees for group I 51.8+-1.83 degrees for group II and 53.87+-2.7 degrees for group III and the lower gonion angle to be 79.93+-3.94 degrees for group I 68.67+-3.38 degrees for group II and 66.8+-4.19 degrees for group III. This coincides with the findings of the previous study. In general, The present study showed that the Gonial angle in Maharashtrian population is smaller than that of westerners.

It is observed that the norms established in the present study can be used to evaluate the dentoskeletal relationship of the local population. Though certain differences have been noted between the original and current study.

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