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A Treatment Module in Orthodontics: Cephalometric Polygon Norms as a Guide towards a Harmonious Individual Craniofacial Pattern among Keralites

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Abstract

The objective of the study was to identify a polygon with limited number of cephalometric parameters in region near to teeth; to find values for linear, angular and area measurements for the polygon in the ideal, Class II and III groups and to define correlations and male female differences observed in the study variables. In this cross-sectional study, cephalograms of young adults satisfying the inclusion criteria, were evaluated for the specific parameters. Linear, angular and area measures of polygons in the ideal, Class II and Class III malocclusions were measured from tracings of cephalograms and statistically analysed. Mean±SD of the angular, linear and area measurements for the different study groups, and the Correlations observed between the angular, linear and area measurements in the different study groups; The mean ±SD of the angular, linear and area measurements for males and females in the different study groups; and the Norms for the ideal polygon is identified in the results. A polygon with a limited number of cephalometric parameters was successfully identified; the mean values, correlations and male female differences observed in measurements for the ideal, class II and Class III malocclusions groups are defined.

Key words: Cephalometric Polygon; Polygon Norms; Harmonious Pattern; Craniofacial Pattern; treatment module in orthodontics

Introduction

Cephalograms are routinely used in orthodontics. Different cephalometric analyses involving different parameters have been described[1].

The objective of the study was to identify a polygon in a cephalogram which involves limited number of cephalometric parameters in region near to teeth. The Primary objective was to find the mean, SD, maximum and minimum values for the polygon in the ideal, Class II and III groups for linear, angular and area measurements. Secondary objectives were

(1)To see if there is any correlation between

(a) The two linear measurements used in the analysis

(b) Angle 4 and angle 5

(c) The 5 angular measurements

(d) Area and the angular measurements 4 and 5

(e) Area and linear measures and

(2) To see if there is statistically significant difference between males and females for the study variables.

Materials and Methods

This cross-sectional study was done as a project under the State Board of Medical Research (SBMR) at the Government Medical College, Thiruvananthapuram, with its financial and material support. Institutional ethics clearance certificate was obtained from Institutional Ethics Committee of Government Dental College, Thiruvananthapuram. Cephalograms of young adults in the age group 18-21 in the ideal, Angle Class II and Angle Class III malocclusion groups, available in the Department for treatment and thesis purposes, were included in the study. Sample size was 95, incorporating 18 ideal cases, 28 Class II and 49 Class III cases.

Inclusion criteria were the following: Presence of all permanent teeth up to the first molars; Absence of proximal decay or restoration; Absence of dental anomalies of number, size, form, and position; No previous orthodontic therapy; Subjects whose cephalograms are to be used should belong to Kerala by birth and domicile. Presence of a complete bilateral occlusion with no openbite or crossbite is not taken as criteria, because of inclusion of Class III malocclusion.

Cephalometric tracings were conducted by a single investigator (after standardization) and landmarks, namely ANS, PNS, Go, Gn, Sn points were identified as per standard textual definitions. The hand drawn cephalometric tracings were scanned with a flatbed scanner (at 600 dpi), and then the maxillary plane (ANS-PNS line) and the mandibular plane and the long axis of the incisors were drawn. The point of intersection of the long axis of the maxillary central incisor with the maxillary plane, the point of intersection of the long axis of the mandibular central incisor with the mandibular plane, the incisal tip of the maxillary incisor and the incisal tip of the lower incisor and the Sn point were identified. These points were joined to get a polygon, named and marked as polygon ABCDE in Fig 4. The linear, angular and area measurements were taken with the software program ImageJ. Length 1 was taken as AB and length 2 taken as AC (direct measurement from A to C in a straight line). Angles used in the analysis were angle 1, angle 2, angle 3, angle 4 and angle 5 of the polygon ABCDE shown in Fig 5. Area of the polygon ABCDE was also to be measured.

Data was statistically analysed. The mean, standard deviation, maximum and minimum values of the study variables were computed. The correlation between the two linear measurements, between angle 4 and angle 5, between the 5 angular measurements, between area and the angular measurements 4 and 5 and the relation between area and linear measures, in the ideal, Class II and III groups and the statistically significant difference between males and females for the study variables were examined.

Patients were not directly involved. The rights of the human subjects were protected and approval was obtained from the identified institutional review board. Institutional ethics clearance certificate from Institutional Ethics Committee was obtained.

Results

Results are presented in Tables 1-8. The ‘ideal’ group included 50% males and 50% females; it was 43% males and 57% females in class II group; Class III had 52% males and 48% females (Table 1).

The mean of angle 1, angle 2, angle 3, angle 4 and angle 5 in the ideal were 72.78±5.11, 88.72±6.34, 20.27±3.42, 74.31±14.03 and 72.79±13.46 respectively. In class II, it was 85.00±6.05, 98.89±5.93, 25.14±3.89,

107.73±16.00 and 79.19±17.94 respectively. In Class III, it was 78.80±9.72, 83.07±7.43, 27.02±5.16, 76.90±47.98, and 74.92±49.75 respectively (Table 2).

Angle 1 showed statistically significant difference between males and females in the 'ideal' group and in the Class III group. In the ideal population, the mean value for angle 1 in males was 69.6±4.7; in females, it was 76.0±3.2; In the Class III population, in males it was 76.1±8.6; in females, it was 81.8±10.2 ($p<.05$) (Table 6,8). In class II group, the value for angle 1 is taken as 85.00±6.05. (Table 2).

Length 1 showed a statistically significant difference between males and females in the 'ideal' group and in the Class III group. In the ideal population, the mean value for length 1 in males was 323.8±50.7; in females, it was 284.0±28.2; In the Class III population, the mean in males was 365.0±47.9; in females, it was 332.0±40.1. ($p<0.05$) (Table 6,8). In class II group, the value for length 1 is taken as 329.03 ±37.23. (Table 2).

In the 'ideal' population, the mean value for length 2 was 776.09±63.17 (Table 2). In the Class II population, the mean value for length 2 in males was 974.2±98.7; in females, it was 897.6±60.0. ($p<0.05$) (Table 7). In the Class III population, the mean value for length 2 in males was 886.8±82.3; in females, it was 804.6±94.2. ($p<0.05$) (Table 8).

The mean area of the polygon in the ideal group was 106362.25±22670.58. The area measurement of the polygon in the Class II group was 171951.54±30938.00 and that in the Class III group was 156383.92±43201.74

Correlations observed are listed in table 3-5. A positive correlation was observed in the Class III group between length 1 and length 2. No correlation was observed between length 1 and length 2 in the ideal, and in the Class II groups. There was a statistically significant positive correlation between the angle 4 and angle 5 in the ideal, Class II and III groups. There was a statistically significant positive correlation between angle 3 and angle 4 measurements in the ideal and in the Class II groups. In the Class III group, a positive correlation was observed in angle 1 with angles 3, 4, and 5. Also, in the Class III group, a positive correlation was observed in angle 2 with angles 4, and 5. There was a statistically significant positive correlation in the Class II and Class III population between area and angular measurement 4 and 5. There was a statistically significant positive correlation between area and linear measures in the ideal, Class II and III groups.

When angle 3 increases by one unit, area increases by 0.805 units, length 1 increases by 0.591 units, and angle 4 increases by 0.466 units. In other words, 64.8% of the variations in the area is determined by angle 3. Also, 34.93% of variations in length 1 is determined by angle 3. Also, 21.72% of variations in angle 4 is determined by angle 3.

When length 1 increases by one unit, area increases by 0.725 units, length 2 increases by 0.796 units. When angle 4 increases by 1 unit, angle 5 increases by 0.687 units. In other words, 52.56% of the variations in the area is determined by length 1; and 63.36% of the variations in the area is determined by length 2.

In the Class II population, When angle 1 increases by one unit, angle 3 increases by 0.424units. When angle 3 increases by one unit, angle 4 increases by 0.393units. When angle 2 increases by one unit, angle 5 decreases by 0.407units. When angle 4 increases by one unit, angle 5 increases by 0.880units. When angle 2 increases by one unit, length 1 decreases by 0.462units. When angle 5 increases by one unit, length 1 increases by

0.547units. When angle 4 increases by one unit, area increases by 0.515units. When angle 5 increases by one unit, area increases by 0.376units. When length 1 increases by one unit, area increases by 0.480 units. When length 2 increases by one unit, area increases by 0.791 units. In other words, 18% of the variations in the angle 3 is determined by angle 1. 11.79% of the variations in the angle 4 is determined by angle 3. 11.79% of the variations in the angle 5 is determined by angle 2. 77.44% of the variations in the angle 5 is determined by angle 4. 21.34% of the variations in the length 1 is determined by angle 2. 29.92% of the variations in the length 1 is determined by angle 5. 26.52% of the variations in the area is determined by angle 4. 14.14% of the variations in the area is determined by angle 5. 23.04 % of the variations in the area is determined by length 1. 62.56% of the variations in the area is determined by length 2.

In the Class III population, when angle 1 increases by one unit, angle 3 increases by 0.369 units; angle 4 increases by .395 units; angle 5 increases by 0.363 units; and area increases by 0.288 units. when angle 2 increases by one unit, angle 4 increases by 0.452units; angle 5 increases by 0.477units; length 2 increases by 0.539 units; and area increases by 0.351 units.

Again, in the Class III population, when angle 3 increases by one unit, length 1 increases by 0.443 units; and area increases by 0.636 units. When angle 4 increases by one unit, angle 5 increases by 0.960 units; length 2 increases by 0.423 units and area increases by 0.421units. When angle 5 increases by one unit, length 2 increases by 0.488 units and area increases by 0.508 units. When length 1 increases by one unit, length 2 increases by 0.491units and area increases by 0.671 units. When length 2 increases by one unit, area increases by 0.839 units. In other words, 8.29% of the variations in the area is determined by angle 1, 12.32% of the variations in the area is determined by angle 2, 40.45% of the variations in the area is determined by angle 3, 17.72% of the variations in the area is determined by angle 4, 25.8% of the variations in the area is determined by angle 5, 45.02% of the variations in the area is determined by length 1 and 70.39% of the variations in the area is determined by length 2.

Statistically significant correlations were observed in the ‘ideal’ population between angle 4 and angle 3, angle 5 and angle 4, between length 1 and angle 3, between area and angle 3, and also between length 1 and length 2. ($p<.05$). (Table 3).

In the Class II population, a statistically significant positive correlation was observed between angle 4 and angle 3, between angle 5 with angle 2 and angle 4, between length 1 and angle 2, between length 1 angle 5, between area and angle 4, between area and angle 5 and also between area with length 1 and length 2. ($p<.05$). (Table 4).

In the Class III population, statistically significant positive correlation was observed between angle 3 and angle 1, between angle 4 with angle 1 and angle 2, between angle 5 and angle 1,2 and 4, between length 1 and angle 3, between length 2 angle 2,4 and 5, between area and angle 1,2,3,4 and 5 and also between area with length 1 and length 2. ($p<.05$). (Table 5). There is statistically significant difference between males and females for some of the study variables; these are listed in Table 6-8.

Figures relating to cephalograms are presented in Fig 1-5, and figures relating to the correlations are presented in Fig 6-26.

Discussion

Aesthetic enhancement is the main objective of many of the patients; dental correction is sought by them as an aid for aesthetic enhancement. The values for the ideal for the polygon helps in analysing where the 'discrepancy' is and how much it is, when it comes to orthodontic/surgical treatment for a patient for aesthetic enhancement. The cases of Class II and Class III can be analysed with respect to the observed of their respective groups, and also the deviation/variation from the ideal can be measured. The tool can be applied in pure orthodontics also, for benefitting tooth positioning, through diagnosis and treatment planning. Many pioneers in orthodontics developed cephalometric analyses to help in the tooth positioning, many concentrated on the hard tissues (teeth and the bone of the skeletal bases), and some on the soft tissues, like the H line, E line, J line, S line etc, to relate to the lower facial third aesthetic enhancement. We are at present relying on the values from many of them in day to day practice. The Flashlight[2] tetragon is discussed by McLaughlin, Bennett and Trevisi[3]. But definitely, we have to correlate the hard and soft tissue parameters, to know the 'over all' correlation, hence the involvement of the concept 'area' among the parameters in this present study. Soft tissue variable naso labial angle and hard tissue variables relating to the teeth and bone are incorporated in the polygon and correlated to the area measurement. The naso labial angle is directly visualised by the patient and the perceivers, but the tooth to bone relations observed and enhanced by the orthodontist in known to the orthodontist only, but again, the effect of the orthodontically achieved enhancement is perceived, again through both by the hard and soft components. The single area measurement is an achievement in itself and the shape of the polygon in itself can say the facial form to some extent, based on the malocclusion that can be understood by the orthodontist from the polygon. Shape of the polygon relating to Angles 4 and 5 regions in itself is unique from the orthodontic diagnosis of the malocclusion.

Conclusions

A polygon which involves a limited number of cephalometric parameters was successfully identified and the values of for the ideal, class II and Class III malocclusions groups are defined. This can be implemented in diagnosis and treatment planning according to the different treatment options suitable for the malocclusion according to age.

- Norms for the ideal polygon:

1. In the ideal population, the mean value for angle 1 in males was 69.6±4.7; in females, it was 76.0±3.2. ($p<0.05$). (Table 6).
2. The mean of angle 2, angle 3, angle 4 and angle 5 in the ideal were 72.78±5.11, 88.72±6.34, 20.27±3.42, 74.31±14.03 and 72.79±13.46 respectively. ($p>05$). (Table 2).
3. In the ideal population, the mean value for length 1 in males was 323.8±50.7; in females, it was 284.0±28.2. ($p<0.05$) (Table 6).
4. In the 'ideal' population, the mean value for length 2 was ±63.17. ($p>05$). (Table 2).
5. The mean area of the polygon in the ideal group was 106362.25±22670.58.

- The Class II group and The Class III group

6. The mean of angle 1, angle 2, angle 3, angle 4 and angle 5 in class II was 85.00±6.05, 98.89±5.93, 25.14±3.89, 107.73±16.00 and 79.19±17.94 respectively; in Class III was 78.80±9.72, 83.07±7.43, 27.02±5.16, 76.90±47.98, and 74.92±49.75 respectively (p>05) (Table 2).
7. The mean value for length 1 in class II was 329.03 ±37.23 (p>05) (Table 2).
8. There was difference between males and females Angle 1 in the Class III group; in males it was 76.1±8.6; in females, it was 81.8±10.2. (p<.05) (Table 8).
9. There was difference between males and females in Length 1 in the Class III group; and in Length 2 in the Class II and Class III groups. In the Class III population, the mean value for length 1 in males was 365.0±47.9; in females, it was 332.0±40.1. and the mean value for length 2 in males was 886.8±82.3; in females, it was 804.6±94.2. In the Class II population, Length 2 was 974.2±98.7 in males; 897.6±60.0 in females. (p<0.05) (Table 7,8).
10. The area of the polygon in the Class II and Class III groups were 171951.54±30938.00 and 156383.92±43201.74 respectively.

- Correlations(Table 3-5):

11. In the Class III group, a positive correlation there is observed between length 1 and length 2.
12. There is a positive correlation (p<0.05) observed between the angle 4 and angle 5 in the ideal, Class II and III groups. In the Class III population, when angle 4 increases by one unit, angle 5 increases by 0.960 units
13. There was positive correlation in the ideal and in the Class II groups between angle 3 and angle 4 measurements. In the Class III group, positive correlation was observed in angle 1 with angles 3, 4, and 5and in angle 2 with angles 4, and 5. (p<0.05)
14. A statistically significant positive correlation is observed between area and angular measurement 4 and 5 in the Class II and Class III population.
15. There is a statistically highly significant positive correlation between area and linear measures in the ideal, Class II and III groups.

Acknowledgements

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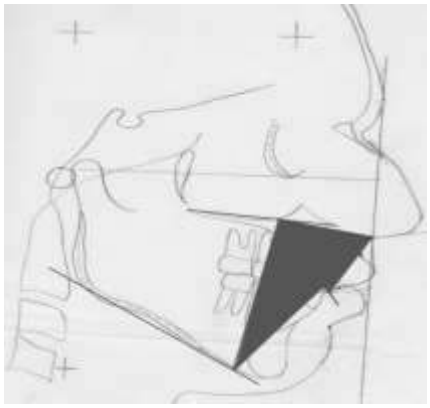


Fig 1a: A sample tracing from the 'ideal population'

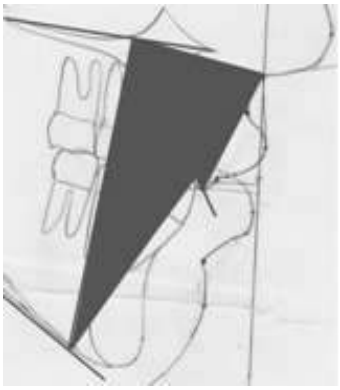


Fig 1b: A sample tracing from the 'ideal population'- relevant portion enlarged

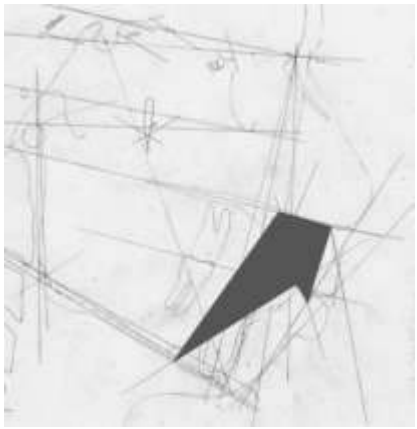


Fig 2a: A sample tracing from the 'Class II population'

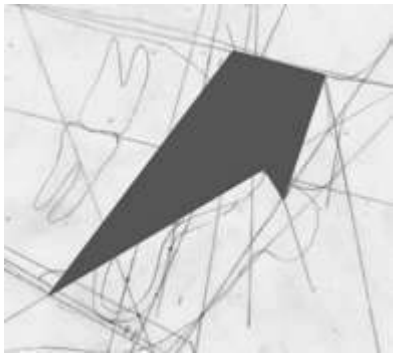


Fig 2b: A sample tracing from the 'Class II population' – relevant portion enlarged

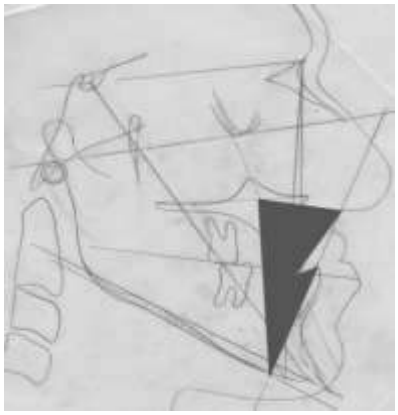


Fig 3a: A sample tracing from the 'Class III population'

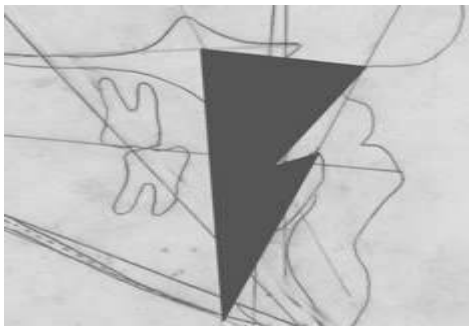


Fig3b: A sample tracing from the 'Class III population' – relevant portion enlarged

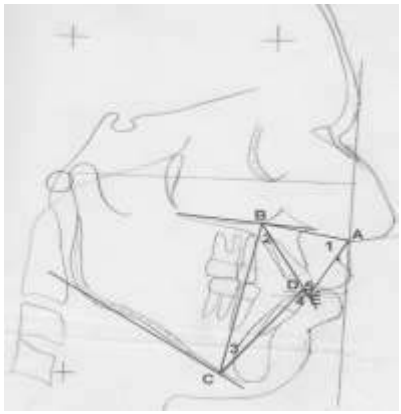


Fig 4: A cephalometric tracing to show the construction of polygon ABCDE under consideration

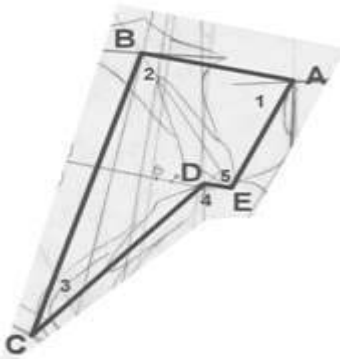


Fig 5: A section of a cephalogram tracing from the Class II population to show the polygon (labelled as ABCDE), to describe the study variables

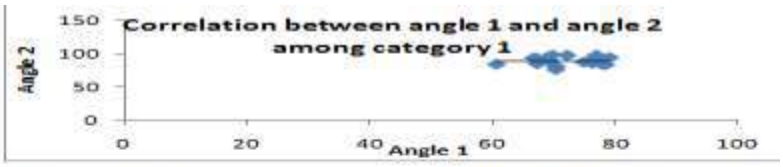


Fig 6: Correlation between angle 1 and angle 2 among category 1

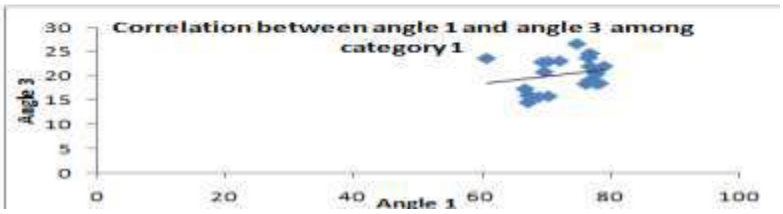


Fig 7: Correlation between angle 1 and angle 3 among category 1

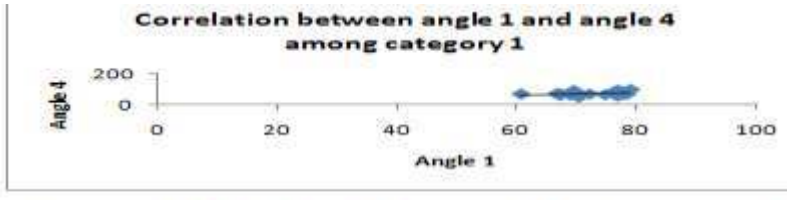


Fig 8: Correlation between angle 1 and angle 4 among category 1

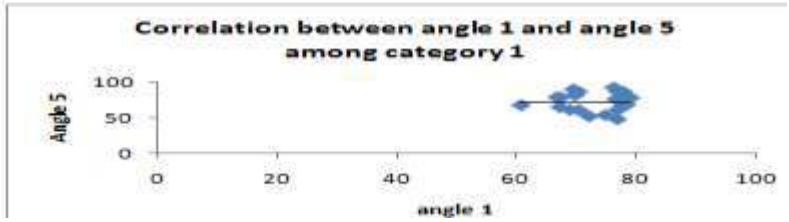
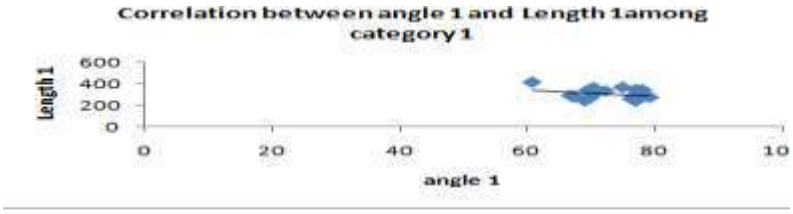


Fig 9: Correlation between angle 1 and angle 5 among category 1



ig 10: Correlation between angle 1 and length 1 among category 1

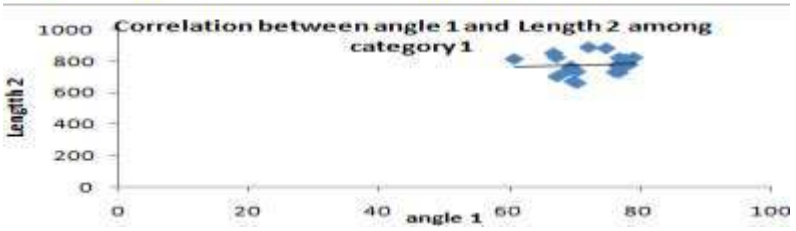


Fig 11: Correlation between angle 1 and length 2 among category 1

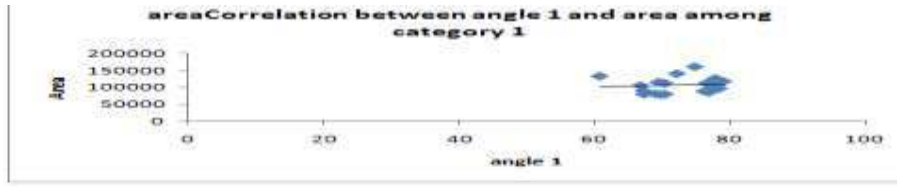


Fig 12: Correlation between angle 1 and area among category 1

Fig 13: Correlation between angle 1 and angle 2 among category 2

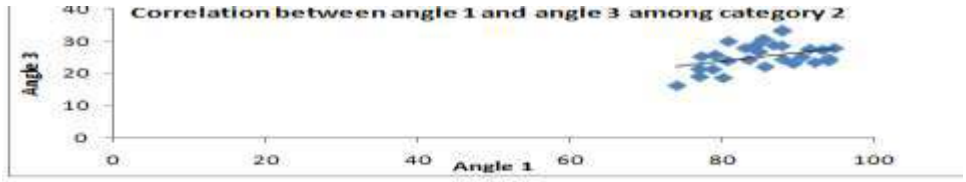


Fig 14: Correlation between angle 1 and angle 3 among category 2

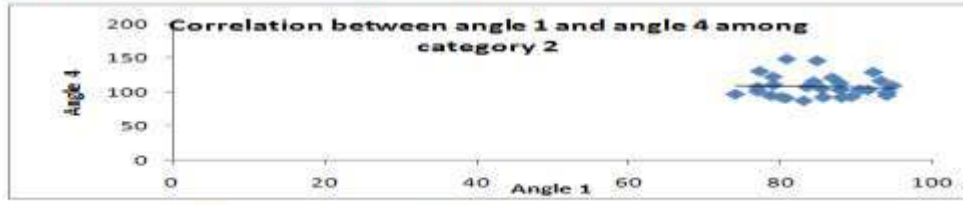


Fig 15: Correlation between angle 1 and angle 4 among category 2

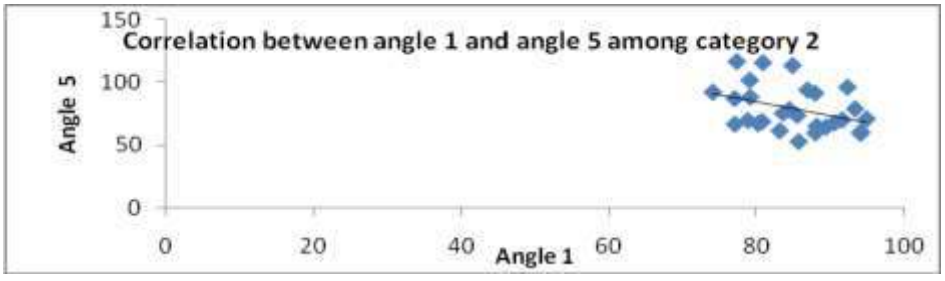


Fig 16: Correlation between angle 1 and angle 5 among category 2

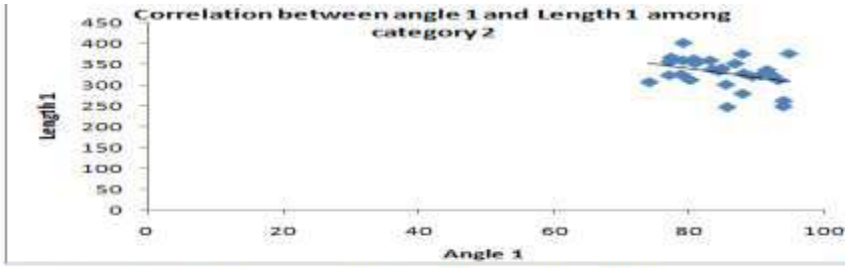


Fig 17: Correlation between angle 1 and length 1 among category 2

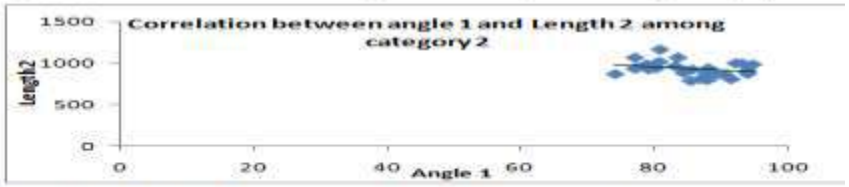


Fig 18: Correlation between angle 1 and length 2 among category 2

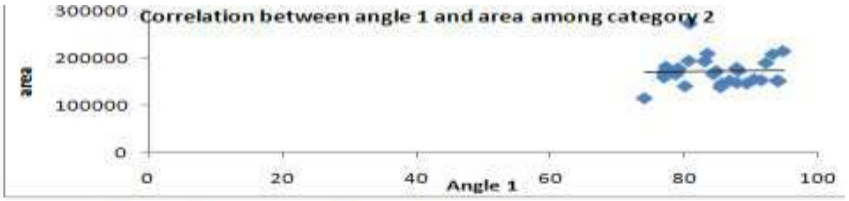


Fig 19: Correlation between angle 1 and area among category 2

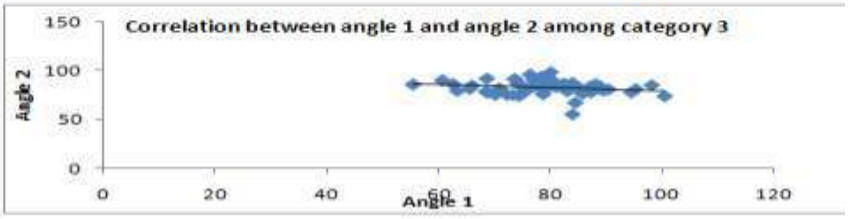


Fig 20: Correlation between angle 1 and angle 2 among category 3

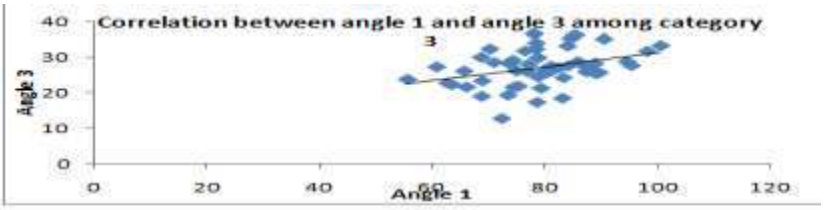


Fig 21: Correlation between angle 1 and angle 3 among category 3

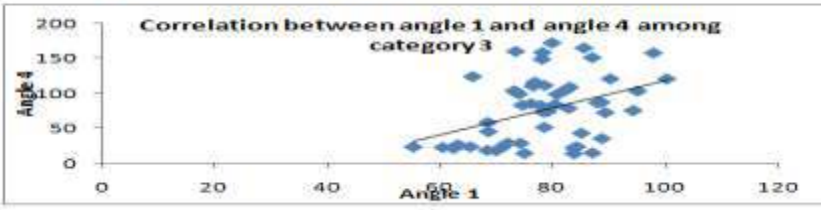


Fig 22: Correlation between angle 1 and angle 4 among category 3

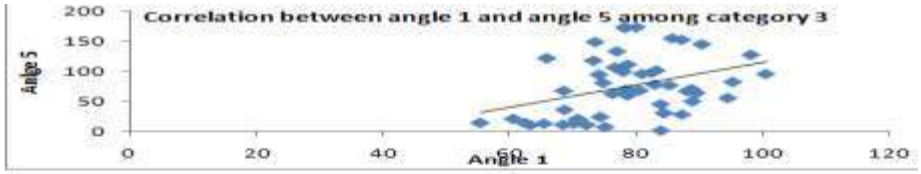


Fig 23: Correlation between angle 1 and angle 5 among category 3

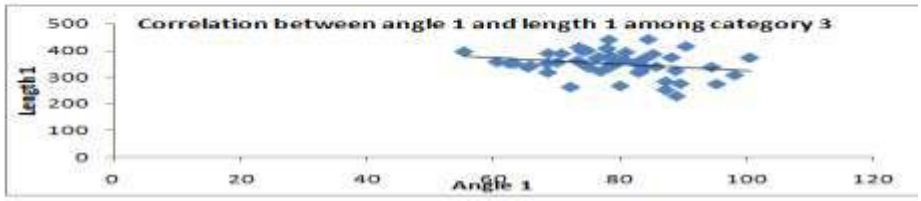


Fig 24: Correlation between angle 1 and length 1 among category 3

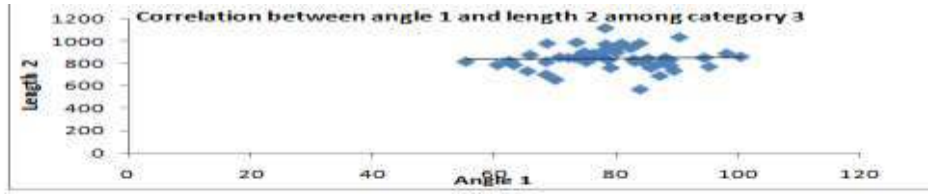


Fig 25: Correlation between angle 1 and length 2 among category 3

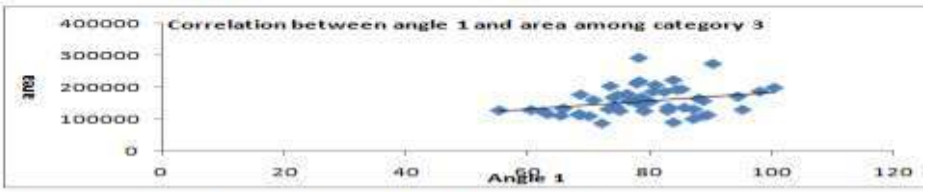


Fig 26: Correlation between angle 1 and area among category 3

Table 1: Gender wise distribution in the different study groups

Gender	category						Total	
	Ideal		Class II		Class III			
	N	%	N	%	N	%	N	%
Male	10	50	12	42.9	26	52	48	49
Female	10	50	16	57.1	24	48	50	51
Total	20	100	28	100	50	100	98	100

Table 2: Mean±SD of the angular, linear and area measurements for the different study groups

Table 2	category	N	Mean	sd	Minimum	Maximum
angle 1	Ideal	20	72.78	5.11	60.75	79.12
	Class II	28	85.00	6.05	73.98	94.79
	Class III	50	78.80	9.72	55.42	100.48
angle 2	Ideal	20	88.72	6.34	75.62	97.90
	Class II	28	98.89	5.93	85.58	114.60
	Class III	50	83.07	7.43	55.53	99.23
angle 3	Ideal	20	20.27	3.42	14.54	26.57
	Class II	28	25.14	3.89	16.02	33.21
	Class III	50	27.02	5.16	12.70	36.79

Table 2	category	N	Mean	sd	Minimum	Maximum
angle 4	Ideal	20	74.31	14.03	48.12	99.46
	Class II	28	107.73	16.00	86.98	148.18
	Class III	50	76.90	47.98	13.31	171.29
angle 5	Ideal	20	72.79	13.46	48.55	93.40
	Class II	28	79.19	17.94	53.24	116.80
	Class III	50	74.92	49.75	1.66	173.62
length 1	Ideal	20	303.90	44.84	240.07	410.46
	Class II	28	329.03	37.23	247.39	400.52
	Class III	50	349.16	46.95	227.56	441.66
length 2	Ideal	20	776.09	63.17	659.37	885.94
	Class II	28	930.39	86.35	789.35	1161.57
	Class III	50	847.35	96.63	569.21	1113.29
area	Ideal	20	106362.25	22670.58	78426.00	161118.00
	Class II	28	171951.54	30938.00	115119.00	274392.00
	Class III	50	156383.92	43201.74	87606.00	291248.00

Table 3: Correlation between the angular, linear and area measurements in the 'ideal' study group

category			angle 1	angle 2	angle 3	angle 4	angle 5	length 1	length 2
Ideal	angle 2	r	.040						
		p	.869						
		N	20						
	angle 3	r	.221	.109					
		p	.349	.647					
		N	20	20					
	angle 4	r	.338	.276	.466*				
		p	.145	.240	.038				
		N	20	20	20				
	angle 5	r	.005	-.266	.006	.687**			
		p	.985	.257	.978	.001			
		N	20	20	20	20			
	length 1	r	-.300	-.433	.591**	.103	.130		
		p	.199	.056	.006	.666	.585		
		N	20	20	20	20	20		
	length 2	r	.094	.271	.420	.177	-.192	.414	
		p	.693	.247	.065	.454	.417	.070	
		N	20	20	20	20	20	20	
	area	r	.104	.021	.805**	.242	-.132	.725**	.796**
		p	.663	.931	.000	.303	.579	.000	.000
		N	20	20	20	20	20	20	20

Table 4: Correlation between the angular, linear and area measurements in the 'Class II' study group

category			angle 1	angle 2	angle 3	angle 4	angle 5	length 1	length 2
Class II	angle 2	r	-.221						
		p	.257						
		N	28						
	angle 3	r	.424*	-.373					
		p	.025	.051					
		N	28	28					
	angle 4	r	-.047	-.249	.393*				
		p	.811	.202	.039				
		N	28	28	28				
	angle 5	r	-.371	-.407*	.138	.880**			
		p	.052	.032	.482	.000			
		N	28	28	28	28			
	length 1	r	-.350	-.462*	.183	.366	.547**		
		p	.068	.013	.350	.056	.003		
		N	28	28	28	28	28		
	length 2	r	-.277	.353	-.240	.256	.230	.273	
		p	.154	.065	.219	.189	.240	.160	
		N	28	28	28	28	28	28	
	area	r	.049	-.044	.356	.515**	.376*	.480**	.791**
		p	.805	.822	.063	.005	.049	.010	.000
		N	28	28	28	28	28	28	28

Table 5: Correlation between the angular, linear and area measurements in the 'Class III' study groups

category			angle 1	angle 2	angle 3	angle 4	angle 5	length 1	length 2
Class III	angle 2	r	-.188						
		p	.191						
		N	50						
	angle 3	r	.369**	.093					
		p	.008	.519					
		N	50	50					
	angle 4	r	.395**	.452**	.196				
		p	.005	.001	.173				
		N	50	50	50				
	angle 5	r	.363**	.477**	.268	.960**			
		p	.010	.000	.060	.000			
		N	50	50	50	50			
	length 1	r	-.254	.045	.443**	.003	.062		
		p	.075	.759	.001	.982	.667		
		N	50	50	50	50	50		
	length 2	r	.052	.539**	.171	.423**	.488**	.491**	
		p	.721	.000	.236	.002	.000	.000	
		N	50	50	50	50	50	50	
	area	r	.288*	.351*	.636**	.421**	.508**	.671**	.839**
		p	.043	.012	.000	.002	.000	.000	.000
		N	50	50	50	50	50	50	50

Table 6: The mean ±SD of the angular, linear and area measurements for males and females in the 'ideal' study group

category		sex	N	Mean	Std. Deviation	t	p
Ideal	angle 1	Male	10	69.6	4.7	-3.521	.002
		Female	10	76.0	3.2		
	angle 2	Male	10	88.1	6.7	-.444	.662
		Female	10	89.4	6.3		
	angle 3	Male	10	20.3	4.1	-.003	.998
		Female	10	20.3	2.8		
	angle 4	Male	10	71.5	10.3	-.899	.380
		Female	10	77.1	17.1		
	angle 5	Male	10	72.8	14.1	-.011	.991
		Female	10	72.8	13.6		
	length 1	Male	10	323.8	50.7	2.165	.044
		Female	10	284.0	28.2		
	length 2	Male	10	799.8	63.9	1.774	.093
		Female	10	752.3	55.6		
	area	Male	10	114439.8	26744.9	1.666	.113
		Female	10	98284.7	14991.1		

Table 7: The mean ±SD of the angular, linear and area measurements for males and females in the 'Class II' study group

category		sex	N	Mean	Std. Deviation	t	p
Class II	angle 1	Male	12	82.5	4.8	-2.044	.051
		Female	16	86.9	6.3		
	angle 2	Male	12	100.7	6.9	1.414	.169
		Female	16	97.5	4.9		
	angle 3	Male	12	23.9	3.8	-1.521	.140
		Female	16	26.1	3.8		
	angle 4	Male	12	108.7	19.1	.269	.790
		Female	16	107.0	13.8		
	angle 5	Male	12	81.0	21.2	.468	.644
		Female	16	77.8	15.7		
	length 1	Male	12	327.4	32.7	-.202	.841
		Female	16	330.3	41.3		
	length 2	Male	12	974.2	98.7	2.549	.017
		Female	16	897.6	60.0		
	area	Male	12	177892.9	38023.6	.876	.389
		Female	16	167495.5	24763.2		

Table 8: The mean ±SD of the angular, linear and area measurements for males and females in the 'Class III' study group

category		sex	N	Mean	Std. Deviation	t	p
Class III	angle 1	Male	26	76.1	8.6	-2.149	.037
		Female	24	81.8	10.2		
	angle 2	Male	26	83.5	6.2	.379	.707
		Female	24	82.7	8.7		
	angle 3	Male	26	26.4	6.2	-.911	.367
		Female	24	27.7	3.8		
	angle 4	Male	26	70.6	43.5	-.964	.340
		Female	24	83.7	52.5		
	angle 5	Male	26	73.7	47.8	-.171	.865
		Female	24	76.2	52.8		
	length 1	Male	26	365.0	47.9	2.631	.011
		Female	24	332.0	40.1		
	length 2	Male	26	886.8	82.3	3.293	.002
		Female	24	804.6	94.2		
	area	Male	26	166977.9	48663.2	1.849	.071
		Female	24	144907.1	33732.4		