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Impact of Bimaxillary Position on Esthetic Preferences among Health Professionals and Lay Persons

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Abstract

Background: Facial harmony and beauty make people attractive. One of the important parts that has a significant role in esthetics is the position of maxillary and mandibular bones. This study aimed to evaluate the effect of different positions of both jaws on esthetic preferences among health professionals and laypersons. **Materials and Methods:** Two colored photographs of a profile were selected among one-hundred patients by evaluating the soft tissue parameters. Photographs were changed with Onyx-ceph software. All soft tissue landmarks of lower 3rd part of the profiles were displaced in the horizontal plane by 2mm intervals relative to the true vertical plane. We selected different group of people as judges, who were lay persons (N=100), general dentists (N=100), plastic surgeons (N=25), orthodontists (N=25), and maxillofacial surgeons (N=24); and asked them to select their preferred profile and acceptable anterior and posterior limits. ANOVA and LSD post-hoc tests were carried out to determine the differences among the responses of groups. **Results:** No significant differences were found among the judges' opinion regarding the most attractive profile. Ranges for male photographs were statistically different in evaluators groups. A wider range was accepted for the male subject by plastic surgeons and general dentists which was significant comparing to laypersons (P<0.05). **Conclusion:** All of the evaluators selected the straight profile as the most preferred one. However, the range of acceptability was the narrowest in the layperson group in comparison with plastic surgeons and general dentists. Gender of the judges did not have an impact on their selections.

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Introduction

The impact of Facial attractiveness on desirable physical characteristics has been accepted for many centuries [1]. Some studies have shown that people from different areas with different cultures and ethnicities had little disagreement on facial attractiveness. It

has been shown that people with appealing features had enough self-confidence for social activities and were more successful [2-5]. Undoubtedly one of the main efforts of orthodontists is to achieve a more attractive face. Studies have reported that esthetic improvement was the major cause for orthodontic surgeries [6].

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Favorable outcomes of orthodontic treatments depend on placing the dentition correctly on the maxillomandibular skeleton to gain ideal soft tissue esthetics. Although class I occlusion (normal relationship of the molar, the mesiobuccal cusp of the upper molar occludes in the buccal groove of the lower molar) based on the Angle classification [6] is mostly the goal, it may not lead to a beautiful face. Despite the achievement of an ideal occlusion, some practitioners and patients are dissatisfied with the effect of their orthodontic therapies on profile esthetics [7,8]. In some cases practitioners felt that facial harmony had been sacrificed in favor of the correction of malocclusions. As a result in the new century soft tissue paradigm override the angle classification for occlusion. Some studies [9-11] tried to define the soft tissue profile preferences in a particular population. Dongieux *et al.* [9] stated that vertical and anteroposterior mandibular variations could influence the total soft tissue facial esthetics. Their result showed that a class III (lower molar mesially positioned relative to upper molar) open bite was not acceptable and the most favorite one was a class I normal profile [6]. Peck and Peck studied on the lay person's preferences for the profile of lip [10]. They admired a fuller lip profile. De Smit and Dermout concluded that anteroposterior characteristics in profile view had less impact on esthetic preferences than vertical pattern [11]. Bimaxillary position is a factor that influences profile perceptions. It is determined by different horizontal positions of both jaws in sagittal plane. Sometimes decisions for treatment of patients with such a problem may vary among orthodontist, surgeons and lay people from non-extraction, extraction or even surgical options.

Foster and colleagues conducted a study on different sagittal positions of lip by using silhouette [12]. Results showed that all groups agreed on the selection of more protruded lips for younger ages. Findings of the study by Farrow *et al.* [13] also showed that the profile with lips within 3.1 to 6 mm of glabella perpendicular was the most preferred ones among Afro-Americans. This profile considered more protrude in comparison with orthodontic norms. Other studies [14,15] reported

that the judges' and patients' race or ethnicity and sex had some effects on lay persons' preferences for the lip profile positions. As general population became more esthetically inclined, orthodontists have to consider the patients' opinion in their treatment planning. Since the concept of beauty is mostly subjective and race and sex have considerable effects on it, orthodontists should not simply meet the standards, presented by other races, without considering their own society.

To the best of our knowledge, there has been no study which has evaluated preferences of sagittal positions of jaws in Iranian population. The antero-posterior positions of jaws have a significant influence on the profile even if they are in a normal relationship to each other. The purpose of this study was to determine whether there are differences in the perception of bimaxillary protrusion and the preferences among lay people, general dentists, orthodontists, orofacial surgeons and plastic surgeons in our society. We also tried to determine the range of acceptability for every group of examiners to specify the sensitivity of each group on this matter to reduce over or under treatments and to determine effects of sex on patients and general dentists' ideas.

Materials and Methods

Selection of Photographs

Colored photographs of profile and lateral cephalograms of men and women who attended for treatment in the orthodontic department at Shiraz University of Medical Sciences, School of Dentistry, were selected by two orthodontists among 100 photographs of all patients referred to the clinics for alignments of their teeth those who have any sagittal or vertical skeletal malocclusion excluded. The pictures were taken in natural head position with digital camera (EOS 60D, Canon, Japan). The profiles were analyzed; using soft tissue parameters of Jacobson [16]. The Selected photographs had an ideal soft tissue profile (Table-1). This study was done from September 2012 to March 2013.

Modification of Photographs

The photographs and their lateral cephalo-

Table1. Cephalometric Parameters of the Ideal Male and Female Subjects According to Jacobson's Value

Parameters	Maxillary protrusion	Mandibular protrusion	Upper lip protrusion	Lower lip protrusion	Facial convexity angle	E line from		S line from	
						Ls	Li	Ls	Li
Normal Range	6±3mm	0±4mm	3±1mm	2±1mm	12±4 °	-4 mm	-2mm	0	0
Male	5mm	4mm	+2mm	0	15°	-6mm	-4mm	0	0
Female	4mm	0	+3mm	+1mm	9°	-4mm	-2mm	0	0

Ls: labrale superius. A point indicating the mucocutaneous border of the upper lip.

Li: labrale inferius. The median point on the lower margin of the lower memberanous lip.

grams were digitized with a scanner (Mircrotek Scanmaker i800, Tiawan). Using Onyx-ceph software (2D pro version, Germany) which is normally used for predictions in orthogenetic surgeries. Orthodontic treatments were applied to change the profiles as desired. The digital form of each patient's photograph and lateral cephalograms were uploaded in the program. All landmarks required for the treatment option simulation were pinpointed by an orthodontist. The landmarks of the lower 3rd (Sn, Sls, Ls, Li, Sts, Sti, Li, Ils, pog', Me') of profile were displaced on the horizontal plane by 2 mm intervals relative to the true vertical plane, assumed tangent to each landmarks. Displaying screen showed the positions of landmarks with accuracy of 0.1 mm in two directions of protrusion and retrusion. The result was 12 pictures with 12 mm displacement of bimaxila in the protrusion and retrusion positions. Then the pictures were created and printed (HP, Photosmart Premium C309G, Ca, USA) [13].

Two panels (white color, size 50×70cm) were constructed with 13 profiles on each of them for male and female subject in order from the most retruded to the most protruded. For ethical reasons, eyes of the subjects were concealed. The sizes of photographs were 11×15 cm (Figure-1).

Evaluation of Esthetic Preferences

The evaluators of this study were all health professionals who were available in Shiraz. Twenty five orthodontists, 25 orofacial surgeons, 25 plastic surgeons, 100 general dentists with some orthodontic back ground (50 male and 50 female) and 100 lay persons (50

male and 50 female). Lay people were selected randomly among patients who were in the waiting room of dental clinics; none of them received any orthodontic treatment. Evaluators were asked to concentrate on the profiles before answering, in a quiet room with adequate light for 5 minutes. They determined the preferred profile and the acceptable range that did not need any treatment among 26 profiles of male and female subjects, separately.

Statistical Analysis

Mean value and standard deviations (SD) for the preferred profiles and anteroposterior limits of acceptability were calculated for each group. The anterior and the posterior limits of acceptability were the most protruded and retruded profile that were acceptable, respectively. The differences between these means of limits determined each judge's range of acceptability (Table-2). Statistical analysis was done using SPSS software (Version 15.0, SPSS, Chicago, USA). Using ANOVA followed by the conservative LSD Post hoc Test different groups of the judges were compared with each other. T-test was used to compare the effects of gender. Range of acceptability was compared to the value defined by Jacobson as the range with T-test. Since this range was 6mm for maxilla (±3mm) and 8mm for mandible (±4mm), the mean of 7mm was considered for the bimaxillary range. Differences were significant at P<0.05.

Results

All evaluators completed a three-item questionnaire about their sex, age, and experience.

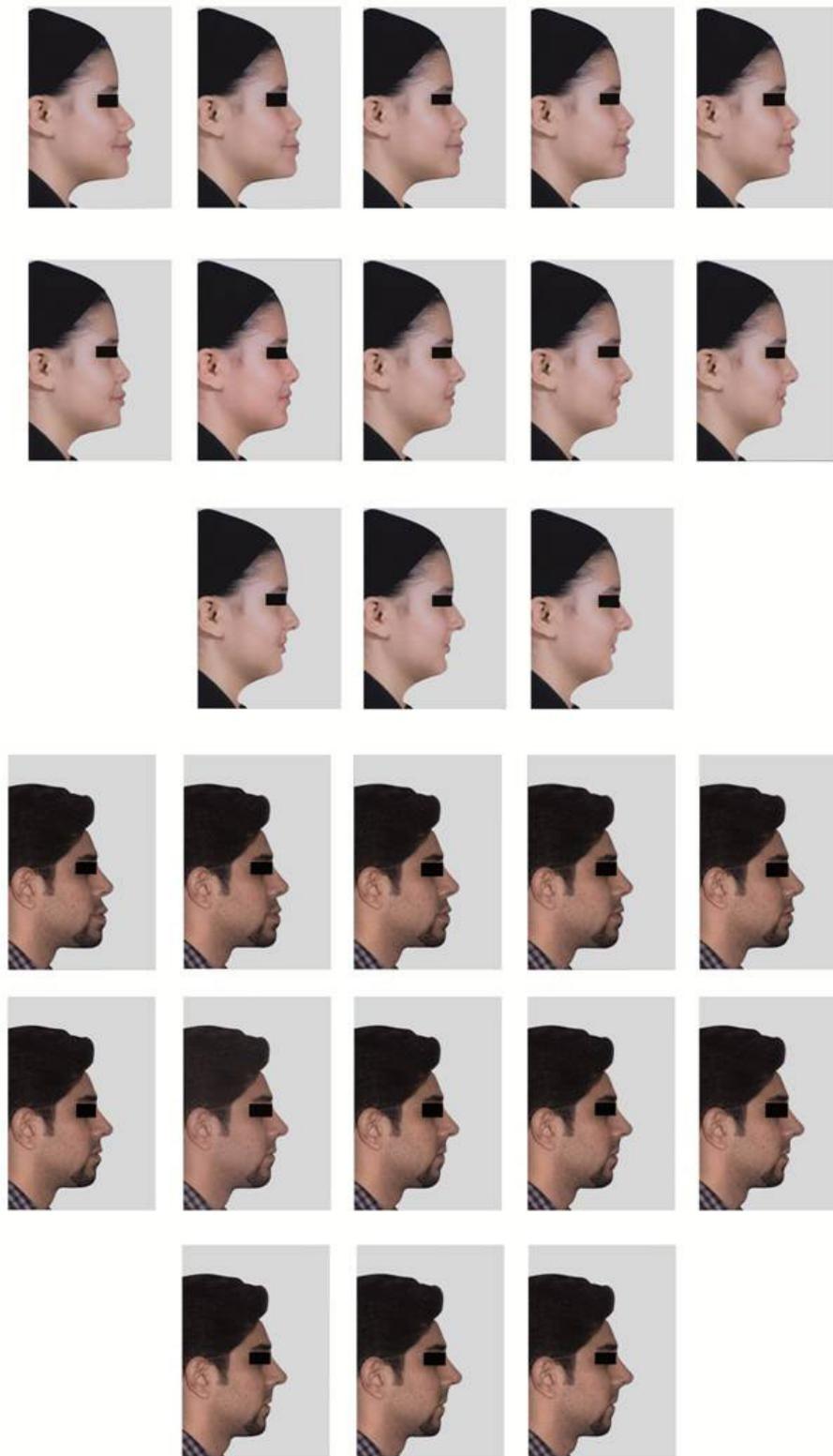
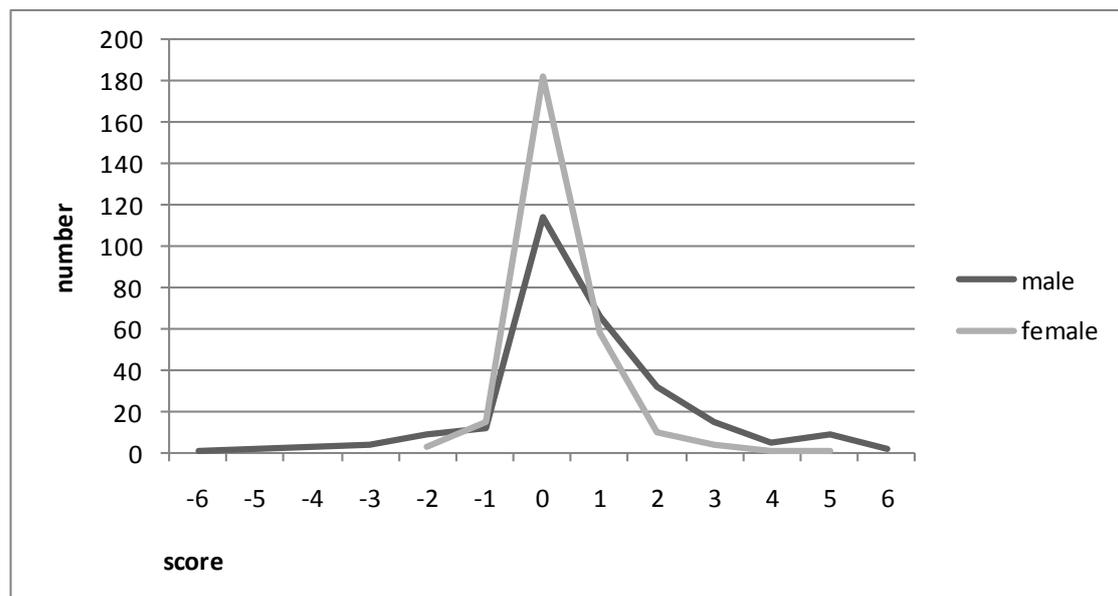


Figure 1. Series of Male and Female Profile from the Most Protrusion to the Most Retrusion One for Each Sex (12, 10, 8, 6, 4, 2, 0, -2, -4, -6, -8, -10, -12)

Table 2. The Preferred Profile, Range and Anterior-Posterior Limits of Acceptability by Distance of Displacement [Mean± SD (mm)] Among Evaluators

	Preferred Male	Profile Female	Anterior limit of acceptability	Posterior limit of acceptability	Range of acceptability
			Male/Female	Male / Female	Male / Female
General dentist	0.82 ± 1.83	0.27 ± 0.81	1.99± 1.58 /1.43±1.37	-2.01±2.14 / - .96±1.05	8.00±3.79/ 4.78±2.58
Orthodontist	0.56 ± 0.76	0.12 ± 0.52	2.20± 1.04 /1.44±0.76	-1.72± 1.67 / - .96±1.13	7.84±4.11 / 4.80±3.26
Plastic surgeons	0.92 ± 1.70	0.28 ± 0.67	2.72± 1.24/1.44±0.71	-1.72±2.30 / - .88±1.05	8.88±4.72 / 4.64±2.36
Maxillofacial Surgeons	0.58 ± 1.66	0.25 ± 0.53	2.08± 1.10 /1.54±0.65	-2.0±2.14/- .83±1.12	8.16±4.16 / 4.75±2.41
Public	0.49 ± 1.77	0.35 ± 0.94	1.67±1.6 / 1.29±0.97	-1.66±1.92 / - .94±1.10	6.66±3.25 /4.48±2.41
P-value	0.63	0.78	0.026* / 0.81	0.77 / 0.98	0.03* / 0.93

*Significant to at least P<0 .05

**Chart 1.** Mode for Preferred Profile of Male and Female Subject

Mean age of judges were 33.5 years old, and their mean experience were 5.5 years for general dentists, 12.5 years for plastic surgeons, 9 years for orthodontist and 8 years for maxillofacial surgeons.

Considering the preferred profile, there

were no differences among different groups of judges. However, the mode for selected profiles between male and female subjects showed that the most attractive profile for the male was more distributed (Chart-1). Comparing the selected anterior and posterior lim-

its among different groups, plastic surgeons considered more protruded profiles acceptable only in male subject ($P<0.05$). There were no differences among the groups for selected posterior limits of acceptability. The range of acceptability was different in male photographs ($P=0.03$). The narrowest range of acceptability was in the lay persons group which was significantly narrower in comparison with plastic surgeons and general dentists, $P=0.09$ and $P=0.12$ respectively (Table-3). In general, the zone of acceptability was nar-

rower for the females in comparison to the males; however, it was not statistically significant. There were no sex differences among evaluators in esthetic preferences of the ideal profile, anterior and posterior limits of acceptability.

Comparison of total range of acceptability to the range defined by Jacobson for bimaxillary soft tissue horizontal position showed that a small zone was accepted for the female subjects which was statistically significant ($P<0.005$; Table-4)

Table 3. Analysis of Variance and LSD Test for Preferred Profile, Range of Acceptability and Anterior-Posterior Limits of Acceptability

Source	Total Mean \pm SD (Male)	Total Mean \pm SD (Female)	P value (Male)	P value (Female)	Post hoc Test (LSD)
Preferred profile	0.66 \pm 1.71	0.28 \pm 0.81	0.637	0.783	
Anterior limit of acceptability	1.97 \pm 1.50	1.39 \pm 1.08	0.026*	0.816	1-3 , 3-5
Posterior limit of acceptability	-1.83 \pm 2.03	-0.94 \pm 1.10	0.777	0.987	
Range of acceptability	7.59 \pm 3.81	4.65 \pm 2.58	0.030*	0.939	1-5 , 3-5
Judge groups	1=General dentist 4=Maxillofacial surgeon	2=Orthodontist 5= Public	3=Plastic surgeon		

*Significant to at least $P<0.05$

Table 4. Comparison of the Mean \pm SD and Mean Differences of Groups' with the Jacobson's Average Value for Range of Bimaxillary Position

	Female patient			Male patient		
	Mean \pm SD	Mean difference	P value	Mean \pm SD	Mean difference	P value
General dentist	4.78 \pm 2.58	-2.22	<0.001*	8.00 \pm 3.79	1.00	0.10
Orthodontists	4.80 \pm 3.26	-2.20	0.003*	7.84 \pm 4.11	0.84	0.31
Plastic surgeons	4.64 \pm 2.36	-2.36	<0.001*	8.88 \pm 4.72	1.88	0.58
Maxillofacial surgeons	4.75 \pm 2.81	-2.25	0.001*	8.16 \pm 4.16	1.16	0.18
Public	4.48 \pm 2.41	-2.52	<0.001*	6.66 \pm 3.25	-0.34	0.29

*Significant to at least $P<0.05$

Discussion

The main goal of this study was to determine the most attractive and range of acceptable profiles based on the amount of bimaxillary protrusion among 5 groups of lay persons, general dentists with some orthodontic knowledge, orthodontists, maxillofacial and plastic surgeons. There were no significant differences among all the health professionals' opinions in selecting the most ideal profiles. They all preferred the straight profile in women and men subjects. It can be explained by the fact that they had been exposed to the norms illustrated in the literature as average. In most studies the average for the soft tissue profile parameters were calculated from the Caucasian samples with straight profiles [17,18]. On the other hand, there are some studies based on "excellent" occlusion and faces not even "average". For example Stieners' sample was selected by orthodontist considering good facial esthetic without even considering ethnicity [17]. Although De Smit *et al.* reported that orthodontics knowledge had no significant effect on esthetic preferences [11]. Foster's study showed that orthodontists had different esthetic concerns at least in the profiles of lips [12]. Also Ioi *et al.* declared that Japanese orthodontists had different esthetic preferences in comparison with dental students [19]. Surprisingly, comparing the lay person evaluators of Iranian origin also showed that esthetic selections may not be based on education and has specific pattern at least for bimaxillary protrusion. Although the results of this study cannot be generalized to the whole population, it indicates that the standards which orthodontists used for ideal bimaxillary position is based on current socially acceptable esthetic standards. It seems that most of the normal profiles in our population without skeletal malocclusion are straight and close to Caucasian norms but Iran is multi-tribal with respect to bimaxillary protrusion. The south parts have a tendency to protrusion, more close to Arab world and the north parts have tendency for a more retruded profile, close to European. This may even change the opinion of the samples considering the region of their selection. However, this would need an

extended study to be evaluated. Forrow *et al.* showed that black American preferred a more protruded profile for male and female subjects [13]. However, according to Deloach, the lay persons' esthetic consideration may be based on facial features other than the profile, since their study revealed that blacks prefer a flatter profile [20]. Also, Martin found that there is no difference in preferences between white and African judges [21]. Cross and Cross, s study revealed that the white faces were rated higher than the black [22]. As stated by Martin, studies conducted in multi-ethnic societies could be influenced by the coexistence of diverse ethnic norms [21]. However, Mejia Maidl *et al.* showed that Mexican American judges preferred a more retruded profile in comparison with judges [23]. The ethnicity of subjects, the judges and society could definitely have an impact on the esthetic preferences. In this study we found that the range of acceptability for bimaxillary protrusion and retrusion was wider for surgeons and general dentists than orthodontists and laypersons with the narrowest for lay persons surprisingly. Cost benefit considerations for surgical corrections may have influenced the surgeons' opinion.

Hier *et al.* also showed the effect of self-perception on the magnitude of this zone. Judges who rated themselves higher had a wider range of acceptability [24]. Also Nomura *et al.* showed that African-American had the widest and European American had the narrowest zone of acceptability [14]. The standard range for soft tissue bimaxillary protrusion and retrusion [16] is not in accordance with current socially defined zone of acceptability, especially for female subject, hence, a significantly smaller zone was selected. Therefore these standards should be used only as a guide for orthodontic treatment planning. Hier *et al.* declared that their judges in the study had the ability to differentiate <1 mm of changes in soft tissue, which is more applicable by using video imaging technique rather than photographs [24]. Herein, we had 2 mm changes in each photograph that may have decreased the sensitivity. This brings to mind that conducting a study to evaluate the effect of different increments of profile distortions on judgments

maybe valuable. The use of silhouettes has the benefit of not having distracting information during judgment, but specification of sex differences is harder in comparison to photographs. However, the beard of the male photograph in this study may have concealed some characters of the lower 3rd of the profile, which could be considered as a limitation.

Conclusions

There were no differences in ideal profile among groups, all preferred straight profile as the most attractive one and the range of acceptability was different among groups for male photographs. Also, no differences were found in posterior limit of acceptability for male and female subjects. Anterior limit

of acceptability was more protruded in male subjects for the plastic surgeons and general dentists in comparison to lay persons. This difference was statistically significant. We also concluded that the gender of judges did not influence esthetic preferences.

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