

CHAPTER IV

RESULTS

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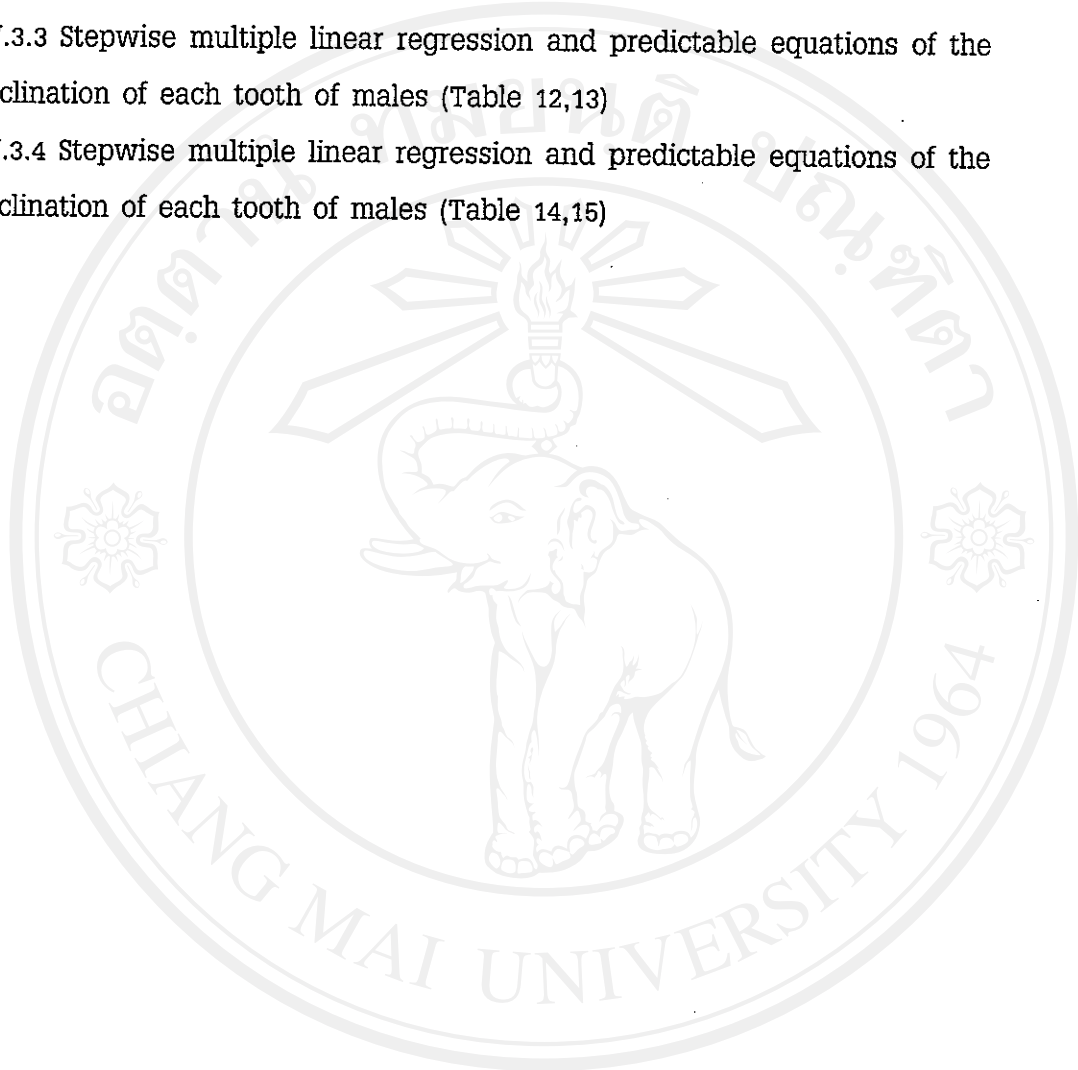
IV.3 Correlations between the crown inclination and the skeletofacial cephalometric variables

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IV.1 Skeletofacial morphology

IV.1.1 Comparisons of the skeletofacial cephalometric variables of males and females

Table 4 Comparisons of the skeletofacial cephalometric variables (degree) of males (n=30) and females (n=30)

Variables	Male		Female		t-value
	\bar{X}	SD	\bar{X}	SD	
ANB	1.03	1.59	2.37	1.84	-3.03**
SNB	81.36	2.95	80.87	2.56	0.69
SNPog	82.06	2.99	81.30	2.57	1.06
N angle	65.22	5.42	65.63	5.67	-0.29
SN-MP	27.58	3.91	29.61	4.30	-1.91
SN-OP	15.83	3.64	17.13	3.61	-1.39
NSGn	67.39	2.60	67.78	2.83	-0.56

** p < 0.01

T-test group statistical analysis was performed to compare the male and female groups. As a result showed in Table 4, there was slightly angular difference between sexes. The only statistically significant difference (p < 0.01) occurred in the basal sagittal relationship (ANB). The ANB angle was smaller in males than in females.

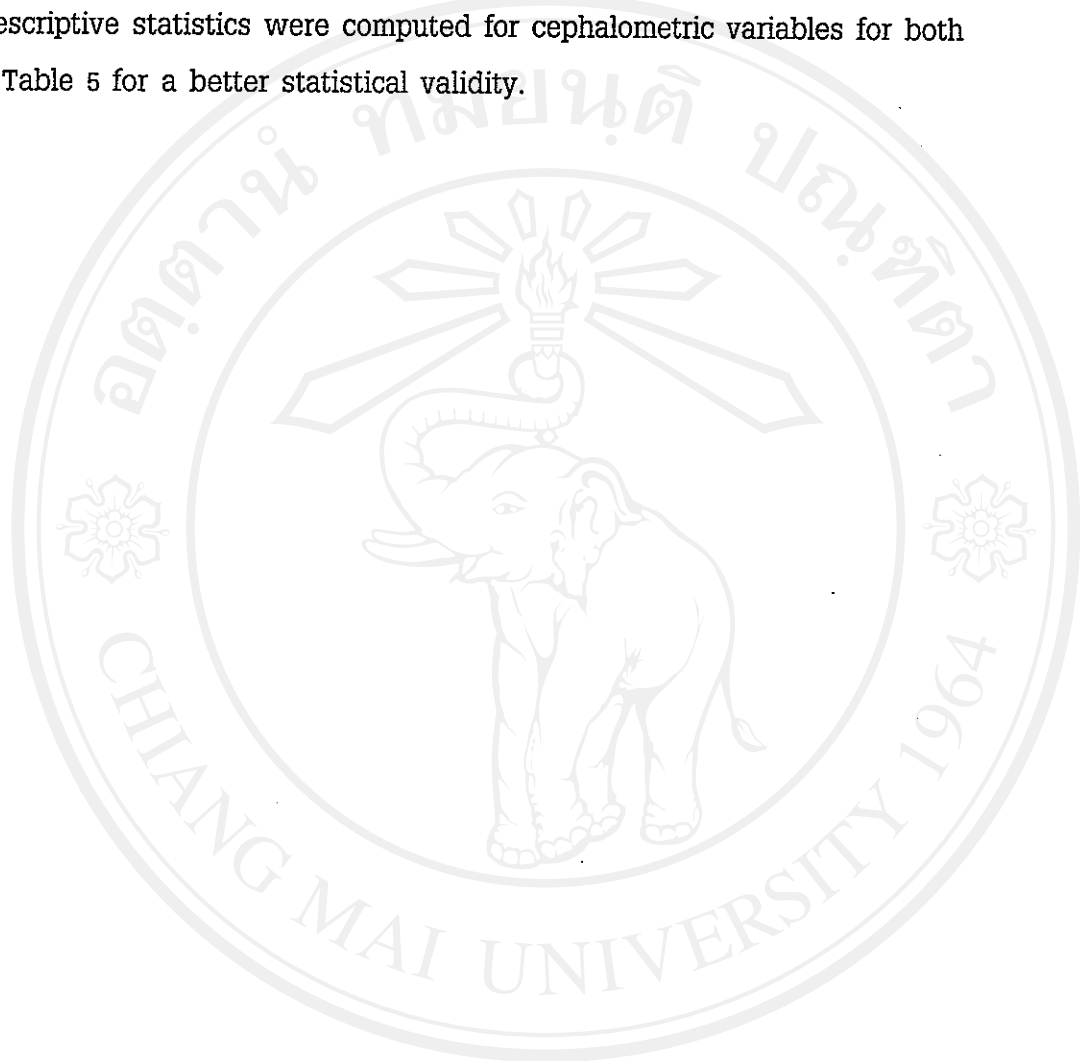
The SNB angle (a measure of anteroposterior development of the mandible) tended to be greater, even though not significantly, in males than females.

The mean chin prominence (SNPog and N angle) of males was not significantly different in both sexes.

Neither the inclination of the mandibular plane (SN-MP) nor the inclination of the occlusal plane (SN-OP) had significantly higher values in females than males.

The Y-growth axis (NSGn) showed a slightly greater in females than in males, but the difference was not statistically significant.

Descriptive statistics were computed for cephalometric variables for both sexes in Table 5 for a better statistical validity.



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IV.1.2 Mean, standard deviation, minimum, maximum and estimate values of mean of the skeletofacial cephalometric variables when both sexes combined.

Table 5 Mean, standard deviation, minimum, maximum and estimate values of mean of the skeletofacial cephalometric variables (degree) when both sexes combined (n=60).

Variables	Min.	Max.	\bar{X}	SD	μ
ANB	-2.75	8.00	1.70	1.83	1.22 - 2.16
SNB	74.00	88.00	81.11	2.75	80.40 - 81.82
SNPog	74.00	89.00	81.68	2.79	80.96 - 82.40
N angle	50.00	77.00	65.43	5.50	64.00 - 66.85
SN-MP	20.25	41.00	28.60	4.20	27.51 - 29.68
SN-OP	9.00	27.75	16.48	3.65	15.54 - 17.43
NSGN	62.00	77.75	67.59	2.70	66.89 - 68.29

Table 5 displayed the mean, standard deviation, minimum, maximum and estimate values of mean of each variable from the study group of 60 subjects with normal occlusion. The estimate values of means were calculated at 95% confidence level. The mean value of ANB angle was 1.70 degrees, exhibiting straight hard tissue profile. The individual values, however, varied from -2.75 to 8 degrees. The mean prognathism of chin (SNPog = 81.68 degrees, N angle = 65.43 degrees) revealed a well developed bony chin. The inclination of mandibular plane (SN-MP) with the mean of 28.60 degrees, ranged from 20.25 to 47.00 degrees, covering 27.75 degrees. In addition, the inclination of occlusal plane (SN-OP) and the Y-axis growth (NSGn) showed a wide range of variations (SN-OP = 18.75 degrees, NSGn = 15.75 degrees).

IV.2 Crown inclination

IV.2.1 Comparisons of the crown inclination of each tooth of males and females

IV.2.1.1 Comparisons of the crown inclination of upper teeth of males and females

Table 6 Comparisons of the crown inclination (degree) of upper teeth of males (n=30) and females (n=30)

Teeth	Male		Female		t-value
	\bar{X}	SD	\bar{X}	SD	
Right					
IU1	8.02	4.62	7.72	5.43	0.23
IU2	6.40	4.31	6.66	4.23	-0.23
IU3	-5.29	5.12	-6.70	5.62	1.02
IU4	-8.35	4.07	-8.58	5.86	0.18
IU5	-7.84	3.77	-8.44	4.66	0.55
IU6	-10.56	4.11	-10.85	4.30	0.27
IU7	-10.36	6.44	-10.01	4.72	-0.24
Left					
IU1	8.00	4.83	7.85	5.54	0.11
IU2	6.61	4.32	6.56	4.24	0.05
IU3	-4.96	5.50	-5.99	6.76	0.65
IU4	-7.91	3.96	-8.20	6.92	0.20
IU5	-9.36	3.71	-9.19	5.50	-0.14
IU6	-10.34	4.45	-10.81	4.16	0.42
IU7	-10.30	6.30	-10.26	5.37	-0.03

IV.2.1.2 Comparisons of the crown inclination of lower teeth of males and females

Table 7 Comparisons of the crown inclination (degree) of lower teeth of males (n=30) and females (n=30)

Teeth	Male		Female		t-value
	\bar{X}	SD	\bar{X}	SD	
Left					
IL1	4.48	5.56	5.55	5.35	-0.76
IL2	3.06	3.96	3.69	4.03	-0.61
IL3	-3.31	4.56	-4.12	5.23	0.64
IL4	-13.44	4.14	-13.38	5.44	-0.05
IL5	-19.19	4.60	-17.53	5.16	-1.31
IL6	-23.60	3.66	-24.40	5.66	0.65
IL7	-29.98	5.56	-33.02	6.74	1.91
Right					
IL1	4.44	5.60	5.48	5.07	-0.75
IL2	2.89	3.76	3.53	3.91	-0.65
IL3	-3.81	4.26	-4.48	4.92	0.57
IL4	-13.26	4.18	-13.46	5.42	0.16
IL5	-19.08	4.58	-17.26	4.99	-1.47
IL6	-23.51	3.63	-24.12	5.80	0.49
IL7	-32.11	5.33	-35.64	7.67	2.07*

* $p < 0.05$

From Table 6 and 7, t-test group statistical analysis was used for determining significant differences of the crown inclination of each tooth occurring between male and female groups. All teeth showed no significant differences between the mean of two groups except the lower right second molar ($p < 0.05$). The inclination values of central and lateral incisors (both arches) were positive while those of the canines through second molars were negative in both sexes. The inclination values of the upper posterior teeth

were steadily negative and those of the lower posterior teeth were progressively increased.



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IV.2.2 Comparisons of the crown inclination of the right and the left sides when both sexes combined.

Table 8 Comparisons of the crown inclination (degree) of the right and the left sides when both sexes combined (n=60).

Teeth	Right		Left		t-value
	\bar{X}	SD	\bar{X}	SD	
IU1	7.87	5.00	7.93	5.15	-0.73
IU2	6.53	4.24	6.59	4.24	-0.74
IU3	-6.00	5.38	-5.47	6.13	-0.95
IU4	-8.47	5.00	-8.06	5.59	-1.08
IU5	-8.14	4.21	-9.28	4.65	4.13***
IU6	-10.71	4.18	-10.57	4.28	-0.77
IU7	-10.18	5.60	-10.28	5.80	0.26
IL1	4.96	5.32	5.01	5.44	0.46
IL2	3.21	3.82	3.37	3.97	2.07*
IL3	-4.15	4.58	-3.71	4.88	1.79
IL4	-13.36	4.80	-13.41	4.80	-0.62
IL5	-18.17	4.84	-18.36	4.92	-1.24
IL6	-23.81	4.81	-24.00	4.74	-1.30
IL7	-33.87	6.78	-31.50	6.31	2.12*

* $p < 0.05$, *** $p < 0.001$

The crown inclination differences between sides were tested with paired t-test as presented in Table 8. The crown inclinations of the upper second premolar ($p < 0.001$), the lower lateral incisor ($p < 0.05$) and the lower second molar ($p < 0.05$) that were significantly different, but the others were not significantly different. Therefore, the two groups were combined, in Table 9, for a better statistical validity.

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IV.2.3 Mean, standard deviation, minimum, maximum and estimate values of mean of the crown inclination of each tooth when both sexes and sides combined.

Table 9 Mean, standard deviation, minimum, maximum and estimate values of mean of the crown inclination (degree) of each tooth when both sexes and sides combined (n=60).

Teeth	Min.	Max.	\bar{X}	SD	μ
IU1	-3.92	19.50	7.90	5.07	6.59 - 9.21
IU2	-4.50	14.84	6.56	4.23	5.47 - 7.65
IU3	-18.59	6.09	-5.74	5.36	(-7.12) - (-4.35)
IU4	-20.17	5.00	-8.26	5.09	(-9.58) - (-6.95)
IU5	-19.84	0.84	-8.71	4.31	(-9.82) - (-7.60)
IU6	-19.83	-2.25	-10.64	4.17	(-11.72) - (-9.56)
IU7	-22.59	3.92	-10.23	5.51	(-11.66) - (-8.81)
IL1	-11.50	15.00	4.99	5.36	3.60 - 6.37
IL2	-8.09	9.66	3.29	3.89	2.29 - 4.30
IL3	-13.75	7.00	-3.93	4.64	(-5.13) - (-2.73)
IL4	-24.17	3.25	-13.38	4.79	(-14.62) - (-12.15)
IL5	-32.00	-5.50	-18.27	4.84	(-19.51) - (-17.02)
IL6	-38.67	-10.84	-23.91	4.74	(-25.13) - (-22.68)
IL7	-49.17	-22.92	-32.69	4.90	(-33.95) - (-31.42)

The descriptive statistics, including the minimum, maximum, mean, standard deviation and estimate values of mean of the crown inclination of each tooth combined sexes and sides were summarized in Table 9. The estimate values of mean were calculated at 95% confidence level .

In both arches the mean values of the crown inclination of central and lateral incisors were positive. In addition, the central incisors showed a greater value than that of the lateral incisors. There was an almost constant upper negative torque of the upper posterior segment. Mean values of the crown inclination from first premolar to second molar were -8.26 to -10.23 degrees.

The lower buccal segment had a negative torque with a progressive increased towards the posterior teeth from canine to second molar were -3.93 to -32.65 degrees.



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IV.3 Correlations between the crown inclination and the skeletofacial cephalometric variables

IV.3.1 Correlations between the crown inclination and the skeletofacial cephalometric variables of males

Table 10 Correlations between the crown inclination and the skeletofacial cephalometric variables of males

Variables	ANB	SNB	SNPog	N angle	SN-MP	SN-OP	NSGn
IU1	-0.194	0.043	0.001	0.268	-0.104	0.071	-0.161
IU2	-0.236	0.171	0.104	0.301	-0.126	-0.027	-0.273
IU3	-0.220	-0.142	-0.124	0.034	0.008	0.051	-0.065
IU4	-0.302	0.035	-0.047	0.299	-0.021	0.022	-0.078
IU5	-0.118	-0.017	-0.077	0.148	0.170	0.077	0.090
IU6	-0.155	-0.101	-0.118	0.153	0.103	0.031	0.132
IU7	-0.294	-0.148	-0.195	0.295	0.170	0.055	0.160
IL1	0.903**	0.001	0.077	-0.469**	0.179	0.207	-0.078
IL2	0.864**	-0.005	0.065	-0.445*	0.199	0.188	-0.091
IL3	-0.346	-0.172	-0.182	-0.078	0.348	0.248	0.220
IL4	-0.359	-0.126	-0.140	-0.023	0.120	0.029	0.076
IL5	-0.354	-0.254	-0.275	-0.004	0.300	0.205	0.326
IL6	-0.246	0.031	0.019	-0.058	0.159	0.082	0.073
IL7	-0.224	-0.359	-0.354	0.154	0.216	0.178	0.286

* $p < 0.05$, ** $p < 0.01$

The Pearson correlation coefficient was used to quantify the linear correlation between the crown inclination of each tooth of males and the cephalometric variables. The ANB correlated with the inclination of the lower central and lateral incisors significantly ($p < 0.01$). Moreover, the N angle correlated with the inclination of the lower central and lateral incisor significantly ($p < 0.01, 0.05$ respectively).

IV.3.2 Correlations between the crown inclination and the skeletofacial cephalometric variables of females

Table 11 Correlations between the crown inclination and the skeletofacial cephalometric variables of females

Variables	ANB	SNB	SNPog	N angle	SN-MP	SN-OP	NSGn
IU1	-0.197	0.056	-0.019	0.029	0.162	0.139	0.221
IU2	-0.238	0.121	0.084	-0.049	0.035	0.036	0.142
IU3	-0.068	0.040	0.029	-0.248	0.254	0.080	0.167
IU4	-0.139	-0.137	-0.097	-0.330	0.144	0.035	0.227
IU5	-0.262	-0.253	-0.209	-0.345	0.276	0.302	0.267
IU6	-0.274	0.040	0.124	-0.252	-0.115	0.115	0.072
IU7	-0.054	-0.039	-0.059	-0.038	0.004	-0.046	0.027
IL1	0.717**	0.010	-0.094	-0.111	0.246	0.091	0.184
IL2	0.757**	-0.019	-0.141	-0.060	0.291	0.105	0.203
IL3	-0.053	-0.152	-0.169	0.075	0.207	-0.199	0.136
IL4	-0.188	-0.041	0.018	-0.108	-0.172	-0.227	-0.106
IL5	-0.220	-0.229	-0.150	-0.059	-0.122	-0.105	0.003
IL6	-0.115	0.026	0.046	-0.076	-0.085	-0.141	-0.079
IL7	0.045	0.094	0.264	0.026	-0.003	-0.164	-0.103

** $p < 0.01$

The Pearson correlation coefficient was used to quantify the linear correlation between the crown inclination of each tooth of females and the cephalometric variables. There was only the ANB angle that significantly correlated with the inclination of the lower central and lateral incisors ($p < 0.01$).

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IV.3.3 Stepwise multiple linear regression and predictable equations of the crown inclination of each tooth of males

The general form of the multiple regression model was as follows

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_kX_k$$

when Y = dependent variable which was the crown inclination value (degree)

X_1 to X_k = independent variables (skeletofacial variables)

a = constant

b_1 to b_k = regression coefficients

The independent variables (ANB, SNB, SNPog, N angle, SN-MP, SN-OP and NSGn), which might have influences on the crown inclination. The multiple linear regression (stepwise method) was used for calculating for predictable equations of the crown inclination. Table 12 to 15 illustrated the effective predictors of the crown inclination of central and lateral incisors of males and females.

Table 12 Stepwise multiple linear regression of the crown inclination of lower central incisor (IL 1) of males

Variables	b	SE _b	Beta	t-value
ANB	3.168	0.286	0.903	11.093***
Constant	1.213	0.533	-	2.277

*** p < 0.001

R = 0.903

R² = 0.815

F = 123.053***

where b = Regression coefficient

SE_b = Standard error of regression coefficient

Beta = Standardized regression coefficient

R = Multiple correlation coefficient

R² = Coefficient of determination

From Table 12, the ANB angle was the most effective predictor for the crown inclination of lower central incisor (IL1) of males. The predictable equation of the crown inclination of lower central incisor in form of raw score was :

$$IL\ 1\ (\text{raw score}) = 3.168\ (\text{ANB}) + 1.213$$

When the dependent variable (IL1) and the independent variable (ANB) was converted to standard score. Then the predictable equation of the crown inclination of lower central incisor in form of standard score was :

$$IL\ 1\ (\text{standard score}) = 0.903\ (\text{ANB})$$

with the multiple correlation coefficient (R) = 0.903

and the coefficient of determination (R²) = 0.815

The R value of 0.903 indicated a high association between the ANB angle and the crown inclination of lower central incisor.

The coefficient of determination indicated that this equation explained approximately 81.5 percent of the variability in the crown inclination of lower central incisor.

Table 13 Stepwise multiple linear regression of the crown inclination of lower lateral incisor (IL 2) of males

Variables	b	SE _b	Beta	t-value
ANB	2.098	0.231	0.864	9.097***
Constant	0.821	0.430	-	1.908

*** $p < 0.001$

R = 0.864

R² = 0.747

F = 82.752***

From Table 13, the ANB angle was the most effective predictor for the crown inclination of lower lateral incisor (IL2) of males. The predictable equation of the crown inclination of lower lateral incisor in form of raw score was :

$$\text{IL 2 (raw score)} = 2.098 (\text{ANB})$$

When the dependent variable (IL2) and the independent variables (ANB) were converted to standard score. Then the predictable equation of the crown inclination of lower lateral incisor in form of standard score was :

$$\text{IL 2 (standard score)} = 0.864 (\text{ANB})$$

with the multiple correlation coefficient (R) = 0.864

and the coefficient of determination (R²) = 0.747

The R value of 0.864 indicated a high association between the ANB angle and the crown inclination of lower lateral incisor.

The coefficient of determination indicated that this equation explained approximately 74.7 percent of the variability in the crown inclination of lower lateral incisor.

IV.3.4 Stepwise multiple linear regression and predictable equations of the crown inclination of each tooth of females

Table 14 Stepwise multiple linear regression of the crown inclination of lower central incisor (IL 1) of females

Variables	b	SE _b	Beta	t-value
ANB	2.030	0.372	0.717	5.450***
Constant	0.708	1.109	-	0.638

*** p < 0.001

R = 0.717

R² = 0.515

F = 29.697***

From Table 14, the ANB angle was the most effective predictor for the crown inclination of lower central incisor (IL1) of females. The predictable equation of the crown inclination of lower central incisor in form of raw score was :

$$\text{IL 1 (raw score)} = 2.030 (\text{ANB})$$

When the dependent variable (IL1) and the independent variable (ANB) was converted to standard score. Then the predictable equation of the crown inclination of lower central incisor in form of standard score was :

$$\text{IL 1 (standard score)} = 0.717 (\text{ANB})$$

with the multiple correlation coefficient (R) = 0.717

and the coefficient of determination (R²) = 0.515

The R value of 0.717 indicated a moderate association between the ANB angle and the crown inclination of lower central incisor.

The coefficient of determination indicated that this equation explained approximately 51.5 percent of the variability in the crown inclination of lower central incisor.

Table 15 Stepwise multiple linear regression of the crown inclination of lower lateral incisor (IL 2) of females

Variables	b	SE _b	Beta	t-value
ANB	1.633	0.266	0.757	6.136***
Constant	-0.255	0.792	-	-0.321

*** p < 0.001

R = 0.757

R² = 0.573

F = 37.649***

From Table 15, the ANB angle was the most effective predictor for the crown inclination of lower lateral incisor (IL2) of females. The predictable equation of the crown inclination of lower lateral incisor in form of raw score was :

$$\text{IL 2 (raw score)} = 1.633 (\text{ANB})$$

When the dependent variable (IL2) and the independent variable (ANB) was converted to standard score. Then the predictable equation of the crown inclination of lower lateral incisor in form of standard score was :

$$\text{IL 2 (standard score)} = - 0.255 (\text{ANB})$$

with the multiple correlation coefficient (R) = 0.757

and the coefficient of determination (R²) = 0.573

The R value of 0.757 indicated a moderate association between the ANB angle and the crown inclination of lower lateral incisor.

The coefficient of determination indicated that this equation explained approximately 57.3 percent of the variability in the crown inclination of lower lateral incisor.