

Comparative Assessment of the Cleft Profile by Patients with Cleft Lip and Palate, Cleft Surgeons, and Lay People

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Abstract

Background This cross-sectional study aimed to compare subjective assessments among patients with cleft lip and palate (CLP), cleft surgeons, and lay people regarding the soft tissue lateral profile of CLP patients. We also investigated the correlations between subjective assessments and photogrammetric measurements.

Methods A total of 150 CLP patients who wished to have treatment for their unattractive appearance were randomly selected. A standard lateral profile color photograph was taken. Panels of three cleft surgeons, ten CLP patients, and ten lay people were selected to be assessors. They rated nasal tip projection, nasolabial esthetics, upper and lower lip esthetics, and the profile for each photograph. Three angular measurements (nasal prominence angle, nasolabial angle, and lip angle) were measured for each photograph. Kendall's coefficient of concordance and logistic regression were used for statistical analysis.

Results Kendall's coefficient of concordance of nasal tip projection, nasolabial esthetics, upper and lower lip esthetics, and the profile were 0.734, 0.683, 0.828, and 0.747, respectively ($p < 0.001$). Lip angle was associated

with the profile scores for cleft surgeons and CLP patients ($p < 0.001$). The nasal prominence angle and lip angle were associated with the profile scores for lay people ($p < 0.001$).

Conclusions CLP patients, cleft surgeons, and lay people have similar attitudes to the appearance of CLP patients. Upper and lower lip esthetics is associated with the assessment of the cleft profile that is provided by CLP patients, cleft surgeons, and lay people. In addition, nasal tip projection is another determining factor for lay people.

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Keywords Cleft lip and palate · Photogrammetry · Panel assessment

Introduction

Cleft lip and palate (CLP) is one of the most common congenital craniofacial anomalies. CLP patients are considered to be more inhibited and less social because of their deformed appearance. Their self-confidence and self-esteem are affected [1–3]. Therefore, a major goal of surgical management is to make the facial appearance as normal as possible and improve social acceptance in CLP patients.

Subjective panel assessment is an important method to assess appearances. A panel of more than one person provides assessment based on a type of scale or subjective feelings. This method is reliable [4]. Assessors can be CLP patients, professionals who work closely with CLP individuals, and lay people. Their opinion regarding esthetics

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of appearance needs to be determined because it may influence preoperative counseling, surgical plans, and treatment outcomes. Many studies have focused on this issue. Some research has emphasized subjective assessment of facial satisfaction between professionals and CLP patients or between professionals and lay people [5–10]. No studies have focused on comparative assessments among CLP patients, professionals, and lay people at the same time. Some studies investigated the correlations between subjective assessments of professionals and soft tissue measurements [11, 12], but there are no studies on CLP patients' and lay people's perspectives.

This cross-sectional study aimed to compare subjective assessments among CLP patients, cleft surgeons, and lay people regarding the soft tissue profile of CLP patients. This study also aimed to determine the correlations between subjective assessments and photogrammetric measurements.

Methods

In this cross-sectional study, panels of three cleft surgeons, ten CLP patients, and ten lay people were selected to rate 150 standard lateral color photographs from CLP patients. Angular measurements were measured for each photograph.

Selection of Photographs

A total of 150 standard lateral profile color photographs of CLP patients were randomly selected. They originated from CLP patients who were treated at our hospital who complained about their unattractive appearance from 2001 to 2014. All of the patients were Chinese. The sample consisted of 55 men and 33 women, all of whom were older than 18 years. None of them had craniofacial or other syndromes. Some of them were treated with alveolar bone grafting and orthognathic surgeries, whereas others did not receive these procedures. Their lips or noses were corrected at least 3 months after alveolar bone grafting or 6 months after orthognathic surgeries.

The photographs were taken according to requirements provided by Ettore et al. [13]. The photographs were taken by professional photographers. Patients were informed that their photographs were being used for research purposes, and written informed consent for this purpose was obtained from all of the patients.

Assessors

Assessors included CLP patients, cleft surgeons, and lay people. All of the assessors were Chinese. Ten CLP

patients who visited our hospital complaining of nasolabial deformities were selected as assessors. They had lateral or bilateral cleft lip and/or palate and had primary cleft repairs. They were older than 18 years, did not work in any medically related profession, had no craniofacial or other syndromes, and did not have hearing or visual impairment, mental retardation, or communicational disorders. Sociodemographic characteristics of CLP patient assessors are shown in Table 1.

Three cleft surgeons who were familiar with CLP patients from our hospital were selected as assessors. They did not treat CLP patients who provided photographs. Sociodemographic characteristics of cleft surgeons are shown in Table 2.

The panel of lay people consisted of ten persons. They did not have CLP, were older than 18 years, did not work in any medically related profession, and did not have hearing or visual impairment, mental retardation, or communicational disorders. None of them were relatives of CLP patients who provided photographs. Sociodemographic characteristics of lay people are shown in Table 3. Lay people included an engineer, a civil servant, an accountant, a housewife, an editor, a bank clerk, an IT practitioner, an architecture student, and two teachers.

Panel Assessments

All of the assessors provided written informed consent that all of the photographs were used for research purposes only. The photographs were projected onto a screen 100 cm in front of the assessors for 30 s. The 150 photographs were presented to each assessor in random order. The assessors were asked to look at each photograph and rate nasal tip projection, nasolabial esthetics, upper and

Table 1 Sociodemographic characteristics of CLP patients as assessors

Characteristics	Number
Sex	
Female	4
Male	6
Age (years)	
20–25	6
26–30	4
Level of education	
Middle school	2
Bachelor degree	6
Higher than a Bachelor degree	2
Type of cleft	
Lateral CLP	7
Bilateral CLP	3

Table 2 Sociodemographic characteristics of cleft surgeons

Characteristics	Number
Sex	
Female	2
Male	1
Age (years)	
35–36	3
Level of education	
Bachelor degree or higher	3

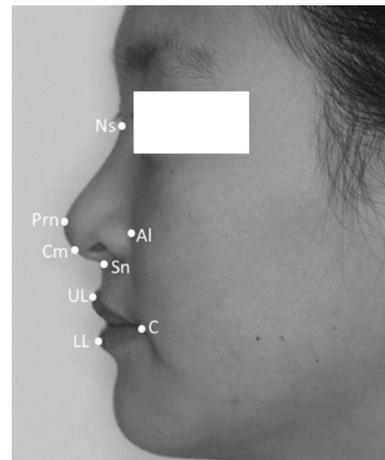
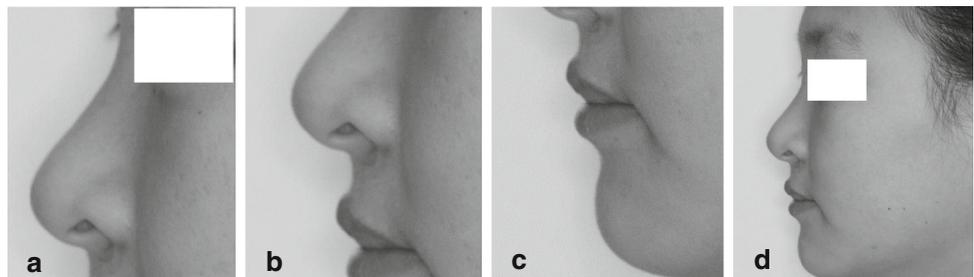
Table 3 Sociodemographic characteristics of lay people

Characteristics	Number
Sex	
Female	4
Male	6
Age (years)	
20–25	3
26–30	5
31–35	2
Level of education	
Middle school	3
Bachelor degree	4
Higher than a Bachelor degree	3

lower lip esthetics, and the profile (Fig. 1a–d) on a three-point scale: 1 = unsatisfactory, 2 = basically satisfactory, and 3 = satisfactory. The final score of each photograph depended on the majority of scores provided by assessors. All of the photographs were divided into three groups according to their final scores. Group 1 had a final score of 1, group 2 had a final score of 2, and group 3 had a final score of 3.

Photogrammetric Analysis

The landmarks (Fig. 2) and angular measurements (Table 4) for each photograph were calculated as described

Fig. 1 a Nasal tip projection, b nasolabial esthetics, c upper and lower lip esthetics, and d the profile**Fig. 2** Landmarks digitized in soft tissue profile analysis. *Ns* soft tissue nasion, the deepest point in the frontonasal curve, *Prn* pronasale, the most prominent point on the apex of the nose, *Al* the ala point, the tangent point of the tangent to the *Ns* and the ala, *Sn* subnasale, the deepest point in the nasolabial curvature, *Cm* columella point, the most anterior point on the columella of the nose, *UL* upper lip point, the most prominent point on the prolabium of the upper lip, *LL* lower lip point, the most prominent point on the prolabium of the lower lip, *C* corner of the mouth point, the crossover point of the upper lip and lower lip**Table 4** Calculated angular measurements

Variable	Definition
Nasal prominence angle	$\angle Al-Ns-Prn$
Nasolabial angle	$\angle Cm-Sn-UL$
Lip angle	$\angle UL-LL-C$

See Fig. 2 for location of landmarks

by Wang [14]. Most of the landmarks were based on soft tissue analysis of the Eurocleft study by Molsted et al. [15]. Angular measurements of the 150 photographs were made by measuring the nasal prominence angle, the nasolabial angle, and the lip angle (see Table 4 for descriptions) [14]. Two surgeons other than those who were assessors in the study were asked to calculate the angular measurements twice to calculate repeatability of angular measurements.

Statistical Analysis

Data were entered into a computer using IBM SPSS Statistics 19 (IBM Corp., Armonk, NY). Kendall's coefficient of concordance was used to compare agreement on nasal tip projection, nasolabial esthetics, lower and upper lip esthetics, and the profile among CLP patients, cleft surgeons, and lay people. Logistic regression was used for the correlations between panel profile assessments and photogrammetric analysis. Profile assessments were dichotomized, with a score of 1 classified as poor/unacceptable and scores of 2–3 classified as good/acceptable. Probability of entry was set at 0.05. Probability of exclusion was set at 0.10. The Kolmogorov–Smirnov test was used to test the assumption that the data were normally distributed. The significance level was set at $p < 0.05$ with a 95 % confidence interval and a 5 % error owing to chance. ICC was used for repeatability of angular measurements. The data were analyzed by IBM SPSS Statistics 19.

Results

Repeatability of Angular Measurements

The ICC between two surgeons for \angle Al–Ns–Prn, \angle Cm–Sn–UL, and \angle UL–LL–C were 0.892, 0.934, and 0.938, respectively. The ICCs of two measurements of each surgeon were 0.994 and 0.998, respectively.

Consistency of Subjective Assessments Among CLP Patients, Cleft Surgeons, and Lay People

Consistency of subjective assessments on nasal tip projection, nasolabial esthetics, upper and lower lip esthetics, and the profile among CLP patients, cleft surgeons, and lay people is shown in Table 5.

Correlations between Profile Assessments and Photogrammetric Analysis

A test for normality of Al–Ns–Prn (nasal prominence angle), Cm–Sn–UL (nasolabial angle), and UL–LL–C (lip angle) showed that all variables were normally distributed.

Table 5 Consistency of subjective assessments among CLP patients, cleft surgeons, and lay people

Variable	Kendall's W	<i>p</i>
Nasal tip projection	0.734	<0.001
Nasolabial esthetics	0.683	<0.001
Upper and lower lip esthetics	0.828	<0.001
Profile	0.747	<0.001

Logistic regression analysis is shown in Table 6. For cleft surgeons and CLP patients, UL–LL–C was associated with the profile scores. For lay people, Al–Ns–Prn and UL–LL–C were associated with the profile scores.

Discussion

In this study, CLP patients were requested to rate other patients' photographs instead of their own photographs to exclude factors influencing their subjective assessment and to obtain satisfaction about appearance. In previous studies, CLP patients were usually asked to assess their own appearance [5, 6, 8, 9]. Many factors affect the assessment of CLP patients on their own appearance. Women may be more critical of their appearance than men because of the importance of physical attractiveness in society [9]. Some patients will not always speak about their problems about appearance because they feel grateful to their cleft surgeons [8, 16]. Some patients desiring more surgeries may not be satisfied with their own appearance [9]. All of these factors limit the accuracy of assessment of CLP patients. They may overestimate or underestimate their own appearance.

In this study, the reason for choosing CLP patients, cleft surgeons who worked closely with CLP individuals, and lay people as assessors was that they all play important roles in the treatment. Cleft surgeons made treatment plans and were responsible for the outcomes of treatments. Lay people's assessments represented the general public's assessment. CLP patients were chosen to be assessors because their realistic requirements should be fulfilled by surgical treatment.

In this study, the number of patients who were assessors and lay people who were assessors was equal, but the number of surgeons who were assessors was less. Surgeons who were assessors usually had good consistency of subjective assessment because of their medical knowledge. Therefore, there can be fewer surgeons who are assessors than patients and lay people who are assessors. Many previous studies showed that the number of surgeons who were assessors was <10, and this number was less than that of the assessors who were patients [9, 16].

Repeatability of angular measurements was excellent in this study.

Previous studies have shown differences regarding assessments among CLP patients, professionals, and lay people. Sinko et al. [9] and Marcusson et al. [16] found that patients rated their appearance worse than medical professionals did. Oosterkamp et al. showed that bilateral cleft lip and palate patients were more dissatisfied with the upper lip and the nose than controls without clefts [17]. Thomas et al. [8] and Turner et al. [18] reported that CLP

Table 6 Correlations between profile assessments and photogrammetric analysis

Dependent variable <i>Y</i>	Independent variable <i>X</i>	<i>p</i>	Odds ratio	Regression equation
CLP patients' scores	UL–LL–C	<0.001	1.128	$\text{Logist}Y = -6.387 + 0.121X_{\text{UL-LL-C}}$
Surgeons' scores	UL–LL–C	<0.001	1.091	$\text{Logist}Y = -3.818 + 0.088X_{\text{UL-LL-C}}$
Lay people's scores	Al–Ns–Prn	0.008	0.859	$\text{Logist}Y = -4.382 - 0.152X_{\text{Al-Ns-Prn}} + 0.154X_{\text{UL-LL-C}}$
	UL–LL–C	<0.001	1.167	

See Fig. 2 for location of landmarks

patients were less satisfied with their appearance than their parents.

Professionals appear to be more critical about appearance because they are responsible for deciding on additional surgeries or other treatments, such as orthodontics or prosthetics, to achieve improvement for patients [6]. In addition, professionals are trained to focus on isolated features exclusively and critically examine faces. However, patients and lay people are rarely asked to assess an individual's face formally.

CLP patients are teased because of their facial anomalies, which affect their self-confidence [3]. Therefore, CLP patients are subject to a lot of pressure because of deformities, which might affect finding a job or finding a spouse. Women may be more affected by clefts because female facial attractiveness is thought to be important in society [9]. Some researchers found that traditional cultures may make CLP patients feel more embarrassed [19]. Therefore, CLP patients may be more critical of their appearance than professionals.

With regard to lay people, age and sex do not influence subjective assessment [6, 20]. Unfamiliar judges give more positive ratings of appearance not only because they felt more sympathetic toward individuals who have facial deformities, but also because they are not often asked to assess an individual's attractiveness formally [6]. Lay people may not be more critical than professionals because they lack specialized knowledge [21].

However, some previous studies have shown that professionals, CLP patients, and lay people may have a similar level of satisfaction for appearance [3, 5, 10]. Our study showed similar results to these previous studies. Our study showed that Kendall's *W* was high, which implied that the subjective assessment of CLP patients, cleft surgeons, and lay people was basically consistent. This result indicated that all of them had similar attitudes toward appearance, which could lead to some practical benefits. First, additional treatments that are recommended to CLP patients simply because of cleft surgeons' criticism would be avoided. Second, this finding suggested that CLP patients would find it easy to build self-confidence around the general public.

Correlations between soft tissue profile measurements and panel assessments have been determined in previous studies. Some studies showed that profile measurements were associated with subjective assessments [11, 12, 22]. However, some other studies showed that few "ideal" angles and ratios had a significant relationship with facial esthetics [23]. In our study, UL–LL–C (lip angle) was associated with the profile scores of subjective evaluation among CLP patients, cleft surgeons, and lay people. This finding suggested that upper and lower lip esthetics was an important factor influencing subjective evaluation of the profile. Upper and lower lip esthetics can be affected by the relationship of the location between the maxilla and mandible, which is an important factor in determining the profile. Therefore, upper and lower lip esthetics could influence the assessment of the profile. To improve the appearance of CLP patients, upper and lower lip esthetics needs to be improved. Additionally, treatment plans for CLP patients should be made by maxillofacial surgeons, orthodontists, and prosthodontists. In the current study, for lay people, Al–Ns–Prn (nasal prominence angle) was also associated with the profile scores. The nose is located in the middle part of the face and is thus the face's most prominent feature. Hiding the nose during communication is not possible. A nice-looking nose encourages people to consider a person as being more trustful, honest, and loyal. CLP patients have scars on their noses. Nasal deformities mean that CLP patients lack a youthful appearance [10]. Lay people are unfamiliar with CLP patients, and therefore they pay more attention to the nasal deformities of CLP patients. Correction of nasal deformities for CLP patients is important.

In the current study, Cm–Sn–UL (nasolabial angle) was not associated with profile assessments. However, previous studies have shown that the nasolabial angle is associated with profile scores of cleft surgeons [11, 12]. The reason for this difference may be owing to the differences in facial features among Asians and Caucasians. Nasolabial angles of American and Chinese patients were calculated by Oh et al. [22]. They found that Chinese patients' mean nasolabial angle was $97.1^\circ \pm 9.6^\circ$, whereas American patients' mean nasolabial angle was $127.3^\circ \pm 8.2^\circ$. The nasolabial

angle of American patients was significantly larger than that of Chinese patients because American patients' noses were more prominent than Chinese patients' noses. The nasolabial angle reflects the relationship between the upper lip and the base of the nose. Subjective assessment of nasolabial esthetics is affected by the upper lip and the base of the nose. CLP patients usually have the problem where the base of the nose encroaches on the upper lip and the nose appears down-turned [12]. As a result, the nasolabial angle of CLP patients is smaller than that of the general population. Because an Asian's nose is flatter than a Caucasian's nose and the nasolabial angle of Asians is smaller than that of Caucasians, nasolabial deformities in Asians do not appear as obvious as nasolabial deformities in Caucasians. Therefore, the nasolabial angle, which affects subjective scores of the profile in Caucasians, is not associated with subjective assessment of the profile in Asians.

Facial attractiveness is a complex issue and factors can affect subjective assessment. Simple measurements cannot adequately evaluate the multifactorial natures of attractiveness [11]. The appearance of a person's face is more than the sum of the contributing parts [24]. This may explain why the results of many studies are different.

Although three-dimensional photo is one of the advanced techniques for assessing facial appearance, the present research focused on the lateral profile and two-dimensional photo was an easy and economic tool to practice. Three-dimensional photo technique will be implied to assess and make treatment plan for cleft lip and palate patients in our further research work.

Conclusions

CLP patients, cleft surgeons, and lay people have similar attitudes toward the appearance of CLP patients. Upper and lower lip esthetics is associated with the assessment of the cleft profile provided by CLP patients, professionals, and lay people. In addition, nasal tip projection is another determining factor for lay people.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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