Correlation of Malocclusion with Facial Profile in Javanese Population: A Cephalometric Analysis

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Abstract

The facial profile is directly related to facial aesthetics, which has been known to be one of the factors that can affect interpersonal relationships and self-confidence. This makes facial harmony one of the objects considered in orthodontic treatment. The stability of the occlusion function can also be reflected through the harmony of the face.

The aim of this study is to investigate the relationship between malocclusion and facial profile shape in the Javanese population.

Cephalometric analysis using cephalometric radiographs of samples met the inclusion and exclusion criteria. The variables measured in this study were SNA, SNB, ANB, FMA, FMIA, IMPA, Facial Axis, Y-Axis, Facial Angle, Angle of Convexity, Angle S–N–Ba, Angle N–Ba–S, Angle Ba–S–N, SN–Mandibular Plane, SN–Maxillary Plane, SN–Occlusal Plane, FH–Mandibular Plane, FH–Maxillary Plane, FH–Occlusal Plane, Gonial Angle, Upper Gonial Angle, Lower Gonial Angle, Maxilla Length, Mandibular Length, Wits Appraisal, Point A–Nation Perpendicular Distance, Pogonion–Nation Perpendicular Distance, U1–NA Angle, and Holdaway Soft Network Analysis. The data were analyzed using a descriptive test, then the Kolmogorov-Smirnov normality test was carried out, and the correlation test was carried out with the Pearson Correlation test ($p < 0.05$).

There was a positive correlation between Holdaway Soft Tissue Analysis and Facial Axis, Facial Angle, SNA, SNB, ANB, IMPA, Wits Appraisal, U1–NA Angle.

The shape of the facial profile of the Javanese population in malocclusion class I, II, and III has a convex facial profile.

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Introduction

Malocclusion is a functional disability or disorder that can become an obstacle to the physical and emotional health of patients who need treatment.[1] In Indonesia, dental and oral health problems are still relatively high. Based on the National Basic Health Research or *Riset Kesehatan Dasar* (RISKESDAS) results in 2018, the prevalence of dental and oral problems was 57.6%. Malocclusion is one of the most common dental and oral disorders.[2]

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Although malocclusion is not life-threatening, malocclusion can cause adverse effects on the patient's social interactions and psychological health.[3] Malocclusion is also a problem in the oral cavity that affects a person's quality of life and temporomandibular disorders (TMDs); mouth pain and stomatitis; dental caries, missing teeth, and dental fillings (DMF-T). Malocclusion is the third major oral health problem after dental caries and periodontal disease. Some of the effects of malocclusion on surrounding tissues include increasing the risk of caries, traumatic tooth injury, and temporomandibular joint problems. Genetic and environmental factors, together with local factors (such as habits that are detrimental or damaging to the oral cavity), can cause malocclusion.[4]

Malocclusion can be caused by a person's dental or skeletal misalignment. Dental

malocclusions are classified as the relation of the permanent first molars. According to Angle's classification of the malocclusion, a correct molar relation can occur when the mesiobuccal cusp of the maxillary first molar is in the buccal groove of the mandibular first molar, and the teeth are arranged in a neat line of occlusion. The skeletal classification can be determined through various variations from the cephalometric analysis.[5,6]

According to Jeelani et al. in their research in 2015, the thickness of the soft tissue of the facial profile is influenced by several things, including age, gender, and race. The facial profile is directly related to facial aesthetics, which has been known to be one of the factors that can affect interpersonal relationships and self-confidence. This makes facial harmony one of the objects considered in orthodontic treatment. The stability of the occlusion function can also be reflected through the harmony of the face.[7]

Cephalometric is one way to know/measure a person's facial profile. Positioning the teeth according to cephalometric rules does not guarantee that the soft tissue profile will directly follow the skeletal profile. The soft tissue covering the teeth and bones can vary widely.[8] Therefore, there is also a cephalometric analysis of soft tissue using various methods, including Rickett's E-line, nasolabial Angle, and Holdaway soft tissue analysis.[9] Furthermore, the aim of this study is to investigate the relationship between malocclusion and facial profile shape in the Javanese population.

Materials and methods

Population and Sample

This research is quantitative research with an analytical observational type and a cross-sectional research method. This research was conducted at Dental Hospital or *Rumah Sakit Gigi Mulut* (RSGM) Universitas Airlangga (UNAIR) Surabaya in 2018-2020. The population used in this study were men and women aged between 16-35 years at RSGM UNAIR Surabaya. Sampling was carried out with minimal sampling technique using secondary data of patients according to inclusion and exclusion.

Cephalometric analysis

The data collection technique looks at the malocclusion pattern consisting of class I, II, and III malocclusions and then enters the cephalometric photo into the tracing software. The variables measured in this study were SNA, SNB, ANB, FMA, FMIA, IMPA, Facial Axis, Y-Axis, Facial Angle, Angle of Convexity, Angle S – N – Ba, Angle N – Ba – S, Angle Ba – S – N, SN – Mandibular Plane, SN – Maxillary Plane, SN – Occlusal Plane, FH – Mandibular Plane, FH – Maxillary Plane, FH – Occlusal Plane, Gonial Angle, Upper Gonial Angle, Lower Gonial Angle, Maxilla Length, Mandibular Length, Wits Appraisal, Point A – National Perpendicular Distance, Pogonion – National Perpendicular Distance, U1 – NA Angle, and Holdaway Soft Network Analysis. The data were analyzed using a descriptive test. The Kolmogorov-Smirnov normality test was performed, and a correlation test was performed using the Pearson Correlation test ($p<0.05$) using Statistical Package for Social Science (SPSS) software version 20.0, (IBM corporation, Chicago, US).

Results

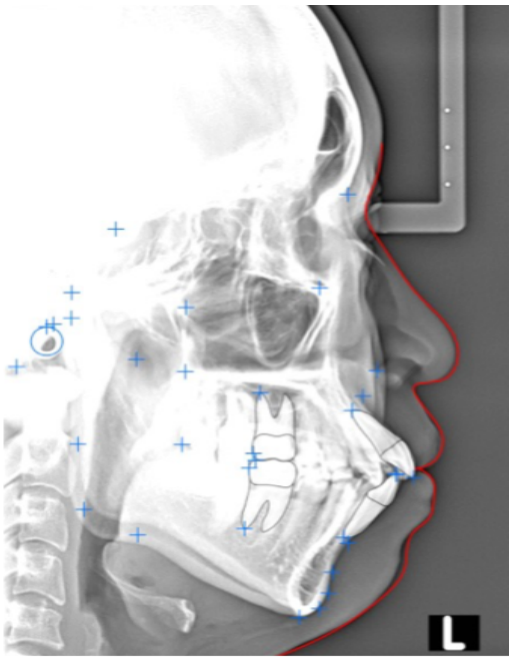

Figure 1. Facial Profile Shape in Class I Skeletal Malocclusion.

Based on the sample measurements in the Table 1 above, it can be seen that there is a description of the average value, normal value, and standard deviation of the values of SNA, SNB, ANB, FMA, FMIA, IMPA, Facial Axis, Y-Axis, Facial Angle, Angle of Convexity, S Angle. – N – Ba, Angle N – Ba – S, Angle Ba – S – N, SN – Mandibular Plane, SN – Maxillary Plane, SN – Occlusal Plane, FH – Mandibular Plane, FH

– Maxillary Plane, FH – Occlusal Plane, Gonial Angle, Upper Gonial Angle, Lower Gonial Angle, Maxillary Length, Mandibular Length, Wits Appraisal, Point A – National Perpendicular Distance, Pogonion – Nasion Perpendicular Distance, and U1 – NA Angle in patients with Class I, II, and III malocclusions.

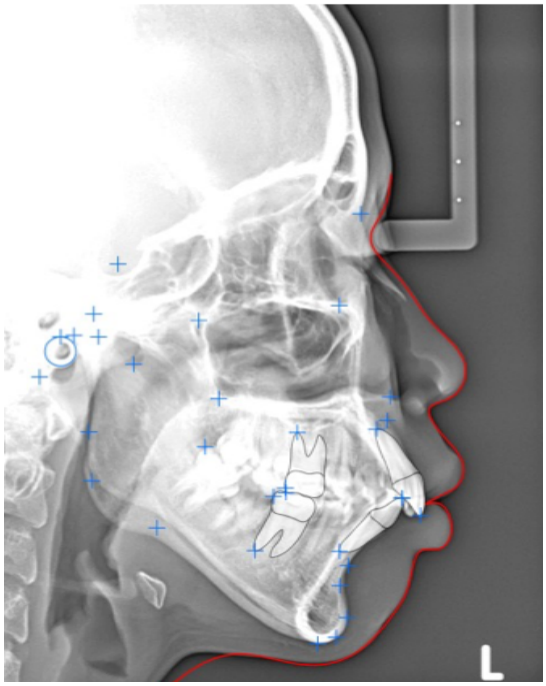

Figure 2. Facial Profile Shape in Class II Skeletal Malocclusion.

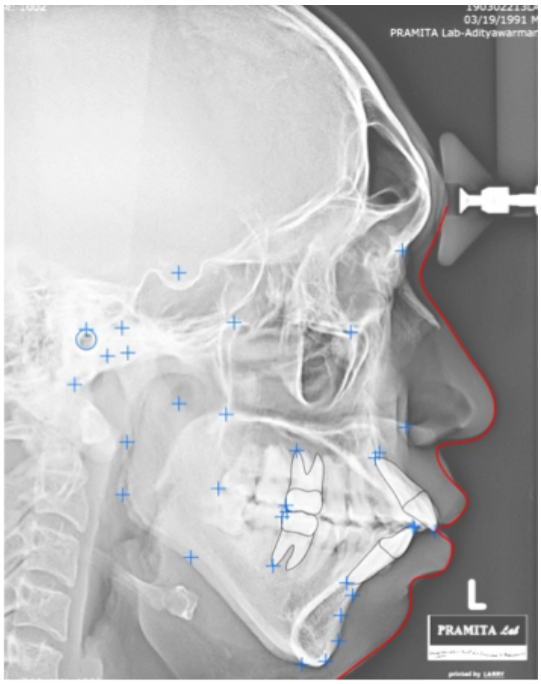

Figure 3. Facial Profile Shape in Class III Skeletal Malocclusion.

The facial profile of Class I, Class II and Class II Malocclusion based on Angle's classification shown in Figure 1-3. Based on the sample measurements in the Table 2 above, it can be seen that there is a description of the average value, normal value, and standard deviation of the value of the Holdaway Soft Tissue Analysis, which consists of 11 parameters, including Facial Angle, Upper Lip Curvature, Skeletal Convexity at Point A, H - Line Angle, Pn – H Line, Upper Sulcus Depth, Li – H Line, Lower Sulcus Depth, Soft Tissue Chin Thickness, Upper Lip Thickness, Upper Lip Strain in patients with class I, II, and III malocclusions. The correlation test was carried out with the Pearson Correlation test only to determine whether there was a relationship between two or more variables from the study or how significant the relationship was between the research variables. The results of the Pearson Correlation test are said to be correlated if the p-value > 0.01 or p > 0.05. Table 3 showed Correlation Test Results of Facial Profile Shapes with Malocclusion Class I. Meanwhile, table 4 and table 5 Correlation Test Results of Facial Profile Shapes with Malocclusion Class II and Class II.

Discussion

Based on the research results that have been done, it is known that the shape of a person's facial profile can be identified with 2 Holdaway parameters, namely Skeletal Convexity at points A and H - Line Angle. In class I, II, and III malocclusions of the Javanese population, the sample has a skeletal profile that is still included in the ideal value of the Caucasoid race, and it is known in this study that the Javanese population has a characteristic soft tissue profile that is convex and thicker than the Caucasoid race. This is because the thickness of the soft tissue in each individual varies greatly, and it is known that the Javanese population has thick, soft tissue but is still influenced by the skeleton.

In this study found that the soft-tissue facial profile analysis based on Holdaway soft tissue analysis include; The first is Facial Angle, Soft Tissue. The average value of Facial Angle Soft Tissue in class I malocclusion is 88.54°, class II is 87.57, and class III is 88.21. Facial Angle Soft Tissue is used to measure the position of the lower jaw with the upper jaw and

has a normal value of 90 – 92°. However, for some cases, Holdaway said that the value could be 92° ± 7°.[10-12] From these results, it can be seen that the average value of Facial Angle Soft Tissue can still be considered normal with the largest value in class I malocclusion and the lowest value in class II malocclusion, which indicates that patients in class I, II, and III malocclusions have a retrusive facial shape. A small Facial Angle Soft Tissue indicates a retrusive face shape and vice versa, and a large Facial Angle Soft Tissue indicates a protrusive face shape.[13]

The second is Upper Lip Curvature. The average value was 12.76 mm in class I malocclusion, 13.60 mm in class II malocclusion, and 11.10 mm in class III malocclusion with a normal value of 2.5 mm. However, in individuals who have thin or thick lips, a value of 1-4 mm is still considered normal.[10-12] From these results, it can be seen that the average Upper Lip Curvature in the Javanese population has different values from the Caucasoid race, with the largest value in class II malocclusion and the lowest value in class III malocclusion. In the Caucasian race, the highest value was in class III malocclusion, and the lowest value was in class II malocclusion.[14]

The third is Skeletal Convexity at point A. The average value is 1.71 mm for Class I malocclusion, 1.399 for Class II malocclusion, and 0.33 for Class III malocclusion. The normal value is -2 – 2 mm. So, from these results, it can be seen that the greatest value is in patients with Class I malocclusion, and the lowest value is in class III malocclusion, but all of them are still in the ideal value. The convexity of the skeletal profile is not a measure for soft tissue. However, it is an observation to show that if the size of the convexity of the skeletal profile increases, the convexity of the soft tissue profile will also increase.[10,12,15]

Fourth is H – Line Angle. The average score was 20.2 for class I malocclusion, 21.12 for class II malocclusion, and 18.84 for class III malocclusion. The H – Line Angle is said to be harmonious and balanced if the value is in the range of 7 – 15. From these results, it can be seen that the highest H – Line Angle value is in class II malocclusion and the lowest value is in class III malocclusion, but these three values exceed the ideal value of H – Line Angle in the Caucasoid race. This shows that the Javanese population has thicker soft tissue than the Caucasoid race. The angle and convexity of the facial profile are determined by the Skeletal Convexity at points A and H – Line Angle. Increasing the convexity of Skeletal Convexity at point A also increases the value of H–Line Angle.[16]

The fifth is the Pn – H Line. The average value was -2.29 mm in class I malocclusion, -2.76 mm in class II malocclusion, and -0.41 mm in class III malocclusion. The normal value was 12 mm. Holdaway states that in Caucasian races, a value of <14 mm is considered a small nose, and >24 mm is considered a large or protruding nose. These results show that the average value of the largest Pn-H Line patients is in patients with class III malocclusion, and the lowest value is in patients with class II malocclusion. All three have a small nose and are far from the normal value. This is following the characteristic that the Javanese have a small nose. Nasal prominence in each individual is different because the sharpness of the nose has no relationship with the growth of the underlying hard tissue.[10,17]

Sixth is Upper Sulcus Depth. The average value for class I malocclusion is 10.39 mm, class II malocclusion is 11.35 mm, and class III malocclusion is 9.37 mm. Holdaway states that the normal value is 5 mm. It is known that Upper Sulcus Depth has the greatest value or depth in patients with class II malocclusion and the lowest value in patients with class III malocclusion. However, the average value of the three types of malocclusion is far from the ideal value in the Caucasoid race. This shows that the Javanese population has a deeper Upper Sulcus Depth than the Caucasoid race.

Seventh is the Li – H line. The average value for class I malocclusion is 2.53 mm, class II malocclusion is 4.85, and class III malocclusion is 3.29. The lower lip is considered harmonious if it has a value of 0 ± 2 mm. A negative sign indicates that Li is behind the H-Line, and a positive value indicates that Li is in front of the H-Line. Looking at these data, it is known that the average value of the three types of malocclusion has the characteristics of the lower lip being more forward than the H - Line. This is also following the characteristics of the Javanese, who have thick lips.[17]

Eighth is Lower Sulcus Depth. The average value for Class I malocclusion is 3.15 mm, Class II malocclusion is 1.11 mm, and Class

III malocclusion is 2.38 mm. It has the same normal value as the Upper Sulcus Depth, 5 mm. With these data, it is known that the average value of Lower Sulcus Depth in patients with class I, II, and III malocclusions also has a value greater than the ideal value in the Caucasoid race with the largest value in patients with class I malocclusion and the lowest value in patients with class II malocclusion.

The ninth is Soft Tissue Chin Thickness. The average value for class I malocclusion is 15.21 mm, class II malocclusion is 13.82 mm, and class III malocclusion is 15.10 mm, and has a normal value of 10-12 mm. With these data, it can be seen that the average value of chin thickness in patients with class I, II, and III malocclusions are less harmonious because it exceeds the normal value with the largest value in class I malocclusion and the lowest value in class II malocclusion. This is different from the results of a study conducted by Tiwari et al., who found that the value of Soft Tissue Chin Thickness was greater in patients with class III malocclusion.[18] This indicates that the Javanese population has thicker chin soft tissue than the Caucasoid race.

The tenth is Upper Lip Thickness. The average value for class I malocclusion is 17.02 mm, class II malocclusion is 17.24 mm, and class III malocclusion is 17.51. Holdaway states that the ideal/normal value of Upper Lip Thickness is 15 mm. So, patients with class I, II, and III malocclusions had upper lip thickness that was more than the normal value with the largest value in class III malocclusion and the lowest value in class I malocclusion with a slight difference. This is different from the research of Yan et al., 2021 and Ashraf et al., who got the results that the largest value was obtained in class III malocclusion and the lowest value was in class II malocclusion.[13,14] This value indicates that the Javanese population has thicker lips than races Caucasoid.

The eleventh is the Upper Lip Strain. The average value for class I malocclusion is 13.25 mm, class II malocclusion is 14.54 mm, and class III malocclusion is 13.34. Upper Lip Strain has a normal value of 13 – 14 mm. From these results, it is known that the Upper Lip Strain in patients with class I, II, and III malocclusions has the ideal shape and value with the largest value in patients with class II malocclusion and the lowest value in class I malocclusion. This is different from the research conducted by Yan. et al. with the results that the largest value was in class III malocclusion. The lowest value was in class II malocclusion because lip thickness tends to increase in cases with maxillary retrusion as a form of soft tissue compensation.[14,15] This indicates that the Javanese population has characteristic lips. Thicker than the Caucasoid race.

In patients with class I malocclusion, it is known that Facial Angle Soft Tissue has a positive correlation with Facial Axis, Facial Angle, SNA, and SNB and has a negative correlation with Wits Appraisal. In patients with class II and III malocclusion, Facial Angle Soft Tissue has a positive correlation with Facial Axis, Facial Angle, and SNB and negatively correlates with Wits Appraisal. The results obtained are the same as those of Fareen et al., who stated that an increase in the skeletal convexity profile also increased the facial profile.[16]

In patients with class I malocclusion, it is known that the Upper Lip Curvature has a positive correlation with Facial Axis, Facial Angle, SNA, and SNB and has a negative correlation with Wits Appraisal. In patients with class II and III malocclusion, Upper Lip Curvature positively correlates with Facial Angle and IMPA. The results obtained are different from the research conducted by Fareen, which found that there was no significant difference in the Upper Lip Curvature after treatment, which means changing the skeletal pattern. This can happen because, in his research, Fareen used a sample with class III malocclusion that had a normal SNA value (functional class III), meaning that in this case, it did not change the position of point A and did not affect the upper lip curvature of the sample.[16]

In patients with class I malocclusion, it is known that Skeletal Convexity at point A has a positive correlation with SNA, ANB, and Wits Appraisal and has a negative correlation with Facial Axis, Facial Angle, and U1 – NA. In patients with Class II and III malocclusions, Skeletal Convexity at point A positively correlates with Wits Appraisal and IMPA. It negatively correlates with Facial Axis, Facial Angle, SNB, and U1 – NA. The results obtained are the same as those of Fareen et al., who stated that an increase in the skeletal convexity profile also increased the facial profile.[16] In patients with class I malocclusion, it is known that the H-Line Angle has a positive correlation with IMPA. In

patients with class II and III malocclusion, the H-Line Angle had a positive correlation with Wits Appraisal and IMPA, and a negative correlation with Facial Axis, Facial Angle, SNB, and U1-NA. Following previous studies, an increase in the skeletal convexity profile also increased the value of the H-Line Angle, and the H-Line Angle correlated with the position of the upper lip associated with maxillary incisor inclination.[16,19,20]

In patients with class I malocclusion, it is known that the Pn-H Line has a positive correlation with the Facial Axis. In patients with class II and III malocclusion, the Pn–H Line had a positive correlation with the Facial Axis, Facial Angle, SNB, and U1–NA, and a negative correlation with the Wits Appraisal. This result is different from the results obtained by Fareen et al. in their study in 2021, which stated that there was no significant difference in nasal prominence after treatment, which meant modifying the skeletal pattern. Because, in the research conducted by Fareen, treatment for class III malocclusion with normal SNA means that in this case, it does not change the position of point A and does not affect the Pn – H Line of the sample.[16]

In patients with class I malocclusion, it is known that Upper Sulcus Depth has a positive correlation with U1 – NA. In patients with class II and III malocclusion, Upper Sulcus Depth has a positive correlation with Wits Appraisal and a negative correlation with Facial Axis, Facial Angle, SNB, and U1 – NA. These results match the results obtained from the research of Yan et al. Abnormal growth of the Upper Sulcus Depth can be corrected directly and significantly with early intervention of the skeletal growth pattern. By inhibiting excessive maxillary growth in Class II malocclusion, it can significantly reduce the sulcus depth, while encouraging maxillary growth in Class III malocclusion can significantly increase the sulcus depth. In patients with class I malocclusion, it is known that the Li-H Line does not correlate with the existing variables. In patients with class II and III malocclusions, the Li–H Line positively correlates with the Facial Axis and Facial Angle. This is following the research of Lu et al. and Khatri and Sanap, which states that the position of the lower lip can change according to the teeth below.[20,21]

In patients with class I malocclusion, it is known that Lower Sulcus Depth is not correlated with the existing variables. In patients with class II and III malocclusion, Lower Sulcus Depth positively correlates with Wits Appraisal and IMPA. These results follow a study conducted by Lu et al., who found that the soft tissue thickness in the chin area increased after extraction of the mandibular incisors.[21]In patients with class I, II, and III malocclusions, it is known that Soft Tissue Chin Thickness is not correlated with the existing variables. These results follow the results of research conducted by Perovic et al. and Shinde et al. They mention that the Pogonion area is the area least affected by divergence. This may be due to the nature of the body to disguise the existing situation and give a more normal facial appearance.[22,23]

In patients with class I malocclusion, it is known that the Upper Lip Thickness is not correlated with the existing variables. In patients with class II and III malocclusion, Upper Lip Thickness has a positive correlation with Facial Axis and U1 – NA and negatively correlates with Wits Appraisal. In patients with class I malocclusion, it is known that the Upper Lip Strain does not correlate with the existing variables. Whereas in patients with class II and III malocclusion, the Upper Lip Strain negatively correlates with Wits Appraisal. The results obtained from this study differ from the research conducted by Perovic et al. and Yan et al. with the results that the thickness of the upper lip does not differ in any variation of the skeletal pattern, which means that a person's skeletal pattern does not influence the thickness of the lips.[14,22] However, in a study conducted by Asmar et al. and McNamara et al. in 2008, it was stated that thick lips were not affected by incisor inclination. However, thin lips could be affected by incisor inclination. Therefore, this study follows the results of the Upper Lip Thickness and Upper Lip Strain which have a relatively normal thickness.[24,25]

Conclusions

The facial profile of a sample of the Javanese population in class I, II, and III malocclusions have a convex facial profile. Samples with class II malocclusion had the most convex profile shape among the three. This research will be very useful for planning treatment in orthodontics in the future. The author hopes that this research can be used as a guide for orthodontic treatment in determining the

components or variables that need to be changed or improved to get a good and satisfactory treatment result in the aspect of harmony of occlusion and facial profile. The author finds that it is necessary to conduct further research with more specific inclusion criteria, such as differentiating age, gender, race, etc., in order to obtain detailed results.

Declaration of Interest

The authors declare there is no conflict of interest in this study.

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	Class 1			Class II		Class III	
	Mean	SD	Normal Range	Mean	SD	Mean	SD
FMA (dg)	32.239	7.2155	16 – 35	34.217	9.1992	32.6155	6.84102
Facial Axis (dg)	-4.2779	5.29062	0 (90°)	-4.7276	6.98144	-4.6441	4.36328
Y Axis (dg)	66.7631	5.19218	53 – 66	66.5829	5.62269	66.4386	4.64559
Facial Angle (dg)	83.9038	4.67273	82 – 95	84.1900	5.55740	83.3939	3.93970
S-N-Ba Angle (dg)	19.9872	2.40783	20	19.8969	3.23697	19.6343	2.71693
SN-Mandibular Plane (dg)	36.2495	7.14578	32	38.3971	10.16695	36.6051	6.48986
SN-Maxillary Plane (dg)	8.2905	3.07214	8.5	9.1700	4.02453	8.1584	3.56352
SN-Occlusal Plane (dg)	14.1021	6.74536	14.5	14.3560	7.23953	12.1747	5.87424
FH-Mandibular Plane (dg)	32.239	7.2155	17 – 28	34.217	9.1992	32.6051	6.83942
FH-Maxillary Plane (dg)	5.3305	7.73002	4.5	4.3652	4.28678	4.100	4.2375
FH-Occlusal Plane (dg)	10.6444	7.12354	1.5 – 14	10.5581	6.39516	9.0990	5.17809
Gonion Angle (dg)	128.1246	8.13016	130	132.0452	10.25464	129.8661	8.07840
Upper Gonial Angle (dg)	48.8385	5.11869	52 – 55	50.1490	4.67384	50.351	4.5870
Lower Gonial Angle (dg)	79.3110	6.39947	70 – 75	81.8974	8.38727	79.5227	6.25354
Mandibula Length (mm)	137.0485	23.90374	130 – 133	140.4388	20.74554	136.7776	21.11912
Maxilla Length (mm)	92.9062	16.21555	100	91.8498	19.09265	92.2629	14.28588
SNA (dg)	81.3464	4.67713	82	79.9200	9.03565	79.7059	4.42299
SNB (dg)	79.9167	4.35851	80	79.9264	7.03670	78.1145	7.91689
ANB (dg)	2.7982	0.60369	2 – 4	6.0007	1.35867	0.5529	1.06768
FMIA (dg)	50.056	7.7783	60 – 75	49.3726	10.97434	49.7582	7.31250
IMPA (dg)	97.7051	6.36396	85 – 95	96.4093	8.01766	97.6259	6.45946
Angle of Convexity (dg)	4.1349	8.94630	-8.5 – 10	2.1369	13.44400	0.6241	2.75005
Wits Appraisal (mm)	-0.7769	7.18287	0 – 1	-2.6338	10.97449	0.1343	6.78591
A - Nasion Perpendicular (mm)	-5.2941	5.33310	1	-5.9357	6.46075	-7.3524	4.36055

Ba-S-N Angle (dg)	130.4456	4.72182	129	127.6712	18.05027	128.6337	16.14895
S-Ba-N Angle (dg)	29.6526	2.77026	30	29.9545	3.12612	29.6716	3.47865
U1-NA Angle (dg)	29.6574	7.24246	22±4	30.9362	9.42908	35.2112	6.56405
Pog - Nasion Perpendicular (mm)	-13.6677	11.07319	0 – 5	-12.8821	14.52432	-14.8327	9.34274

Table 1. Results of Descriptive Statistical Test of Hard Tissue Cephalometry.

	Class 1			**Class II**		**Class III**	
	Mean	**SD**	**Normal range**	**Mean**	**SD**	**Mean**	**SD**
Facial Angle (dg)	88.546	4.5308	90 – 92	87.5771	10.11740	88.2192	4.95673
Upper Lip Curvature (mm)	12.7631	5.11376	2.5	13.6010	5.30941	11.1004	4.36694
Skeletal Convexity At Point A (mm)	1.7110	3.23033	-2 – 2	1.399	7.8255	0.3327	1.58136
H Line Angle (dg)	20.2031	4.00687	7 – 15	21.1286	6.05937	18.8410	4.18665
Pn - H Line (mm)	-2.2987	5.06496	≤12	-2.7674	7.04469	-0.4186	5.06749
Upper Sulcus Depth (mm)	10.3977	3.61910	5	11.3545	3.58334	9.372	3.3358
Li - H Line (mm)	2.5374	2.45045	0 ± 2	4.85	3.120	3.2914	2.38199
Lower Sulcus Depth (mm)	3.1551	2.65347	5	1.114	3.6650	2.3822	2.94815
Soft Tissue Chin Thickness (mm)	15.2141	3.75242	10 – 12	13.8286	3.94319	15.1082	4.02600
Upper Lip Thickness (mm)	17.026	3.3417	15	17.2400	3.53025	17.51	4.325
Upper Lip Strain (mm)	13.2544	3.64579	13 – 14	14.5440	2.95215	13.342	3.2326

Table 2. Soft Tissue Cephalometry Descriptive Statistical Test Results.

			FACIAL ANGLE (dg)	UPPER LIP CURVATURE (mm)	Skeletal Convexity At Point A (mm)	H LINE ANGLE (dg)	PN - H LINE (mm)	UPPER SULCUS DEPTH (mm)	LI - H LINE (mm)	LOWER SULCUS DEPTH (mm)	SOFT TISSUE CHIN THICKNESS (mm)	UPPER LIP THICKNESS (mm)	UPPER LIP STRAIN (mm)
Class I Malocclusion	FACIAL AXIS (dg)	Pearson Correlation	0.525**	0.348*	-0.397*	-0,216	0.356*	-0,140	-0,168	0,140	-0,099	-0,083	0,113
		Sig. (2-tailed)	0.001	0.030	0.012	0.186	0.026	0.394	0.307	0.397	0.548	0.614	0.494
		N	39	39	39	39	39	39	39	39	39	39	39
	FACIAL ANGLE (dg)	Pearson Correlation	0.913**	0.621**	-0.0421**	-0.0160	0.105	-0.089	0.092	-0.078	-0.284	0.154	0.122
		Sig. (2-tailed)	0.000	0.000	0.008	0.332	0.526	0.589	0.579	0.635	0.080	0.348	0.460
		N	39	39	39	39	39	39	39	39	39	39	39
	SNA (dg)	Pearson Correlation	0.375*	0.457**	0.356*	0.035	0.042	0.041	0.074	-0.117	0.026	-0.122	0.161
		Sig. (2-tailed)	0.019	0.003	0.026	0.830	0.800	0.803	0.654	0.480	0.874	0.460	0.329
		N	39	39	39	39	39	39	39	39	39	39	39
	SNB (dg)	Pearson Correlation	0.681**	0.608**	-0.149	-0.072	0.113	-0.001	0.062	-0.043	-0.019	0.042	0.290
		Sig. (2-tailed)	0.000	0.000	0.366	0.663	0.493	0.995	0.708	0.794	0.907	0.802	0.073
		N	39	39	39	39	39	39	39	39	39	39	39
	ANB (dg)	Pearson Correlation	-0.201	0,091	0.488**	0.294	-0.022	0.015	0.175	-0.291	-0.062	-0.249	0.065
		Sig. (2-tailed)	0,220	0,580	0.002	0.070	0.892	0.925	0.287	0.072	0.706	0.127	0.692
		N	39	39	39	39	39	39	39	39	39	39	39
	IMPA (dg)	Pearson Correlation	-0,067	0,099	-0.105	0.382*	-0.226	0.072	0.043	-0.152	-0.205	0.016	-0.240
		Sig. (2-tailed)	0,684	0,547	0,526	0,017	0,167	0,664	0,795	0.357	0.211	0.924	0.142
		N	39	39	39	39	39	39	39	39	39	39	39
	WITS APPRIASAL (mm)	Pearson Correlation	-0.373*	-0.330*	0.371*	0.017	0.041	-0.089	-0.270	0.204	-0.058	-0.286	-0.258
		Sig. (2-tailed)	0.019	0.040	0.020	0.917	0.804	0.590	0.096	0.213	0.725	0.077	0.113
		N	39	39	39	39	39	39	39	39	39	39	39
	U1-NA ANGLE (dg)	Pearson Correlation	0.076	0.199	-0.380*	0.144	-0.307	0.356*	0.253	-0.293	0.055	0.239	-0.032
		Sig. (2-tailed)	0.647	0.225	0.017	0.383	0.057	0.026	0.120	0.071	0.740	0.144	0.848
		N	39	39	39	39	39	39	39	39	39	39	39

Table 3. Correlation Test Results of Facial Profile Shapes with Malocclusion Class I.
*information: significant at p<0.05.

			FACIAL ANGLE (dg)	UPPER LIP CURVATURE (mm)	Skeletal Convexity At Point A (mm)	H LINE ANGLE (dg)	PN - H LINE (mm)	UPPER SULCUS DEPTH (mm)	LI - H LINE (mm)	LOWER SULCUS DEPTH (mm)	SOFT TISSUE CHIN THICKNESS (mm)	UPPER LIP THICKNESS (mm)	UPPER LIP STRAIN (mm)
Class II Malocclusion	FMA (dg)	Pearson Correlation	-0.757**	-0.307*	0.580**	0.543**	-0.590**	0.612**	0.591**	-0.294	0.056	-0.200	-0.100
		Sig. (2-tailed)	0.000	0.048	0.000	0.000	0.000	0.000	0.000	0.059	0.723	0.205	0.530
		N	42	42	42	42	42	42	42	42	42	42	42
	FACIAL AXIS (dg)	Pearson Correlation	0.682**	0,157	-0.738**	-0.699**	0.669**	-0.589**	-0.437**	0.031	-0.045	0.326*	0.283
		Sig. (2-tailed)	0.000	0.320	0.000	0.000	0.000	0.000	0.004	0.848	0.779	0.035	0.070
		N	42	42	42	42	42	42	42	42	42	42	42
	Y AXIS (dg)	Pearson Correlation	-0.744**	-0.433**	0.566**	0.534**	-0.599**	0.586**	0.408**	-0.158	-0.011	-0.238	-0.097
		Sig. (2-tailed)	0.000	0.004	0.000	0.000	0.000	0.000	0.007	0.317	0.945	0.128	0.541
		N	42	42	42	42	42	42	42	42	42	42	42
	FACIAL ANGLE (dg)	Pearson Correlation	0.757**	0.440**	-0.633**	-0.612**	0.652**	-0.634**	-0.308*	-0.075	-0.065	0.276	0.137
		Sig. (2-tailed)	0.000	0.004	0.000	0.000	0.000	0.000	0.047	0.636	0.684	0.077	0.389
		N	42	42	42	42	42	42	42	42	42	42	42
	SNA (dg)	Pearson Correlation	0.124	0.195	0.081	0.011	0.029	-0.065	-0.030	-0.050	-0.202	-0.160	-0.134
		Sig. (2-tailed)	0.435	0.216	0.612	0.942	0.855	0.681	0.848	0.752	0.200	0.312	0.397
		N	42	42	42	42	42	42	42	42	42	42	42
	SNB (dg)	Pearson Correlation	0.543**	0.219	-0.600**	-0.584**	0.518**	-0.477**	-0.215	-0.208	-0.140	0.279	0.236
		Sig. (2-tailed)	0.000	0.164	0.000	0.000	0.000	0.001	0.171	0.186	0.376	0.074	0.132
		N	42	42	42	42	42	42	42	42	42	42	42
	ANB (dg)	Pearson Correlation	0.032	-0.041	0.153	0.005	-0.033	0.023	0.115	-0.101	0.008	-0.110	-0.074
		Sig. (2-tailed)	0,839	0,797	0,332	0,975	0,835	0,886	0,470	0,525	0,962	0,487	0,640
		N	42	42	42	42	42	42	42	42	42	42	42
	IMPA (dg)	Pearson Correlation	0.107	0.311*	0.513**	0.522**	-0.357*	0.306*	-0.261	0.455**	0.135	-0.524**	-0.477**
		Sig. (2-tailed)	0.500	0.045	0.001	0.000	0.020	0.049	0.096	0.002	0.393	0.000	0.001
		N	42	42	42	42	42	42	42	42	42	42	42
	WITS APPRIASAL (mm)	Pearson Correlation	-0.369*	0.196	0.841**	0.741**	-0.693**	0.584**	0.100	0.357*	0.140	-0.579**	-0.441**
		Sig. (2-tailed)	0.016	0.214	0.000	0.000	0.000	0.000	0.527	0.020	0.378	0.000	0.003
		N	42	42	42	42	42	42	42	42	42	42	42
	U1-NA ANGLE (dg)	Pearson Correlation	0.296	-0.059	-0.749**	-0.477**	0.396**	-0.508**	-0.187	-0.043	-0.135	0.503**	0.176
		Sig. (2-tailed)	0.057	0.712	0.000	0.001	0.009	0.001	0.234	0.789	0.395	0.001	0.265
		N	42	42	42	42	42	42	42	42	42	42	42

Table 4. Correlation Test Results of Facial Profile Shapes with Malocclusion Class II.
*information: significant at p<0.05.

			FACIAL ANGLE (dg)	UPPER LIP CURVATURE (mm)	Skeletal Convexity At Point A (mm)	H LINE ANGLE (dg)	PN - H LINE (mm)	UPPER SULCUS DEPTH (mm)	LI - H LINE (mm)	LOWER SULCUS DEPTH (mm)	SOFT TISSUE CHIN THICKNESS (mm)	UPPER LIP THICKNESS (mm)	UPPER LIP STRAIN (mm)
Class III Malocclusion	FACIAL AXIS (dg)	Pearson Correlation	0.538**	0.292*	-0.277	-0.145	0.308*	-0.264	-0.244	0.224	-0.068	-0.369**	-0.069
		Sig. (2-tailed)	0.000	0.042	0.054	0.320	0.031	0.067	0.092	0.121	0.644	0.009	0.636
		N	49	49	49	49	49	49	49	49	49	49	49
	FACIAL ANGLE (dg)	Pearson Correlation	0.911**	0.559**	-0.419**	-0.389**	0.458**	-0.329*	-0.265	0.397**	0.129	-0.128	0.265
		Sig. (2-tailed)	0.000	0.000	0.003	0.006	0.001	0.021	0.066	0.005	0.379	0.382	0.066
		N	49	49	49	49	49	49	49	49	49	49	49
	SNA (dg)	Pearson Correlation	0.311*	0.208	0.128	-0.067	0.177	-0.135	-0.068	0.089	-0.037	-0.251	0.032
		Sig. (2-tailed)	0.030	0.151	0.379	0.649	0.223	0.355	0.644	0.541	0.799	0.082	0.827
		N	49	49	49	49	49	49	49	49	49	49	49
	SNB (dg)	Pearson Correlation	-0.184	-0.223	-0.062	0.033	0.037	-0.169	-0.008	-0.355*	-0.300*	-0.177	-0.326*
		Sig. (2-tailed)	0.205	0.123	0.674	0.823	0.801	0.245	0.957	0.012	0.036	0.223	0.022
		N	49	49	49	49	49	49	49	49	49	49	49
	ANB (dg)	Pearson Correlation	-0.294*	-0.123	0.872**	0.257	-0.211	0.136	0.161	-0.154	-0.171	-0.190	-0.147
		Sig. (2-tailed)	0.041	0.400	0.000	0.075	0.145	0.353	0.270	0.291	0.241	0.192	0.313
		N	49	49	49	49	49	49	49	49	49	49	49
	IMPA (dg)	Pearson Correlation	-0.016	-0.092	0.007	0.083	0.110	-0.101	-0.351*	0.150	-0.134	-0.029	-0.160
		Sig. (2-tailed)	0.912	0.531	0.963	0.571	0.452	0.490	0.014	0.304	0.358	0.844	0.273
		N	49	49	49	49	49	49	49	49	49	49	49
	WITS APPRIASAL (mm)	Pearson Correlation	-0.043	0.076	0.080	0.030	-0.069	0.050	0.057	-0.018	0.067	-0.082	0.190
		Sig. (2-tailed)	0.770	0.602	0.587	0.837	0.636	0.734	0.695	0.903	0.646	0.576	0.190
		N	49	49	49	49	49	49	49	49	49	49	49
	U1-NA ANGLE (dg)	Pearson Correlation	-0.0191	0.109	-0.042	0.351*	-0.397**	0.426**	0.345*	-0.196	0.080	0.234	-0.001
		Sig. (2-tailed)	0.187	0.457	0.775	0.013	0.005	0.002	0.015	0.176	0.585	0.105	0.992
		N	49	49	49	49	49	49	49	49	49	49	49

Table 5. Correlation Test Results of Facial Profile Shapes with Malocclusion Class II.
*information: significant at p<0.05.

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