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A comparative study of facial soft tissue before and after orthodontic treatment for Chinese patients

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Abstract
Background: *The assessment of the patient's facial soft tissue is very important for orthodontic diagnosis and treatment planning. To date, there have been few studies assessing changes in facial esthetics through photography, so we aimed to compare facial soft tissue attractiveness before and after orthodontic treatment through photographic analysis and to find out whether this new analysis is applicable in clinical practice.*
Subjects and Methods*: Pre- and post-treatment photographs for 60patients were divided into three groups according to Angle's classification: Groups I, II, and III comprised patients with Angle's class I, II, and III malocclusions, respectively. Photographs were printed on A4 size paper, and tracings were made using thirteen soft tissue landmarks on profile and frontal photographs using tracing paper. The comparisons between pre- and post-treatment were made using a paired t-test.*
Results: *For class I, there were significant changes in 4measurements: lower facial heightSn-Me,the angle of medium facial thirdN-Trg-Sn, the angle of facial inferior thirdSn-Trg-Me and angle of facial convexity G-Sn-Pog). The significant changes for fourmeasurements were convergent. For class II, there were significant changes in 2 measurements: angles of total facial convexity G-Prn-Pog and Nasomental angle N-Prn/N-Pog). G-Prn-Pogangle was more significant than N-Prn/N-Pog angle. For group III, there was no difference between pre- and post-treatment facial photographic analysis.*
Conclusion: *There were significant changes in facial soft tissue esthetics after orthodontic treatment for class I and II malocclusion cases and we cannot rely on photographs for evaluating of orthodontic treatment.*
Key Words:*Angle malocclusion, aesthetics, facial soft tissue, photograph.*

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I. Introduction

One of the most important components of orthodontic diagnosis and treatment planning is the evaluation of the patient's soft tissue profile. [1]From the patient's point of view, the main cause for asking for orthodontic treatment is facial attractiveness [2]. Hence, it is recommended that through diagnosis, the professional must attempt to recognize the unpleasant facial characteristics that can be improved with the orthodontic treatment. Also, the aspects considered pleasant and must be conserved during orthodontic treatment.

Previously, orthodontists were essentially concerned with the correction of skeletal and dental relationships. [2, 3]These days, it has been observed in orthodontics a great concern about esthetics, particularly involving concepts of balance and facial proportions [3-5].Although several factors influence facial attractiveness, like the forehead, nose, and chin morphology, the lower anterior facial has more effect and can effectively change that; as a result, appropriate correction of oral dental problems increases the patient's self-assurance and attractiveness [6]. On another hand, it has been recommended that maxillary, mandible, and dental morphologies indirectly effect on the perception of facial beauty[7]

The use of photogrammetry in orthodontics was initially proposed by Stoner[8], who compared pre- and post-treatment profiles with perfect profiles. The photographs provide a permanent record of the face that can be accessed throughout the treatment planning[9]., as well allow the observation of harmonious real social relation between soft and hard facial tissues without exposing the patient to unneeded radiation in addition to

lower cost[2].Hence appropriate clinical photographic records of the orthodontic patient have become more importance for a good treatment `planning and follow-up.

Studies on craniofacial growth and facial esthetics typically assess soft tissues utilizing cephalograms [10, 11]. Similar studies are focusing on profile changes depending on the relationship between the lips and incisors [12-14]. To date, the studies assessing changes in facial attractiveness using photography was few [1-3, 9, 15]. Thereforethis study was developed to assess the facial soft tissue changes after orthodontic treatment using photographic analysis and to find out whether this method of assessment is reliable evaluating orthodontic treatment.

II. Subjects And Methods

Sixty Chinese patients were selectedfrom the outpatient clinic, Department of Orthodontics approved by the Research Ethics Committee of (approval number TJ-C20150314-), Tongji Medical College, Huazhong University of Science and Technology (HUST), Wuhan, China, during the period from March 2012 to June 2015. All patient's parents were informed about the study procedures, and informed consent was obtained.The means of pre-treatment age and total treatment time for all groups are shown in [Table1].

Table 1: Mean ages and treatment times of the groups

Group	No. of patients	pre- treatment age (Mean)	Total treatment time (Mean)
I	20	19.4	1.71
II	20	17.4	1.76
III	20	17.6	1.62

Patients who satisfied the following inclusion criteria were selected:No previous orthodontic treatment; no history of craniofacial or dental trauma; no history of maxillofacial or plastic surgery; no using glasses or distracting eyewear or jewelry during photography; they were treated with fixed orthodontic treatment and had frontal and profile extra oral photographs in the clinic archive.

All photographs of the patients were taken in Natural Head Position (NHP)[16]. Before and immediately after orthodontic treatment, with aprofessional photographic camera (Canon D400; Japan) and telescopic lens (Macro- Canon 100 mm; Japan). The patients were divided into three groups according to Angle's classification of malocclusion: Groups I, II, and III comprised Patients with class I, class II, and class III malocclusion, respectively.

The photographs were printed on A4 size paper, and tracings were performed in frontal and profile photographs, by the same trained observer (YAM), and soft tissue landmarks were identified on photographs using tracing paper. Thirteen landmarks were identified and registered on the frontal and profile photographs of each patient. Six linear, ten angular and one proportional were measured directly from landmark values（Fig. 1-4）.

Figure 1. Facial landmarks in frontal view: N- Soft tissue nasion; Sn – Subnasal; Ls-Labial superior; St-Stomion; Li-Labial inferior; Me- Men.

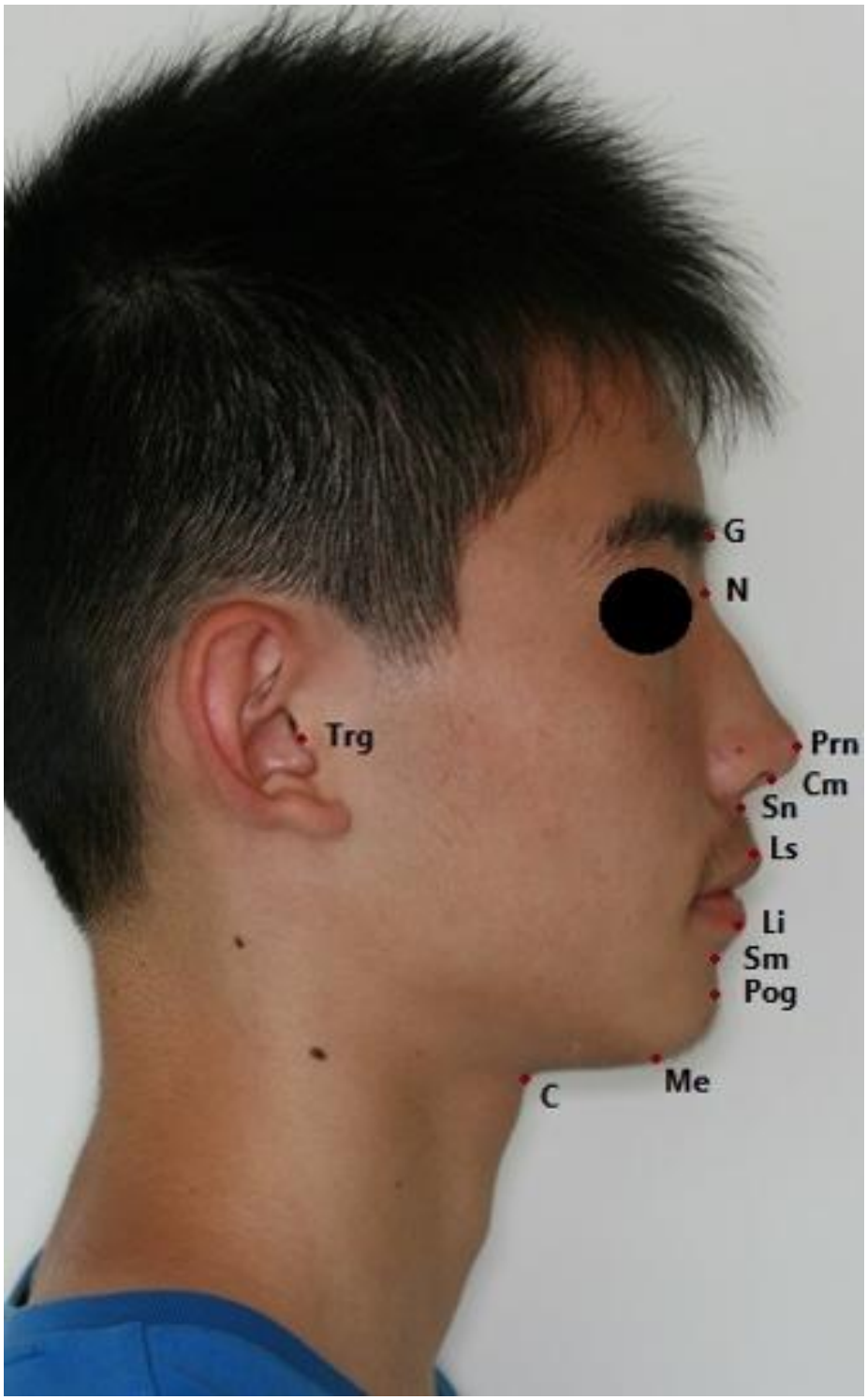

Figure 2. Facial landmarks in lateral view: Trg- tragus; G-glabella, N- soft tissue nasion; Prn- pronasal; Cm, columella; Sn-subnasal; Ls-labiale superior; Li-labial inferior; Sm- supramentale; Pog-pogonion; Me- menton; C- cervical point.

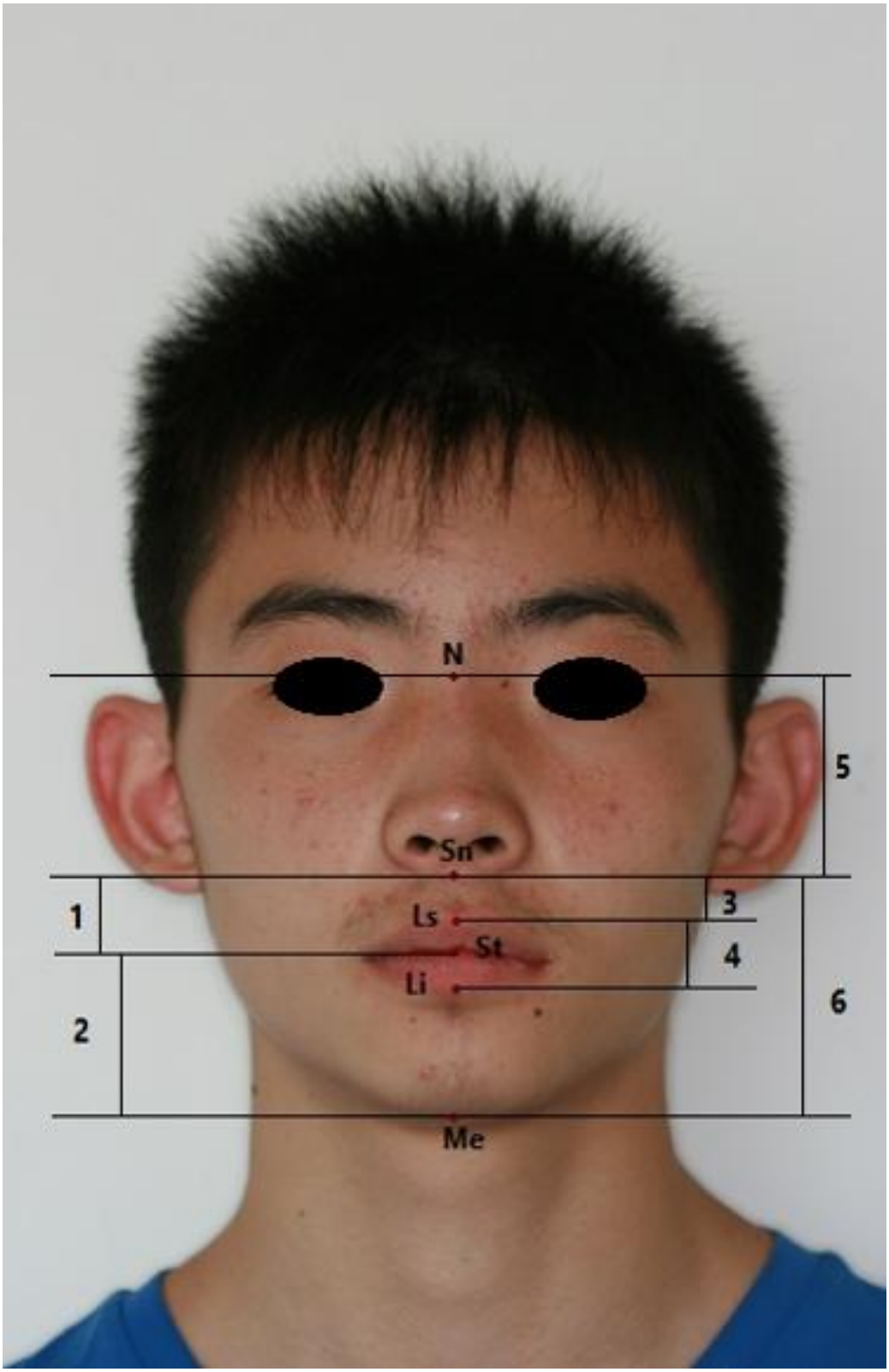

Figure 3.Linear and proportional measurements from 1 to 7 : Upper lip length (Sn–St), (2) Lower lip length (St-Me), (3) Philtrum length (Sn-Ls), (4) Mouth height (Ls-Li), (5) Middle facial height (N – Sn), (6) Lower facial height (Sn – Me), (7) Facial Height Proportion (N-Sn /Sn-Me).

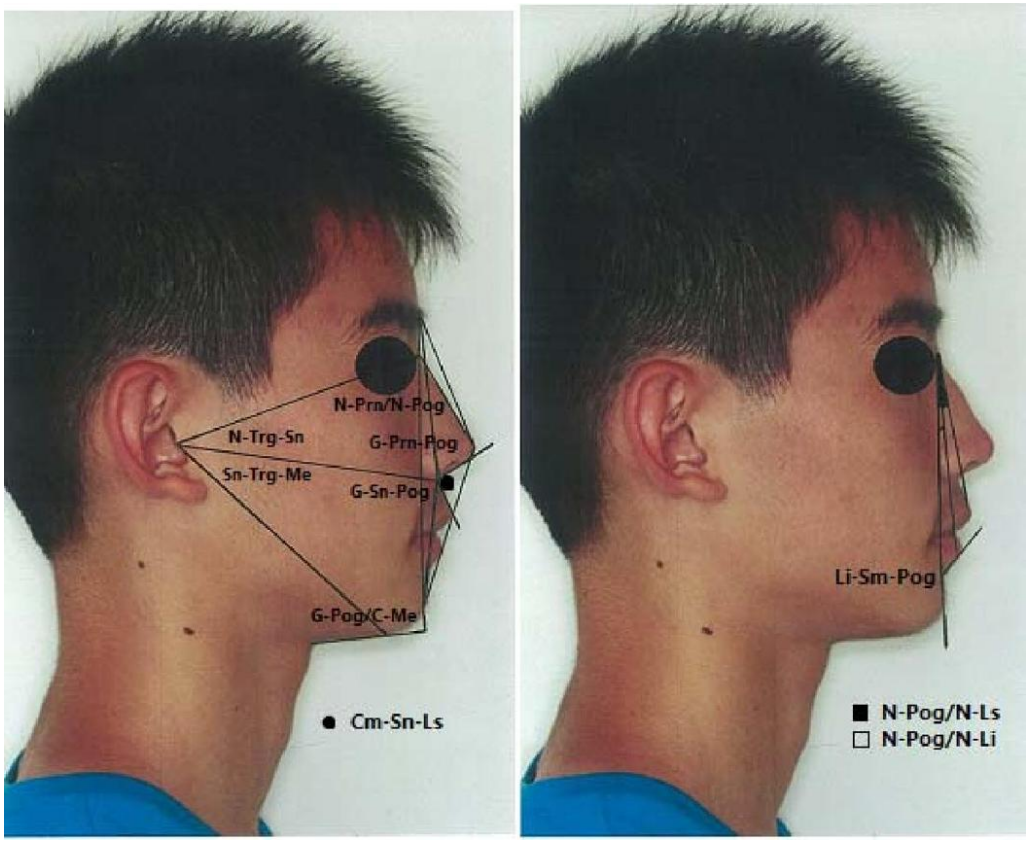

Figure4. Angular measurements from 1 to 10: (1) Angle of the inferior facial third (Sn –Trg–Me), (2) Angle of the medium facial third (N –Trg– Sn),(3) Angle of total facial c onvexity (G-Prn-Pog), (4) Angel of facil convexity (G-Sn- Pog), (5) Nasomental angle (N-Prn/N-Pog), (6) Cervicomental Angle (G –Pog/C – Me) (7) Nasolabial angle(Cm-Sn-Ls), (8) Mentolabial angle (Li-Sm-Pog), (9) Upper lip projection angle (N-Pog /N-Ls), (10) Lower lip projection angle (N-Pog/N-Li).

The definitions for each photographic landmark used in this study are shown in [Table 2].For remove projection errors and to do easier and more applicable measurements we did not use the perpendiculars, projections, or reference axes.After measurement of soft tissue variables, calculations were performed using a statistical method: Because there are normal distributions according to Kolmogorov-Smirnov test, a paired t test was used to determine the significance of pre- and post-treatment changes. Statistical analysis was performed with SPSS* Statistics Version 17 (IBM Corp., Armonk, NY, USA).The significance level was set at 0.05.

Table 2: Photographic landmarks used in the study

Landmarks	Definition
Trg-Trichion	The midpoint of the hairline.
G-Glabella	The most prominent point in the median sagital plane between the spur aorbitalridges.
N-Soft tissue Nasion	The midpoint of the nasofrontal suture.
Prn-Pronasale	The most protruded point of the nasal tip.
Cm-Columella	The most anterior soft tissue points on the columella (nasal septum) of the nose.
Sn-Subnasale	The junction between the lower border of the nasal septum, the partition thatdivides the nostrils, and the cutaneous portion of the upper lip in the midline.
Ls-Labiale superius	The midpoint of the vermilion border of the upper lip.
St-Stomion	The midpoint of the labial fissure when the lips are closed naturally.
Li-Labialeinferius	The midpoint of the vermilion border of the lower lip.
Sm-Supra mentale	The point of greatest concavity in the midline of the lower lip between labialeinferiusand soft tissue pogonion.
Pog-Pogonion	The most anterior point on the soft tissue chin.
Me-Menton	The lowest point in the midline on the lower border of the chin.
C-Cervicalpoint	The intersection between the submentalareaand the tangent line of the neck.

III. Results

All photographs were traced and analyzed for soft -tissue variables (six linear measurements, ten angular and one proportional measurement).The means and standard deviations of the pre- and post-treatment measurements for all groups are shown in [Tables3,4,5]. When we comparing the means of the pre- and post-treatment measurements in all groups, we found that only 6 of these measurements. were statistically significant , one is linear (Lower facial height) and five are angular (angle of the inferior facial third , angle of the medium facial third , angel of facial convexity, angel of total facial convexity and nasomental angle). No statistically significant differences were found in other measurements.

For class I, there was significant changes in 4 measurements. (Sn-Me, N-Trg-Sn, Sn-Trg-Me,and G-Sn-Pog) [Table3]. For class II, there were significant changes in (G-Prn-Pog and N-Prn/N-Pog), the total facial convexity (G-Prn-Pog) was more significant than nasomental angle N-Prn/N-Pog. In class II, profile convexity was reduced according to G-Prn-Pog angle [Table 4]. For class III, there was no statistically significant difference between pre-and post-treatment facial analysis [Table 5].

Table 3: Descriptive and inferential statistics of soft tissue analysis for Class I

Variables	Pre-treatment mean±SD	Post treatment mean±SD	P value
Linear variable (mm)			
Upper lip length	8.6±1.25	8.20±1.19	0.27
Lower lip length	17.86±1.83	16.76±1.61	0.12
Philtrum length	5.46±1.12	5.40±0.92	0.79
Mouth height	7.30±1.80	6.63±0.71	0.24
Medial facial height	22.60±2.44	20.90±2.62	0.12
Lower facial height	26.53±2.13	24.06±1.94	0.025*
Angular variable (degree)			
Angle of the inferior facial third	36.60±0.91	38.66±2.89	0.01*
Angle of medium facial third	27.53±2.16	29.26±1.53	0.01*
Angle of total facial convexity	140.40±3.33	140.93±5.700	0.64
Angle of facial convexity	163.46±2.37	166.46±5.27	0.03*
Nasomental angle	28.20±2.56	28.60±2.97	0.57
Upper lip projection angle	11.13±3.81	10.70±2.11	0.63
lower lip projection angle	4.73±2.25	4.86±1.99	0.78
Nasolabial angle	96.86±11.33	96.66±6.93	0.94
Mentolabial angle	125.66±9.83	130.93±11.76	0.17
Cervicomental angle	93.26±11.76	96.53±9.25	0.200
Proportional measures			
Facial height proportion Sn-Me/ N-Sn	0.81±0.06	0.83±0.06	0.59

* Significant difference, P<0.05, mm=millimeter; SD=Standard deviation,N- soft tissue nasion,Sn – subnasale, Me- Menton.

Table 4: Descriptive and inferential statistics of soft tissue analysis for Class II

Variables	Pre-treatment mean±SD	Post treatment mean±SD	P value
Linear variable (mm)			
Upper lip length	10.30±2.63	9.53±2.25	0.14
Lower lip length	19.80±3.18	20.63±4.09	0.27
Philtrum length	6.40±146	5.93±1.33	0.27
Mouth height	8.10±1.37	8.26±1.17	0.67
Medial facial height	24.13±3.40	24.96±5.17	0.45
Lower facial height	29.46±5.81	30.13±6.94	0.60
Angular variable (degree)			
Angle of inferior facial third	39.06±3.12	38.46±2.50	0.33
Angle of medium facial third	28.00±1.30	28.33±2.46	0.63
Angle of total facial convexity	139.33±3.92	136.46±3.48	0.01*
Angle of facial convexity	162.733±4.41	164.13±5.93	0.23
Nasomental angle	29.93±3.19	28.60±2.84	0.05*
Upper lip projection angle	12.00±2.90	11.06±2.05	0.07
Lower lip projection angle	5.56±2.24	4.66±1.58	0.19
Nasolabial angle	97.46±8.37	95.06±6.01	0.30
Mentolabial angle	127.13±9.18	123.40±12.33	0.21
Cervicomental angle	96.93±6.87	95.00±6.33	0.24
Proportional measures			
Facial height proportion Sn-Me/ N-Sn	0.83±0.10	0.87±0.10	0.37

* Significant difference, P<0.05, mm=millimeter; SD=Standard deviation,N- soft tissue nasion,Sn – subnasale, Me- Menton.

Table 5: Descriptive and inferential statistics of soft tissue analysis for Class III

Variables	Pre-treatment mean±SD	Post treatment mean±SD	P value
	Linear variable (mm)		
Upper lip length	10.50±2.18	11.50±3.31	0.12
Lower lip length	23.30±5.80	23.53±5.75	0.79
Philtrum length	6.73±1.09	6.90±1.61	0.59
Mouth height	9.30±3.13	9.30±3.13	0.40
Medial facial height	30.36±8.06	29.50±7.93	0.37
Lower facial height	33.36±7.48	35.70±5.63	0.14
	Angular variable (degree)		
Angle of inferior facial third	36.66±4.25	36.66±4.25	0.84
Angle of medium facial third	28.00±1.69	28.00±1.69	0.52
Angle of total facial convexity	141.86±3.73	140.46±1.95	0.13
Angle of facial convexity	165.00±1.96	165.13±1.24	0.79
Nasomental angle	25.73±2.54	26.46±2.26	0.21
Upper lip projection angle	9.93±2.76	9.10±2.05	0.19
lower lip projection angle	4.96±1.46	4.80±1.56	0.58
Nasolabial angle	101.00±8.04	98.53±8.75	0.21
Mentolabial angle	139.20±11.71	135.60±8.95	0.16
Cervicomental angle	96.40±2.13	94.80±6.98	0.34
	Proportional measures		
Facial height proportion Sn-Me/ N-Sn	0.85±0.08	0.82±0.16	0.49

* Significant difference, P<0.05, mm=millimeter; SD=Standard deviation,N- soft tissue nasion,Sn – subnasale, Me-Menton.

IV. Discussion

Maintaining general harmony and balance among the different facial features by predicting the individual response to treatment becomes part of an orthodontist's responsibility.[17]. About 80% of orthodontic patients seek treatment out of aesthetic concern rather than the health and function[18].At present, patients believe that they will become more attractive, better liked, and more successful in their socialand occupational life after orthodonticsocial concerns in current society[19]. This investigation was developed to compare facial soft tissue attractiveness before and after orthodontic treatment through photographic analysis.

For regarding changes in class I, for the total facial convexity (G-Prn-Pog) angle, our results showed the stability of total facial convexity.About facial convexity, profile convexity was increased according to (G-Sn-Pog) (P = 0.03) angle; these results differ from those of Aksakalli et al.[3],Bishara, et al. [20], and Chaconas, et al.[21], who found the stability of facial convexity.This difference disagreement may be because of the difference in the assessment method used to analyze photographs in addition to the inclusion of different ages and population between studies.

For class II, our findings showed straightening of facial convexity through a decrease in N-Pog/N-Ls (P = 0.07) angles. Meyer-Marcotty et al. [22]. AndAksakalliet al. [3], found similar results in their study with class II patients. This may be due to the anterior positioning of the mandible.For class III, there was no difference between pre-and post-treatment facial analysis. This possibly because that the treatment objectives for those patients did not include the change facial soft tissue values in these cases, these results are acceptable, but all the changes can be related to growth and develop.In class II and III, there was a decreased in (Cm-Sn-Ls, Li-Sm-Pog, and G –Pog/C – Me) angles but not to a significant level.

In this study, we calculated the lines, angles and ratios directly from landmark values and we did not use perpendiculars, projections, or reference axes. We followed this type of limitations to reduce projection errors and to perform easier and more applicable measurements. According to O'Neill et al., [23] the type of treatment does not affect facial esthetics, for that the different types of treatment were not assessed in this study.The limitations of the current include small sample size, more facial landmarks could have been measured, and different races or ethnicities can be taken into account. Post-treatment analysis can be performed fora longer follow-up time.

V. Conclusion

Within the limitations of this study, the results of this study demonstrate that:
There were statistically significant in class I and II in only six measurements.
There were no statistically significant changes in facial esthetics after orthodontic treatment for class III cases
Orthodontists can no longer rely on a photographic analysis for accurate information on the soft-tissue facial profile changes which happened after orthodontic treatment.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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References

[1]. Malkoc, S., et al., *Angular photogrammetric analysis of the soft tissue facial profile of Turkish adults.* Eur J Orthod, 2009. **31**(2): p. 174-9.
[2]. Morosini, I.d.A.C., et al., *Study of face pleasantness using facial analysis in standardized frontal photographs.* 2012. **17**(5): p. 24-34.
[3]. Aksakalli, S. and A. Demir, *Facial soft tissue changes after orthodontic treatment.* Niger J Clin Pract, 2014. **17**(3): p. 282-6.
[4]. Bergman, R.T., *Cephalometric soft tissue facial analysis.* Am J Orthod Dentofacial Orthop, 1999. **116**(4): p. 373-89.
[5]. Arnett, G.W. and R.T. Bergman, *Facial keys to orthodontic diagnosis and treatment planning. Part I.* Am J Orthod Dentofacial Orthop, 1993. **103**(4): p. 299-312.
[6]. Terry, R.L.J.P. and m. skills, *Further evidence on components of facial attractiveness.* 1977.
[7]. Flores-Mir, C., M.P. Major, and P.W. Major, *Soft tissue changes with fixed functional appliances in Class II division 1.* Angle Orthod, 2006. **76**(4): p. 712-20.
[8]. Stoner, M.M.J.A.j.o.o., *A photometric analysis of the facial profile: A method of assessing facial change induced by orthodontic treatment.* 1955. **41**(6): p. 453-469.
[9]. Asghari, A., et al., *Photographic facial soft tissue analysis of healthy Iranian young adults: anthropometric and angular measurements.* Med J Islam Repub Iran, 2014. **28**: p. 49.
[10]. Hershey, H.G., *Incisor tooth retraction and subsequent profile change in postadolescent female patients.* Am J Orthod, 1972. **61**(1): p. 45-54.
[11]. Vahdettin, L. and Z. Altug, *Longitudinal soft-tissue profile changes in adolescent Class I subjects.* J Orofac Orthop, 2012. **73**(6): p. 440-53.
[12]. Lo, F.D. and W.S. Hunter, *Changes in nasolabial angle related to maxillary incisor retraction.* Am J Orthod, 1982. **82**(5): p. 384-91.
[13]. Talass, M.F., L. Talass, and R.C. Baker, *Soft-tissue profile changes resulting from retraction of maxillary incisors.* Am J Orthod Dentofacial Orthop, 1987. **91**(5): p. 385-94.
[14]. Yogosawa, F., *Predicting soft tissue profile changes concurrent with orthodontic treatment.* Angle Orthod, 1990. **60**(3): p. 199-206.
[15]. Kale-Varlk, S., *Angular photogrammetric analysis of the soft tissue facial profile of Anatolian Turkish adults.* J Craniofac Surg, 2008. **19**(6): p. 1481-6.
[16]. Sujesh, M.J.J.D.F., *Natural Head Position and Its Significance.* Journal of Dentistry Forecast. **1001**.
[17]. Baldwin, D.C., *Appearance and aesthetics in oral health.* Community Dent Oral Epidemiol, 1980. **8**(5): p. 244-56.
[18]. Utomi, I.L., *Challenges and motivating factors of treatment among orthodontic patients in Lagos, Nigeria.* Afr J Med Med Sci, 2007. **36**(1): p. 31-6.
[19]. Shaw, W.C., M.J. Gbe, and B.M. Jones, *The expectations of orthodontic patients in South Wales and St Louis, Missouri.* Br J Orthod, 1979. **6**(4): p. 203-5.
[20]. Bishara, S.E., et al., *Soft tissue profile changes from 5 to 45 years of age.* Am J Orthod Dentofacial Orthop, 1998. **114**(6): p. 698-706.
[21]. Chaconas, S.J. and J.D. Bartroff, *Prediction of normal soft tissue facial changes.* Angle Orthod, 1975. **45**(1): p. 12-25.
[22]. Meyer-Marcotty, P., et al., *Impact of facial asymmetry in visual perception: a 3-dimensional data analysis.* Am J Orthod Dentofacial Orthop, 2010. **137**(2): p. 168.e1-8; discussion 168-9.
[23]. O'Neill, K., M. Harkness, and R. Knight, *Ratings of profile attractiveness after functional appliance treatment.* Am J Orthod Dentofacial Orthop, 2000. **118**(4): p. 371-6; discussion 377.

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