

## DIFFERENCE IN PERCEPTION OF LIP LINE CANTING: A COMPARATIVE EVALUATION AMONG ORTHODONTISTS, GENERAL DENTISTS AND PATIENTS

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### Abstract

**Objective:** To determine the sensitivity to and perception threshold for treatment of lip-line canting (LLC) among orthodontists, general dentists and patients and the influence of age or gender on the detection of LLC.

**Study Design:** Analytical cross-sectional study.

**Study Site and Duration:** Department of Orthodontics, AFID, Rawalpindi, Pakistan from April 2025 to September 2025.

**Methodology:** A standardized frontal facial photograph was digitally altered to produce eight graduated LLC images (1°–8°). Using stratified sampling, 399 evaluators were recruited comprising 133 orthodontists, 133 general dentists, and 133 patients. Each evaluator was asked to review the images twice: once to identify when LLC became detectable (Category I) and then again to determine when LLC required treatment (Category II). Demographic information was obtained. All the statistical analyses were performed using SPSS version 23.

**Results:** There was no significant association between age and gender with Category I or II scores ( $p > 0.05$ ). Significant differences the different evaluator groups were found. Orthodontists had the lowest mean Category I score of  $2.37 \pm 0.89$  and the highest Category II score of  $4.46 \pm 0.95$ , thus showing the greatest sensitivity and strictest treatment thresholds. Patients showed the highest tolerance to LLC, with the lowest Category II score of  $3.60 \pm 1.23$  ( $p = 0.001$  and  $p < 0.001$ ).

**Conclusion:** Orthodontists are significantly more sensitive to mild LLC and recommend intervention at lower degrees compared with general dentists and patients. Professional training, rather than age or gender, is the prime factor influencing LLC perception.

### Introduction

Facial symmetry is an important component of perceived attractiveness and hence overall facial harmony, becoming a major concern for orthodontics and dentofacial esthetics.<sup>1,2</sup> Of the asymmetry features, lip line canting-the tilt of the line connecting the corners of the mouth-is

particularly obvious upon smiling and therefore influences social judgments of balance.<sup>3</sup> Even small deviations in lip-line orientation can detract from perceived beauty, making it an important diagnostic and treatment consideration in both orthodontic and surgical planning.<sup>4</sup> Studies show that facial asymmetry, including lip-line canting, is

not unusual and may meaningfully influence patient satisfaction with treatment outcomes.<sup>5</sup> A growing body of literature has examined LLC from skeletal and soft tissue perspectives. Three-dimensional cephalometric analysis showed moderate to strong correlations between skeletal reference planes (mandibular symmetry plane, occlusal plane, etc.) and lip canting measures, suggesting that asymmetry of the hard tissues underlies soft tissue lip tilt.<sup>6</sup> Jo et al. similarly found that menton deviation, maxillary canting, and ramal length discrepancies have a significant association with the degree of lip canting.<sup>7</sup> In clinical contexts, asymmetry in the lip-line still remains problematic to correct predictably: in a Class III orthognathic surgery study, postsurgical improvement in lip canting on smiling did not always parallel skeletal corrections, suggesting again that soft-tissue behavior and muscle activity also contribute.<sup>8</sup> Additionally, soft tissue manipulation techniques, such as suspension with bioabsorbable devices, have also been explored to correct residual LLC, drawing attention to its importance in esthetic face surgery.<sup>9</sup> On the perceptual side, Lu et al. recorded that the average perceived LLC among observers was 2.65°, while the threshold of “requiring treatment” was about 4.10°, with orthodontists and patients being significantly more sensitive than non-oral practitioners.<sup>10</sup> These findings draw attention not only to the structural origin of LLC, but also to its subjective perceptual dimensions.

Given this complex interplay of anatomy and perception, further investigation into how different evaluator groups perceive lip-line canting is clearly warranted. Understanding perceptual thresholds for sensitivity and tolerance in various populations will contribute to the clinician's ability to tailor treatment plans more appropriately and establish realistic esthetic goals. The sensitivity and tolerance values for LLC are to be evaluated for orthodontists, general dentists, and patients by systematically varying lip-line canting in a controlled photographic model and recording their perceptual judgments. These findings will provide evidence to inform diagnostic criteria and enhance patient-clinician communication in esthetic treatment planning.

## Methodology

This cross-sectional, observational study was conducted in Department of Orthodontics, Armed Forces Institute of Dentistry (AFID), Rawalpindi, Pakistan from April 2025 to September 2025. Sample size was calculated using the difference in Category II mean scores reported by Lu et al.<sup>10</sup> with a mean of 4.23 for orthodontists and 3.70 for patients ( $\Delta = 0.53$ ; pooled SD  $\approx 1.143$ ). By using the two-sample means formula with 95% confidence level and 90% power and applying a Bonferroni-adjusted alpha ( $\alpha = 0.017$ ) to account for comparisons among the three evaluator groups, the minimum required sample size was 126 evaluators per group. Adding a 5% contingency for incomplete responses, the final estimated sample size was increased to 133 evaluators in each group, giving a total of 399 participants (133 orthodontists, 133 general dentists, and 133 patients). The research study was approved by the Institutional Review Board of AFID, Rawalpindi, Pakistan, and informed consent was obtained from all participants prior to enrollment. Stratified random sampling was employed.

Image manipulation in this study utilized a standardized facial photograph of a young female orthodontic graduate. The participant was medically fit, with no history of systemic disease or craniofacial anomalies such as cleft lip or palate or maxillofacial trauma. High-quality frontal facial photographs were obtained under controlled conditions. The participant was seated upright in a natural head position, with the eyes oriented horizontally, lips relaxed and mandible at rest. The image was captured from a fixed distance of 1.5 m with a digital camera (Nikon DSLR D5300).

The picture was digitally treated using Adobe Photoshop (Adobe Systems, San Jose, CA, USA) to homogenize facial skin tone eliminate small pimples/blemishes and other minor imperfections, and produce symmetrical face composites. Right and left hemifaces were flipped and combined into three images: the original face, a left composite, and a right composite. The base research photo chosen was the one perceived most visually well-balanced.

The cheilion landmarks represent the most lateral points of the lip commissures and were used to create the lip-line reference by the method of Farkas et al. The lip line was determined by connecting the bilateral cheilion points. This line was then rotated clockwise in 1° increments to create eight manipulated images representing progressive lip-line canting.

A total of 399 evaluators were recruited, including 133 orthodontists, 133 general dentists and 133 patients. Evaluators were matched for age and gender where possible. All images (the unaltered photograph plus seven manipulated versions) were randomized using a computer-generated sequence. Evaluators, blinded to the study objectives during the initial assessment, viewed each image and recorded the degree at which LLC became detectable. Following the disclosure of the study purpose, the evaluators repeated the assessment, categorizing each image into two groups:

- (1) mild LLC not requiring treatment
- (2) pronounced LLC requiring treatment

Data analyses were performed using the Statistical Package for Social Sciences, version 23.0. Continuous variables - Category I and Category II scores - are described using mean and SD, while categorical variables include age groups, gender and evaluator groups expressed in frequencies and percentages. The Kolmogorov-Smirnov test was used to check for normality of the continuous

data. The mean scores of Category I and Category II were compared across different age groups, gender and evaluator groups, using One-way ANOVA, followed by post hoc Tukey's test for pairwise comparisons between groups. The means among males and females were compared using the Independent Samples t-test. The level of significance was  $p < 0.05$ .

**Results**

The distribution according to age groups was: 16-29 years (27.32%), 30-39 years (36.34%), 40-54 years (36.34%) with Category I scores ranging from 2.51-2.66 and Category II scores ranging from 4.00-4.18 with no significant differences among the groups ( $p > 0.05$ ). The gender distribution was almost equal, and though males had slightly higher Category I scores than females (2.66 versus 2.49), the differences in Category I and Category II were not significant ( $p = 0.051$  and  $p = 0.221$ ) (Table I). Equal distribution of orthodontists, general dentists, and patients (33.33% each) showed significant differences among the groups. The orthodontists had the lowest Category I score of 2.37 and the highest Category II score of 4.46, whereas patients had the lowest Category II score of 3.60. Both categories were statistically significant ( $p = 0.001$  and  $p < 0.001$ ) (Table II).

**Table I. Comparison of Category I and Category II Scores Across Age and Gender Groups**

Variables	n (%)	Category I	p - value	Category II	p - value
<b>Age</b>					
16-29	109 (27.32%)	2.58 ± 0.88	0.295	4.06 ± 1.17	0.373
30-39	145 (36.34%)	2.51 ± 0.75		4.00 ± 1.16	
40-54	145 (36.34%)	2.66 ± 0.89		4.18 ± 1.13	
<b>Gender</b>					
Male	202 (50.63%)	2.66 ± 0.85	0.051	4.02 ± 1.25	0.221
Female	197 (49.37%)	2.49 ± 0.82		4.16 ± 1.04	

**Table II. Comparison of Category I and Category II Scores Among Evaluator Groups**

Evaluator Group	n (%)	Category I	p - value	Category II	p - value
Orthodontist	133 (33.33%)	2.37 ± 0.89	0.001	4.46 ± 0.95	<0.001
General Dentist	133 (33.33%)	2.75 ± 0.86		4.19 ± 1.09	
Patients	133 (33.33%)	2.63 ± 0.70		3.60 ± 1.23	

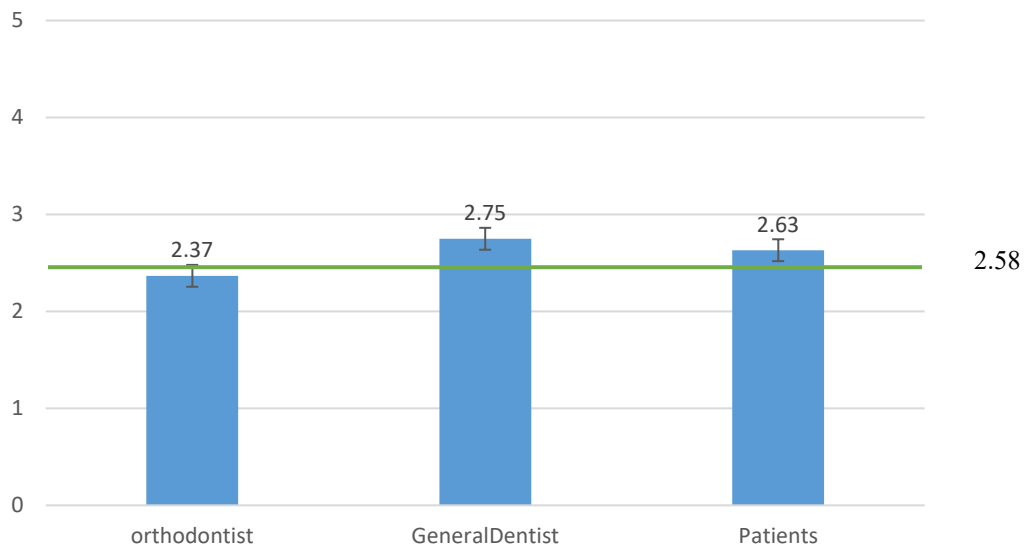


Figure 1. Sensitive values of various evaluators to LLC.

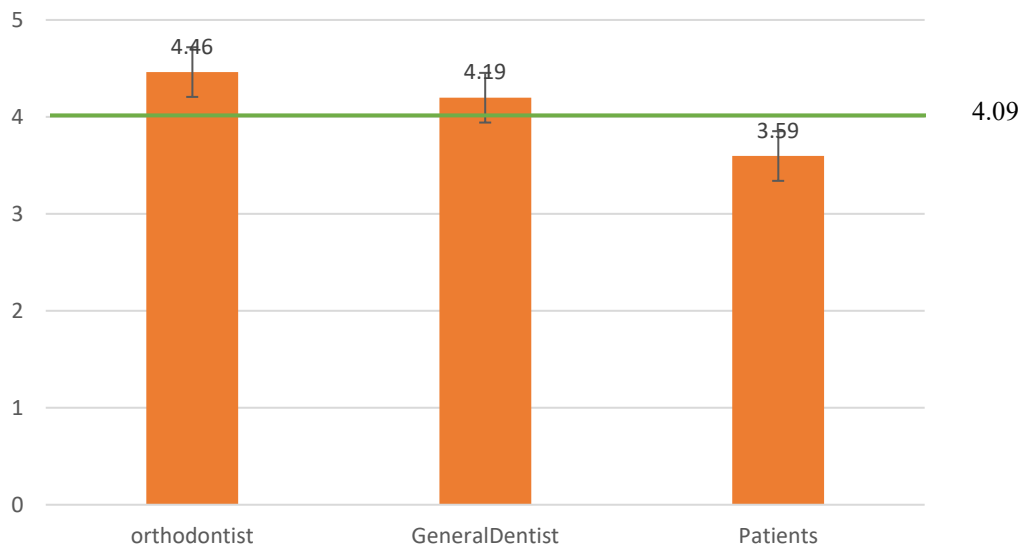


Figure 1. Tolerance values of various evaluators to LLC.

**Discussion**

The present study showed that orthodontists were significantly more sensitive to subtle lip-line canting-the mean for Category I was about 2.37- and also set a higher threshold for treatment-necessitating canting-the Category II mean was about 4.46-while patients were less exacting, with a lower tolerance threshold-the Category II mean was about 3.60. There were no meaningful

differences across age groups or between genders regarding perception.

The increased sensitivity of the orthodontists in our study is supported by the larger literature, which suggests that professionals are more critical than laypersons when evaluating dentofacial esthetics. Kokich et al. reported that orthodontists and general dentists rated a 4 mm maxillary midline deviation as significantly less attractive, whereas laypeople were less likely to notice such

deviations.<sup>11</sup> Likewise, Parrini et al. reported that professionals will tolerate less discrepancy than laypersons in various features of the smile.<sup>12</sup> Such findings reinforce our observation of lower perceptual thresholds in, and reduced tolerance for asymmetry among, dental-trained evaluators.

Regarding lip-line canting, Lee et al. reported, in their study of 64 laypersons and 30 professionals, that the mean first perception of lip-tilt was  $3.25^\circ \pm 1.36^\circ$  for laypeople and  $1.70^\circ \pm 0.69^\circ$  for professionals, while “unacceptable” canting began around  $6.40^\circ$  for laypeople versus  $4.40^\circ$  for professionals.<sup>13</sup> The tolerance threshold (mean  $\approx 4.46$ ) for orthodontists in our study replicates that “unacceptable” perception in professionals and further strengthens the fact that even small angular deviations have significance to the trained evaluator.

Anatomical explanations for this increased sensitivity are provided by skeletal-soft tissue correlation studies. For example, one 3D reconstruction analysis found strong correlations between lip-line canting and several skeletal factors: menton deviation, maxillary plane canting, and ramal length asymmetry.<sup>14</sup> This would support the hypothesis that orthodontists are more perceptive simply because they more internalize the skeletal-soft tissue relationships—the professionals may unconsciously relate the observed lip tilt to underlying bone asymmetries more easily than the patients.

The finding that professionals, especially orthodontists, are more critical of facial asymmetry is in agreement with a recent 3D-simulation study by Zhang et al., in which orthodontists rated asymmetrical virtual faces more critically than laypersons. In that study, with every 2 mm increase in asymmetry, orthodontists' aesthetic ratings decreased by an average of 1.219 on a VAS, and they were significantly more accurate at identifying the asymmetric parts than laypersons.<sup>15</sup> Our results also support a recent eye-tracking study on dental and gingival asymmetries: Chaptini et al. reported that both orthodontists and dentists detected gingival border asymmetries down to 1 mm, while laypeople's threshold was higher ( $\sim 1.5$  mm).<sup>16</sup> This agrees with our observation that dental professionals are more sensitive to subtle

deviations in soft-tissue alignment than non-professionals.

When considering mandibular asymmetry, da Silva et al. performed eye-tracking research in lay observers; they more freely scan large deviations, such as  $6^\circ$  deviations, but their attention for smaller asymmetries - up to  $4^\circ$  - is more distributed, making detection more difficult.<sup>17</sup> This may imply that - similar to lip-line canting - lay observers may tolerate or overlook mild asymmetries, which could explain why our patient group had a higher LLC treatment threshold than orthodontists.

Further, Jarosz et al. stated that orthodontists and non-orthodontic dentists identified chin deviation at  $1^\circ$ - $2^\circ$ , while laypersons were less likely to consistently observe such small angles until  $3^\circ$  or greater.<sup>18</sup> This mirrors our findings in that professionals have a finer “esthetical radar” for facial balance than patients.

One reason orthodontists in the current study showed the lowest Category I score may be their training and frequent exposure to precise metrics of symmetry during diagnosis and treatment planning. Their clinical eye is trained to detect even subclinical deviations, in part because such deviations may signify hidden skeletal or muscular asymmetries. The finding that patients had a lower tolerance-i.e., lower Category II threshold-is intriguing: it may reflect that patients are sensitive to esthetic yet functional changes, but they may not interpret small asymmetries as critical, instead accepting certain deviations as “normal” in their own facial context.

These findings emphasize the need for the clinical process of esthetic treatment planning to be shared by clinicians and patients. Because orthodontists are more critical about asymmetry than patients are, there is a clear risk that “clinically acceptable” results may not meet the expectations of the patients. Shared decision-making tools-such as digitally manipulated smile simulations-can facilitate this process by allowing patients to visualize their own LLC tolerance levels.

## Limitations

In this study, generalizability may be limited by the use of digitally manipulated images of a single

female face. Sensitivity thresholds may be influenced by cultural or ethnic differences in the perception of facial esthetics, which were not evaluated here. Although sample size was adequate, online evaluation introduces variability related to screen size, resolution, and viewing conditions. The study did not include younger adolescents or older adults; thus, its general application may be compromised when considering a greater age spectrum.

## Conclusion

Orthodontists were significantly more sensitive in the detection of LLC and established more stringent treatment thresholds than general dentists and patients. Age and sex had no effect on perception, indicating that professional training is the dominant factor affecting esthetic sensitivity. These findings support the importance of clinician-patient communication during the planning of esthetic treatments, since perceptions of asymmetry are quite different between groups. In this context, the integration of digital visual tools may aid in harmonizing patient expectations with clinical judgment, thereby enhancing treatment satisfaction.

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## Conflict of Interest

None.

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