Assessment of Influence of Soft Tissue Compensation in Patients with Facial Asymmetry: Photographic and Frontal Cephalometric Study

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Abstract

Introduction: Imbalances in facial areas can be noted as facial asymmetry which can be measured directly on face and indirectly with the help of photographs.

Aim: The aim of this study was to assess the contribution of soft tissue components compensating underlying skeletal imbalances in patients with facial asymmetry compared to the symmetrical or moderately symmetrical faces.

Material and Method: Frontal facial photographs and postero-anterior cephalograms were taken for 45 patients and divided into 3 groups viz- no asymmetry, moderate facial asymmetry and severe facial asymmetry. Soft tissue landmarks were identified on photographs and hard tissue landmarks were identified on PA cephalogram and measurements were subjected to statistical analysis.

Results: The result showed that patients with severe facial asymmetry had more degree of skeletal asymmetry as compared to soft tissue asymmetry.

Conclusion: soft tissue compensates for hard tissue asymmetry.

Key words: Frontal facial photographs, Postero-anterior cephalograms, facial asymmetry

INTRODUCTION

Symmetry refers to a sense of harmonious and beautiful proportion and balance. Facial symmetry and asymmetry are of prime importance in judging the face to be attractive or unattractive. The art of facial beauty, the symmetry and the asymmetry related to it, are an important part of field of the art, plastic surgery, orthognathic surgery, orthodontics and psychology.[1] Imbalance in facial areas can be noted in the amount or difference of left and right side of face.[2] Both side of face should coincide with each other in size, shape and volume with respect to the mid-sagittal plane if the face is symmetrical.[3] Asymmetry is seen in faces where the bilateral structures are not equidistant from the mid-sagittal plane.[4] Asymmetry either can be measured directly by taking the measurement on the face i.e., anthropometry or indirectly by measuring on the photographs.[5] Asymmetry can be noted and measured using different radiographic views like the lateral cephalograms, the panoramic radiographs, sub mento-vertex view, the postero-anterior cephalogram and the computed tomographic view.[6] In this study we investigated the imbalance of faceby comparing frontal photographs with postero-anterior cephalograms.

AIMS AND OBJECTIVES

The aims and objectives of this study were to assess the relationship between soft tissue asymmetry and bone tissue asymmetry using photographs and postero-anterior cephalograms and to investigate the contribution of soft tissue components compensating underlying skeletal imbalances.

MATERIALS AND METHODS

Patients who reported to the Department of Orthodontics,Mahatma Gandhi Dental College and Hospital for undergoing orthodontic treatment were included in the study. Postero-anterior cephalogramsand Frontal photographs of the patients were taken as a part of pretreatment records. Prior consent was taken from patient.

Postero-anteriorcephalograms were taken in postero-anterior projection with a distance of 5 feet between the X-ray focus and the films. Postero-anterior cephalograms were printed on films with a 1.15 magnification using a Kodak 8000C Digital panoramic and cephalometric system. (Figure 1,2,3)

Figure 1, 2: OPG and Lateral Cephalogram Machine and A Patient for Recording PA Ceph

Figure 3: P A Cephalogram

Facial photographs were taken using a digital single-lens reflex with a distance of 1.5m between the patients and focus. The patients were seated in an upright position on a chair with natural head position. (Figure 4,5).

Figure 4, 5: Canon Camera for Facial Photograph and Patients Frontal Photograph Showing Facial Asymmetry

Inclusion Criteria

1. No congenital abnormalities in maxillofacial region.
2. No prior surgery or injury involving maxilla or mandible.
3. Patients with permanent dentition.

Exclusion Criteria

1. Patients undergoing orthodontic treatment.
2. Prior surgery involving maxillofacial region.
3. Having congenital abnormalities in maxillofacial region.

100 standardized facial frontal photographs were screened and 45 photograph with little or no facial asymmetry, moderate facial and severe facial asymmetry were chosen. Final sample consisted of 45 photographs. 5 orthodontist from Dept. of Orthodontics and Dentofacial Orthopedics of Mahatma Gandhi Dental College and Hospital judged and selected 45 photographs and classified them in three groups.

Group One - with little or no facial asymmetry, **Group Two** - with moderate facial asymmetry, **Group Three** - with severe facial asymmetry.

Photographic and postero-anterior cephalometric measurements were recorded and correlated using statistical methods. These are some planes and index used for analysis.

S.No	Reference Line	Definition
1.	**Midsagittal Reference Line**	The line passing from Glabella to Sub-nasale.
2.	**Horizontal Reference Line**	The line perpendicular to the midsagittal line passing through the midpoint of both pupils.
3.	**Gonion Canting**	Deviation of Gonion (Go) point from Horizontal reference line.
4.	**Chin Deviation**	Deviation of the Menton (Me) point from the midsagittal reference line.
5.	**Asymmetry Index for Vertical Go (%)**	The ratio of right and left vertical Go´ length.
6.	**The Asymmetry Index for Horizontal Go (%)**	The ratio of right and left horizontal Go' length

Reference Plane and Index for Photographic as well as PA Ceph Analysis

The soft-tissue landmarks used in this study were taken the same as proposed by Farkas and hard tissue land marks were the same as suggested by Grummons. To assess the influence of soft tissue camouflage on hard tissue four common landmarks were gonion canting, chin deviation, asymmetric index horizontal, asymmetric index vertical was measured from asymmetry on frontal photographs and postero-anterior cephalograms.

Statistical Analysis

Software used for statistical analysis was-- IBM SPSS 23.0. Student t- test was used for comparison of soft tissue and hard tissue of group 1, group 2 and group 3. ANOVA one way test was used for comparison between group 1,group 2and group 3.Post hoc test was used to compare multiple components of different variables of group 3 with group1 and group 2.

RESULTS

The present study was conducted on 45 subjects which were divided in group one for symmetry subjects, group two for average subjects, group three for asymmetry subjects. The frontal facial photograph and postero-anterior cephalogram of patients were taken. The data so obtained was subjected to statistical analysis to achieve a correlation between soft tissue and skeletal imbalance and comparison between group 1, group 2, group 3 for soft tissue and hard tissue land marks. The results showed statistically significant differences between the soft and hard tissue parameters in all the 3 groups (Table 1 a, b and c). Intergroup comparison showed statistically significant variation between group 3 and group 1 and 2. Comparison of soft tissue land marks including gonion canting, chin deviation, asymmetry index horizontal and asymmetry index vertical of asymmetry group 3 with symmetry and average group and the result showed soft tissue discrepancy as well as skeletal discrepancy more in group 3 (Table 2a, and 2b). Group three had more degree of skeletal asymmetry as compared to soft tissue asymmetry, suggesting that soft tissue compensate for hard tissue asymmetry.

GROUP 1

		Mean	N	Std. Deviation	Std. Error Mean	P-Value
Pair 1	**Gonion Canting Soft Tissue**	.633	15	.5164	.1333	.001
	Gonion Canting Hard Tissue	1.267	15	.4952	.1279	
Pair 2	**Chin Dev Soft Tissue**	.533	15	.5164	.1333	.001
	Chin Dev Hard Tissue	1.167	15	.4880	.1260	
Pair 3	**Asymmetric Index Horizontal Soft Tissue**	1.7513	15	.52371	.13522	.001
	Asymmetric Index Horizontal Hard Tissue	2.7180	15	.61804	.15958	
Pair 4	**Asymmetric Index Vertical Soft Tissue**	2.3040	15	.80393	.20757	.001
	Asymmetric Index Vertical Hard Tissue	2.9993	15	.91955	.23743	

GROUP 2

		Mean	N	Std. Deviation	Std. Error Mean	P-Value
Pair 1	**Gonion Canting Soft Tissue**	1.100	15	.6036	.1558	.000
	Gonion Canting Hard Tissue	1.867	15	.4806	.1241	
Pair 2	**Chin Dev Soft Tissue**	.367	15	.4419	.1141	.000
	Chin Dev Hard Tissue	1.200	15	.3684	.0951	
Pair 3	**Asymmetric Index Horizontal Soft Tissue**	2.8967	15	1.51145	.39025	.000
	Asymmetric Index Horizontal Hard Tissue	4.0180	15	1.50490	.38856	
Pair 4	**Asymmetric index Vertical soft tissue**	2.6033	15	1.28285	.33123	.005
	Asymmetric index Vertical hard tissue	3.7300	15	1.79707	.46400	

GROUP 3

		Mean	N	Std. Deviation	Std. Error Mean	P-Value
Pair 1	**Gonion Canting Soft Tissue**	2.300	15	1.2071	.3117	.015
	Gonion Canting Hard Tissue	3.467	15	1.2882	.3326	
Pair 2	**Chin Dev Soft Tissue**	2.067	15	1.1629	.3003	.000
	Chin Dev Hard Tissue	3.000	15	1.1952	.3086	
Pair 3	**Asymmetric Index Horizontal Soft Tissue**	5.1373	15	2.30017	.59390	.003
	Asymmetric Index Horizontal Hard Tissue	6.9700	15	2.87610	.74261	
Pair 4	**Asymmetric Index Vertical Soft Tissue**	5.4973	15	3.99464	1.03141	.002
	Asymmetric Index Vertical Hard Tissue	7.5933	15	4.28796	1.10715	

Table 1 (a, b, c): Comparison between Soft Tissue and Hard Tissue Land Marks in 3 Groups

SOFT TISSUE

Dependent Variable			Mean Difference (I-J)	P-Value
Gonion Canting Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	1.6667*	.001
		Average Group 2	1.2000*	.001
Chin Dev Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	1.5333*	.001
		Average Group 2	1.7000*	.001
Asymmetric Index Horizontal Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	3.38600*	.001
		Average Group 2	2.24067*	.001
Asymmetric Index Vertical Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	3.19333*	.003
		Average Group 2	2.89400*	.007

HARD TISSUE

Dependent Variable			Mean Difference (I-J)	P-Value
Gonion Canting Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	2.2000*	.001
		Average Group 2	1.6000*	.001
Chin Dev Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	1.8333*	.001
		Average Group 2	1.8000*	.001
Asymmetric Index Horizontal Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	4.25200*	.001
		Average Group 2	2.95200*	.001
Asymmetric Index Vertical Soft Tissue	**Asymmetry Group 3**	Symmetry Group 1	4.59400*	.001
		Average Group 2	3.86333*	.001

Table (2a, 2b): Comparison of Soft Tissue and Hard Tissue Variables of Group 3 With Group 2 and 1

* The mean difference is significant at the 0.05 level.

DISCUSSION

Perfect bilateral symmetry seldom exists in living organisms. The facial symmetry is considered as the prime requisite for the esthetically pleasing faces. Always right and left side differences are present in nature. These slight facial asymmetries are acceptable esthetically. However, significant asymmetry may cause functional as well as esthetic problems.

In this study 45 subjects were selected by panel of five orthodontists to divide them in to three groups to remove any bias. Photographic and radiographic standardization were used for the subjects involved in this study.

Previous studies have usedpostero-anterior cephalograms to assess facial asymmetry in subjects.[7,8]Some studies were undertaken only for mandible using facial photograph and postero-anterior cephalogram.[9]Some studies were done in subjects with facial asymmetry but having skeletal symmetry.[10]So, the aims and objectives of our study were to assess the relationship between soft tissue asymmetry and bone tissue asymmetry using photographs and postero-anterior cephalograms and to investigate the contribution of soft tissue components compensating underlying skeletal imbalances.

In our study, soft tissue land marks were compared to hard tissue land marks in all 3 groups (Table 1 a, b and c) and result showed that skeletal discrepancy is more than soft tissue discrepancy. In group 3 with severe facial asymmetry this discrepancy was highly significant. Comparison of soft tissue land marks including gonion canting, chin deviation, asymmetry index horizontal and asymmetry index vertical of asymmetry group 3 with symmetry and average group was done and the result showed soft tissue discrepancy as well as skeletal discrepancy more in group 3 (Table 2a, and 2b). These results correlated with the study done using postero-anterior cephalogram by **Shah M et al.[11]**

The study assessed the relationship between soft tissue asymmetry and bone tissue asymmetry using the standardized photographs and the postero-anterior (PA) cephalometric radiographs. Severity of skeletal asymmetry is often masked by compensatory soft tissue contributions,our result showed statistically significant contribution of soft tissue compensation to camouflage skeletal asymmetry and these findings are the same as the studydone by **Lee SM et al[12],Lee et al[9]**and **NaoyaMasuoka etal.[10]**

Haraguchi et al[13]and Farkas et al[14]found that people considered to have symmetry and harmony in clinical examination were found to have some facial asymmetry in radiographic examinations in Class III. The results of our study were coinciding with the study of **Ferrario et al[15] and Haraguchi et al[13]** but our study did not consider any specific malocclusion.

The limitation of the present study was that it was carried out on a small sample of patients. Future studies can be carried out on an increased sample size.

CONCLUSIONS

Within the limitation of the study, following conclusions can be drawn:

- There is relationship between soft tissue component and skeletal component of facial asymmetry subjects.
- Assessment of facial asymmetry subjects using frontal photographs and skeletal asymmetry using postero-anterior cephalograms clarified that there is difference between soft tissue asymmetry and skeletal asymmetry of same subject. Skeletal asymmetry is greater than soft tissue asymmetry and soft tissue components compensate underlying skeletal imbalance.

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