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Clinicians and laypeople assessment of facial attractiveness in patients with cleft lip and palate treated with LeFort I surgery or late maxillary protraction

Eun Hee Chung, DDS¹, Ali Borzabad-Farahani, DDS, MScD, MOrth, RCS(Ed)², and Stephen L-K Yen, DMD, PhD³

¹Formerly, Pediatric Dentistry, Herman Ostrow School of Dentistry, University of Southern California, Los Angeles, CA, USA

²Orthodontics, Warwick Dentistry, Warwick Medical School, University of Warwick, Coventry, UK; Formerly, Craniofacial Orthodontics, Children's Hospital of Los Angeles; Center for Craniofacial Molecular Biology, University of Southern California, Los Angeles, CA, USA

³Craniofacial Orthodontics, Children's Hospital of Los Angeles; Center for Craniofacial Molecular Biology, University of Southern California, Los Angeles, CA, USA

Abstract

Objective—To assess the changes in the Facial Attractiveness (FA) in two groups of cleft lip and palate patients with Class III malocclusions treated using LeFort I surgery or late maxillary protraction.

Materials and Methods—Standardized pre- and post-treatment photographs were taken of 32 patients (17 corrected by orthognathic surgery and 17 by late maxillary protraction). The photographs were randomized and 42 clinicians and 121 laypeople rated them on a 10-point FA scale via a web-based survey.

Results—Clinicians' mean FA values increased from 4.45 to 5.16 [95% CI of Mean Difference (MD), 0.59–0.82, $p < 0.001$] in surgical cases and 4.84 to 5.30 (95% CI of MD, 0.35–0.56, $p < 0.001$) in protraction cases. The laypeople mean FA values increased from 5.07 to 5.54 (95% CI of MD, 0.40–0.53, $p < 0.001$) in surgical cases and 5.51 to 5.68 (95% CI of MD, 0.11–0.23, $p < 0.001$) in protraction cases. When patients combined, laypeople rated FA 0.64 points higher (95% CI, 0.54–0.74, $p < 0.001$) in pre-treatment and 0.38 points higher (95% CI, 0.27–0.48, $p < 0.05$) in post-treatment relative to clinicians.

Conclusion—Both clinicians and laypeople perceived an improvement of FA after both treatments. Laypeople rated FA higher compared to clinicians.

Keywords

Facial attractiveness; Cleft lip and palate; Class III malocclusion

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Corresponding author: Stephen Yen, DMD, PhD, Craniofacial Orthodontics, Division of Dentistry, Children's Hospital of Los Angeles, 4650 sunset BLVD, Los Angeles, CA 90027, USA, Tell/fax: 001 323-361-2130, syen@usc.edu.

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Introduction

Patients with cleft lip and palate have a high incidence of Class III malocclusion. These patients undergo many surgeries throughout childhood. These surgical revisions may result in increased tissue scarring and impairment (1). The resulting scar tissue can restrict the downward and forward growth of the maxilla resulting in a retruded position maxilla and a Class III malocclusion (2). As a result, standardized concepts of beauty, such as symmetry and average facial proportions (1), may not readily apply to patients with cleft lip and palate. However, the desire to improve facial aesthetics is one of the main reasons people seek treatment by an orthodontist (3–6) or oral surgeon (7–10), including patients with cleft lip and palate. The goal of orthodontic treatment includes well-aligned dental arches in an ideal occlusal relationship, as well as a balanced and proportional face that is aesthetically attractive. Successful orthodontic treatment has been deemed important for a child's social popularity and subsequent success in future careers (11).

It is important that differences in the perception of Facial Attractiveness (FA) between clinicians and laypeople to be more thoroughly understood as facial aesthetics is an important component of the treatment-planning process (12). The lateral cephalometric norm values correlate with facial aesthetics, but cannot be the sole factor for a complete evaluation of facial attractiveness. Consequently, it is essential that orthodontists and oral surgeons understand how laypeople perceive FA and the outcome of treatment to determine which treatment option may result in better perception of facial aesthetics.

Contradictory reports exist in the literature on whether there is agreement between clinicians and the laypeople in their perception of facial aesthetics. Some studies have reported general concordance between clinicians and the public (13–15); whereas, other studies have reported the two groups perceive facial aesthetics differently (16–19). The conventional treatment of patients with cleft lip and palate for the Class III dentoskeletal malocclusion include LeFort I maxillary advancement surgery or the non-surgical orthodontic approaches, i.e., late maxillary protraction. The late maxillary protraction therapy is based on the work of Eric Liou (20), using a combination of maxillary sutural loosening (i.e., with an expander by the alternate expansion and constriction of the maxilla) and protraction (with reverse headgear) to advance the maxilla (21,22). The objectives of the study were to (I) evaluate the FA perception of clinicians and laypeople in evaluating patients with cleft Lip and palate that were treated with orthognathic-surgery (LeFort I) or late maxillary protraction, (II) to compare the perceptions of FA between clinicians and laypeople, and (III) to assess the changes of FA in both groups.

Materials and Methods

After Institute Review Board (IRB) approval of the study, the sample population was randomly selected from the list of cleft lip and palate patients who received treatment at Children's Hospital Los Angeles (CHLA). The sample consisted of 17 orthognathic-surgery corrected patients with cleft lip and palate, and 17 late maxillary protraction corrected patients with cleft lip and palate. The Inclusion criteria for the patients were, treated patients with unilateral and bilateral cleft lip and palate with a Class III malocclusion, which were treated at CHLA. The rater population consisted of 42 clinicians and 121 laypeople. The clinician-rater group included orthodontists, pediatric dentists, general dentists, oral maxillofacial surgeons, craniofacial geneticists, craniofacial plastic surgeons, and otolaryngologists. The lay-rater group included registered nurses, anesthesia nurses, technicians, front and back office staff, and administrative staff from all departments of CHLA. The rater group was accessed via the CHLA email list-serve.

Assessment of facial attractiveness

A set of three standardized pre-treatment color photographs and a set of three standardized post-treatment color photographs were presented of each patient: full frontal, full frontal smiling, and profile view (Fig. 1). In order to eliminate identifiable information from being linked to the patient photographs, the eyes were blocked out.

Pre- and post-treatment photographs were presented in a randomized order to the raters via an online survey. For the present study, an internet-based method (www.surveymonkey.com) was used (23). Randomization of the pre- and post-treatment photographs was performed to prevent systematic bias. The raters were asked to rate the FA of the photographs on a discrete scale between 1 (very unattractive) and 10 (very attractive) (Fig. 2). The raters were asked to take no more than 10 seconds to rate each set of photographs. The FA values were divided into 3 categories:

1-Scored <4 were considered 'aesthetically unattractive'.

2-Scored 4 and <7 were considered 'aesthetically acceptable'.

3-Scored 7 were considered 'aesthetically pleasant'.

Rater reliability

In order to assess the reliability of evaluators, a Kappa analysis was performed. Cronbach's α is a coefficient of reliability and greater than 0.95 is considered to be highly reliable. The reliability of the 42 clinicians rating 34 pre-treatment photos was 0.962 (Cronbach's- α) and 0.974 for post-treatment photos. The reliability of 121 laypeople's FA rating 34 pre-treatment photos were 0.983 and 0.987 for post-treatment photos. These demonstrated the raters were highly reliable.

Statistical analysis

SPSS 12.0 for Windows was used for all statistical analyses. Statistical analyses were performed on the FA ratings of clinicians and laypeople. After analyzing the distribution of the data, the FA ratings were analyzed with a multiway Analysis of Variance Repeated Measures (ANOVA) to test for differences between: clinicians vs. laypeople, surgery vs. protraction, and pre-treatment vs. post-treatment. The mean [Standard Deviation (SD)] of the pre- and post-treatment FA ratings for surgery and protraction groups as well as the 95% Confidence Intervals (CI) of differences were calculated.

Paired t-tests were performed to determine the direction of change, as a result of treatment in all patients combined, the difference between pre-treatment and post-treatment ratings (in clinicians and laypeople), and to compare the attractiveness of the initial as well as the final photographs of the cleft lip and palate patients. Then, independent t-tests were performed to evaluate clinicians vs. laypeople ratings of pre- and post-treatment photographs. The significance level was set at 0.05.

Results

According to the ANOVA tests, there were statistically significant differences in facial attractiveness ratings between the clinicians and laypeople ($F=25347.874$, $p<0.001$), between surgery and protraction ($F=89.925$, $p<0.001$), and between pre-treatment and post-treatment ($F=229.352$, $p<0.001$).

The mean (SD) pre- and post-treatment FA ratings for clinicians were 4.64 (1.54) and 5.23 (1.74), respectively. The corresponding values for laypeople were 5.29 (1.73) and 5.61

(1.83), respectively. The paired t-test indicated there were statistically significant differences in FA perception between pre-treatment photo ratings and post-treatment photo ratings (all patients combined) by clinicians ($p<0.001$) and laypeople ($p<0.001$). Clinicians rated post-treatment photographs 0.58 points higher (95% CI, 0.50–0.66) than pre-treatment photographs; laypeople rated post-treatment photographs 0.32 points higher (95% CI, 0.27–0.36) than pre-treatment photographs.

The paired t-tests also showed there were statistically significant differences in FA between pre-treatment and post-treatment photograph ratings for the surgical ($p<0.001$) and protraction ($p<0.001$) groups, according to clinicians and laypeople. Evaluation by clinicians showed the mean attractiveness value increased from 4.45 to 5.16 (mean difference= 0.71, 95% CI, 0.59–0.82) in surgical cases and 4.84 to 5.30 (mean difference=0.46, 95% CI, 0.35–0.56) in protraction cases. The mean attractiveness value increased from 5.07 to 5.54 (mean difference=0.47, 95% CI, 0.40–0.53) in surgical cases and 5.51 to 5.68 (mean difference=0.17, 95% CI, 0.11–0.23) in protraction cases for laypeople.

The Independent t-tests revealed that for the pre-treatment photographs, both rater groups (clinicians and laypeople) observed significant differences ($p<0.001$) in FA ratings between surgery and protraction (Table 1).

The independent t-test also showed there were significant differences between clinicians' and laypeople's ratings of patients (surgery and protraction combined), both pre-treatment (equal variances not assumed, $p<0.001$) and post-treatment (equal variances not assumed, $p<0.001$). Overall, laypeople rated 0.64 points higher (95% CI, 0.54–0.74) in the pre-treatment cases and 0.38 points higher (95% CI, 0.27–0.48) in the post-treatment cases in comparison to clinicians (Table 2).

Discussion

The cleft deformity often affects the facial appearance with scar tissue formation (24) and creating facial asymmetry, particularly in the nasolabial region (25). The resultant facial deformity can reinforce or induce a social stereotype in first impressions (26) and the individual's behavior can be different when encounters those with unsightly appearances (26,27). These negative effects of facial deformity tend to increase as the patient ages (28,29). Further, alongside the functional improvement following treatment, the self-perceived improvement in facial appearance also plays a strong positive role in the quality of life and patient satisfaction (30,31). Therefore, assessment of facial aesthetics is important and various methods such as comparisons of photographs or digitally enhanced images, as well as graduated scales have been used to evaluate the facial aesthetics (27). However, there is no gold standard or standardized method, as each method has its own pros and cons (27). The Internet-based survey that was used had several advantages (23). This method increased the data collection (rater count) and rate of data accrual and analysis; the results were reproducible and logistical and monetary obstacles were eliminated. This method also enables the experimenter to sweep broad demographics.

Due to the lack of objective system to assess the facial aesthetics (32) and the subjective nature of the present study, it is difficult to eliminate biases and this could be a possible limitation of the study. Evaluators can be influenced by factors other than those, which primarily concern clinicians (i.e., hair and skin color and skin texture can influence the assessment of facial attractiveness). In this study, the standard photos taken in the CHLA were used to reduce some of these biases.

This was unfortunate, to learn that from pre- to post-treatment the mean attractiveness value for patients stayed in their same group, i.e. acceptable aesthetics. In fact, the mean scores did

not move much closer towards the group of pleasant aesthetics (7 to 10). This is rather interesting in that despite the rather intense and aggressive treatment, for some reason, these patients were not altered a great deal in terms of the facial attractiveness. The present findings highlight the importance of assessing the different part of the face in terms of facial attractiveness, ie., the forehead, nose, lips, chin, and submental-cervical region (33). Ideally, assessment of FA should evaluate and score all 5 mentioned regions; however, the available FA assessment tools either assess the face as a whole, as this study, or assesses one or a few regions, but not all of them. Previous studies on facial attractiveness are either report on self-rating of patient/parents (32,34–36) or professional assessment (32,37,38) of patients with cleft lip and palate. These studies mainly use Likert/discrete scales (36), as this study, or visual analogue scales (32,35). Orthognathic surgery and orthodontics may have improved the skeletal relationship in patients with cleft lip and palate, but they did not improve the overall facial attractiveness much. This is probably because of the status of their lips and nose that has not been affected much by orthodontics or orthognathic surgery. In particular, the preferred choice of lip fullness can vary depending on the jaw relationships (33,39). It has been noted that clinicians and laypeople preferred fuller lip positions for the more extreme retrognathic and prognathic profiles; however, they preferred more retrusive lip positions for the more average profiles (33,39). The nose has been recognized as the least aesthetic element of facial morphology (25,26, 40,41). Future studies can measure facial attractiveness based on facial proportions, scarring, skin quality, ethnicity, employ indices such as the one developed by Asher-McDade et al. (42), which is more limited to the assessment of nasolabial region, or gather information on the attractiveness of different components of the face such as forehead, nose, lips, chin, submental-cervical region, jaw relationships, or smile dynamics (32).

One of the objectives of treatment of patients with cleft lip and palate is to improve the aesthetic appearance of the face as well as the patient's social acceptability (25). Overall, the findings of this study showed the FA improved by both treatment modalities, as reflected in the post-treatment scores of higher than 4 in both groups. Clinicians and laypeople observed a general improvement in FA from pre- to post-treatment of all patients, regardless of surgery or protraction (Fig. 3). Furthermore, the change was greater for surgery. There are confounding factors that need to be considered, such as the initial severity of the Class III malocclusion in the patients with cleft lip and palate, and the patients' age. Evaluation of FA in LeFort I surgery patients resulted in a greater difference between pre- and post-FA values (Fig. 4) in comparison to protraction patients. The starting values may account for the overall difference between pre- and post-treatment values. According to the raters, the starting point was lower for surgery patients, which meant the protraction patients started with faces that were more attractive. As a pre-treatment comparison of the groups was not performed in this study, an assumption that could be made from the data was that perhaps the surgery cases were more difficult cases, and the protraction cases were probably less severe cases. This may be pointing to the presence of selection bias. Future studies can compare and match the pre-treatment photographs, objectively using indices or soft-tissue analysis, to assess whether both treatments produce similar FA outcomes. However, matching the groups is difficult as there is no standardized objective system to assess all aspects of the facial aesthetics (32). Overall, the results did not state that one treatment type was preferred better to the other.

The results of the direct comparison of clinicians' ratings to laypeople's ratings indicate that laypeople generally rate FA higher than clinicians do. This is similar to the findings of studies that showed a difference between the perceived facial aesthetics of clinicians and laypeople (16–19). Clinicians are more critical in rating aesthetics and may be looking for different facial attributes, compared to laypeople (43), which are usually influenced by clinicians' training and experience (32). Review of the literature points out that the

perception of nasolabial appearance differs among professionals, lay people, and patients (19, 32). Another possible limitation of the study is that the laypeople's sample may have some previous knowledge of the problem, and future studies can employ subjects from a wider community without this previous knowledge to comprise a more valid laypeople opinion (32). The findings of this study are important as the decision to perform cosmetic surgery to correct or enhance the patient's face should not be based only on surgeons or professionals' preference, but also on the patients' and the parents' perception of facial aesthetics.

Conclusion

Both clinicians and laypeople perceived an improvement of FA from pre-treatment to post-treatment photographs for both treatments. Laypeople in this study rated FA higher in patients with cleft lip and palate compared to clinicians.

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Figure 1.
Set of 3 standardized photos used in the survey.



Figure 2.

An example of photo shown on the online survey with a discrete scale. Participants were asked to spend no more than 10 seconds and rate the patient's facial attractiveness. Very unattractive and very attractive correspond to 1 and 10, respectively.

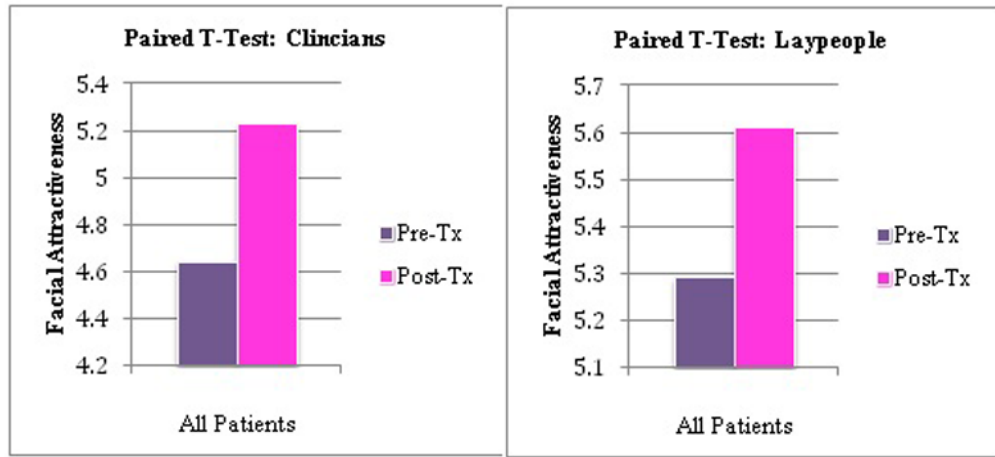


Figure 3. The pre- and post-treatment facial attractiveness ratings of all patients combined according to laypeople and clinicians.

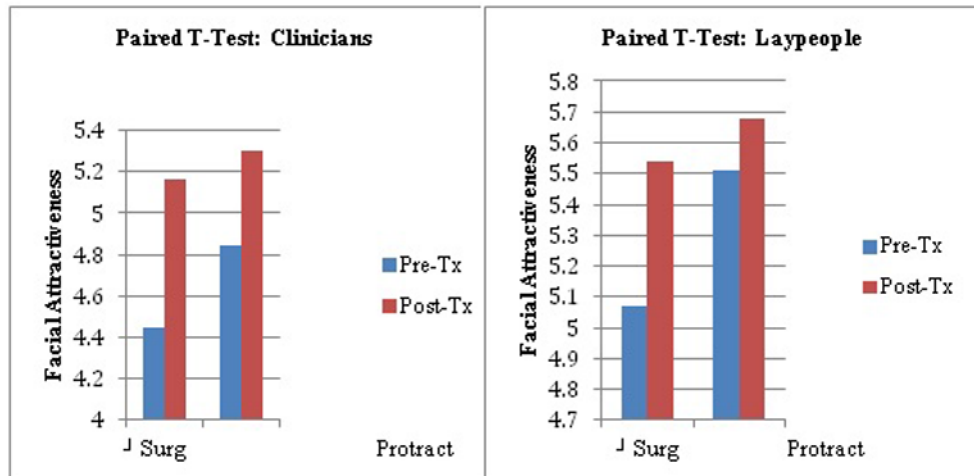


Figure 4. Pre- and post-treatment facial attractiveness ratings of surgery and protraction groups by laypeople and clinicians.

Table 1

Facial attractiveness ratings in two treatment groups (surgery and protraction)

Evaluator		Number of evaluations	Mean (SD)
Clinicians Pre-Tx	Protraction	714	4.84 (1.48)
	Surgery	714	4.45 (1.58)
Clinicians Post-Tx	Protraction	714	5.30 (1.70)
	Surgery	714	5.16 (1.77)
Laypeople Pre-Tx	Protraction	2057	5.51 (1.71)
	Surgery	2057	5.07 (1.73)
Laypeople Post-Tx	Protraction	2057	5.68 (1.79)
	Surgery	2057	5.54 (1.87)

Table 2

Facial attractiveness ratings in clinician and laypeople

	Evaluator	Number of evaluations	Mean (SD)
Pre-Tx	Clinicians	1428	4.65 (1.54)
	Laypeople	4114	5.29 (1.74)
Post-Tx	Clinicians	1428	5.23 (1.74)
	Laypeople	4114	5.61 (1.83)