



Esthetic perception of asymmetric canines treated with space closure in maxillary lateral incisor agenesis

A. F. Gomes, DDS

CESPU, Instituto de Investigação e Formação Avançada em Ciências e Tecnologias da Saúde, Gandra, Portugal

Teresa Pinho, DDS, PhD

CESPU, Instituto de Investigação e Formação Avançada em Ciências e Tecnologias da Saúde, Gandra, Portugal

Instituto Biologia Molecular e Celular (IBMC), i3S – Instituto Inovação e Investigação em Saúde, Universidade do Porto, Porto, Portugal



Correspondence to: [Dr Teresa Pinho](#)

Instituto Universitário de Ciências da Saúde, CESPU, Instituto de Investigação e Formação Avançada em Ciências e Tecnologias da Saúde (IINFACTS), Rua Central de Gandra, 1317, 4585-116 Gandra PRD, Portugal;

Tel: +351 224157151, Fax: +351 224 157 102; Email: teresa.pinho@iucs.cespu.pt

Abstract

Objective: This article assesses the esthetic opinion of the experts involved in dental restoration (general dentists, orthodontists, prosthodontists) and laypeople. Differences in esthetic opinion among the studied groups are assessed.

Material and methods: A questionnaire was constructed based on four photographs. A quantitative esthetic appreciation using a numerical scale was requested from four groups of observers. The final sample consisted of 434 participants: 142 laypeople, 141 general dentists, 100 orthodontists, and 51 prosthodontists. The photographs presented were based on the same lips and modified from the same intraoral photograph with asymmetric canines: the right canine was smaller than the left canine and had a lower gingival margin. A mirror image of the right canine was digitally made to create symmetry.

Results: There were statistically significant differences ($P < 0.05$) in the assessments made across the different groups of observers. For all questions, the laypeople assigned significantly higher scores ($P < 0.05$) than the orthodontists and prosthodontists. However, there was no significant difference between groups, and all the groups considered the photograph with the larger canines to be more esthetic. The dental professionals and the laypeople disagreed the most regarding their assessment of the least esthetic image.

Conclusion: There were differences between the four observer groups in their scoring of the photographs from 0 to 10 relative to the more pleasing esthetics of closure of space with asymmetric canines. However, there were no differences in the results when evaluating each type of canine relative to the form. The canine with the most prominent shape was considered to be more esthetic by all the groups.

(*Int J Esthet Dent* 2019;14:30–38)





Introduction

Maxillary lateral incisor agenesis (MLIA) has been present since the Paleolithic period. As humans evolved, the face and jaw became smaller in the anteroposterior direction. This limited the space needed to accommodate the teeth; the last tooth in each quadrant may be absent (third molars, second premolars, and lateral incisors).

There is a considerable family aggregation, and the probability of a family member also having an agenesis is about 15 times higher than that of the general population. The microdontia of the maxillary lateral incisors can also indicate agenesis.^{1,2}

The treatment of MLIA cases is a controversial topic. The high impact of esthetic and functional restorations encourages people to seek treatment to improve their smiles.³⁻⁷

Harmony is an important factor in MLIA treatment. Most practitioners close rather than open spaces.³⁻⁷ There are many other factors that influence treatment choices, including age, dental morphology, esthetics, periodontal health, and function. These factors require not only a skilled orthodontist, but coordination with specialists in other areas of implantology or restorative dentistry. Quality treatment requires good communication between professionals.

It has been shown that not all people value a smile equally.⁸⁻¹² Orthodontists emphasize several aspects that general dentists do not consider important. The same applies to laypeople and those who have already been treated for MLIA.

There are surprisingly few studies on patients with MLIA with bilateral placement of the asymmetric canines. It is sometimes difficult to decide which of the canines to copy during treatment in cases of asymmetric placement because the shape, size, color, and gingival edge can impact esthetics. However, this is a critical issue among

rehabilitation professionals. It is therefore important to understand how both professionals and laypeople interpret esthetic positioning in cases of space closure with asymmetric canines after MLIA treatment.

Materials and methods

Two photographs of the anterior intraoral space (before and after orthodontic treatment) of a patient with MLIA were selected. The patient had asymmetric canines: the maxillary right canine was smaller than the maxillary left canine and had a lower gingival margin. The subject was treated with space closure. The canines were only slightly worn on the cusp.

The front end of the intraoral orthodontic treatment was transformed with left and right symmetry: both the left and right canines were exactly the same image.

To minimize variables for comparison, Adobe Photoshop CC 2014 was used to eliminate stains and facial imperfections. This changed the tone and hue of the teeth to white dental enamel. The sizes of all the photographs within the respective groups of observers (general dentists, orthodontists, prosthodontists, and laypeople) were standardized. Each observer was requested to complete a questionnaire after evaluating the photographs and rate them on a scale from 0 to 10, based on what s/he considered less or more esthetic, respectively. The questionnaire was conducted anonymously.

Statistical analysis

Statistical analysis was carried out using SPSS version 23, with a significance level of 5%. The variables did not have a normal distribution according to the Kolmogorov-Smirnov test.

A non-parametric Kruskal-Wallis test was used to evaluate the responses from a sin-

gle image. Subgroup analysis was done when there was a statistically significant difference.

The chi-square test was used for the esthetic statistical analysis and to analyze the statistically significant subgroup responses.

Results

The questionnaire was given to 538 respondents, and 104 were excluded. The final sample comprised 434 participants: 267 (62%) female and 167 (38%) male. The four different groups included 142 laypeople (32.7%), 141 general dentists (32.5%), 100 orthodontists (23%), and 51 prosthodontists (11.8%).

Classification given by the different groups to each image

- In the evaluation of image 1 (initial photograph) (Fig 1), all groups gave a negative score (< 5). However, the laypeople gave the highest score (3), and the orthodontists and prosthodontists the lowest score (~ 2).
- In the evaluation of image 2 (final photograph with asymmetry) (Fig 2), all groups gave a positive score (> 5). The laypeople gave the highest score (~ 8), and the prosthodontists the lowest score (~ 5.5).
- Image 3 was a posttreatment photograph with smaller right canines (Fig 3). All groups gave this a positive score (> 5), and the laypeople gave it the highest score (~ 8).
- Image 4 had larger left canines (Fig 4). All groups gave this a positive score (> 5), and the laypeople gave it the highest score (~ 9).



Fig 1 Initial photograph with asymmetric canines.



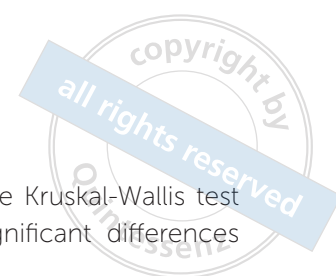
Fig 2 Final photograph with asymmetric canines.



Fig 3 Final photograph with symmetric smaller canines.



Fig 4 Final photograph with symmetric larger canines.



Classification given by the different groups (Figs 5 to 8)

The general dentists, orthodontists, and prosthodontists considered the smile in the photograph with the larger canines (Fig 4) to be the most esthetic.

The laypeople were divided in their opinions. The score was very similar between the final photograph with asymmetric canines (Fig 2), that with symmetric smaller canines (Fig 3), and that with symmetric larger canines (Fig 4). A small majority preferred the photograph with the symmetric larger canines (Fig 4).

For all questions, the Kruskal-Wallis test showed statistically significant differences ($P < 0.05$).

Evaluation of the three final photographs

There were no significant differences in terms of esthetics ($P = 0.299$). Most people in all groups found the image with the larger left canines (Fig 4) to be more attractive. There were no major differences between the groups. The question regarding the least esthetic image was significant ($P < 0.001$), which shows that the professionals selected Figure 2 (final photograph with asymmetric canines) as the worst, while the laypeople selected Figure 3 (final photograph with symmetric smaller canines).

Discussion

The number of observers used in this study is comparable to that used in other studies, including Kokich¹³ and Kokich et al.¹⁴ These two articles are commonly referred to in the scientific literature and inspired this work. The latter study¹⁴ is similar to the present study in that it compares three groups (general dentists, orthodontists, and laypeople) regarding the lack of esthetics. Other examples of similar studies include Brough et al,¹¹ Abu Alhajja et al,¹⁵ and Pinho et al.¹⁶

As prosthodontists are specialists in esthetics and function and can professionally evaluate smiles, the authors saw the need to include this group in the sample population.¹⁷ Like other sample sizes in various studies, it can be said that this study sample was appropriate.^{8,11,13,14-16}

Only one case of MLIA with asymmetric canines after orthodontic treatment was used due to the large differences in size and torque before orthodontic treatment. Considering the negative visual impact already

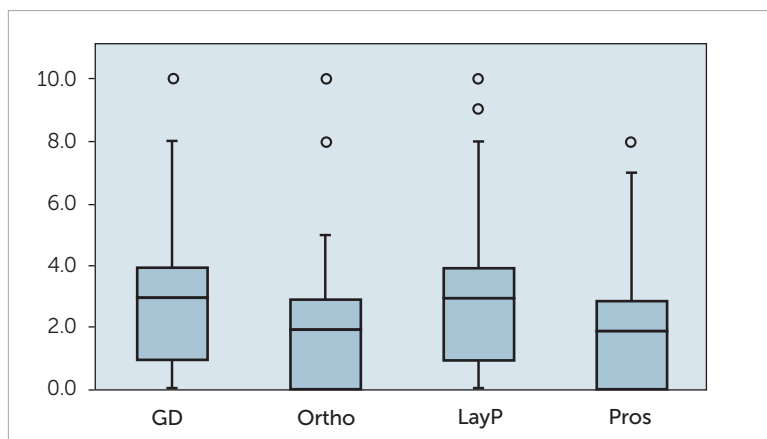


Fig 5 Kruskal-Wallis test for Fig 1: initial photograph.

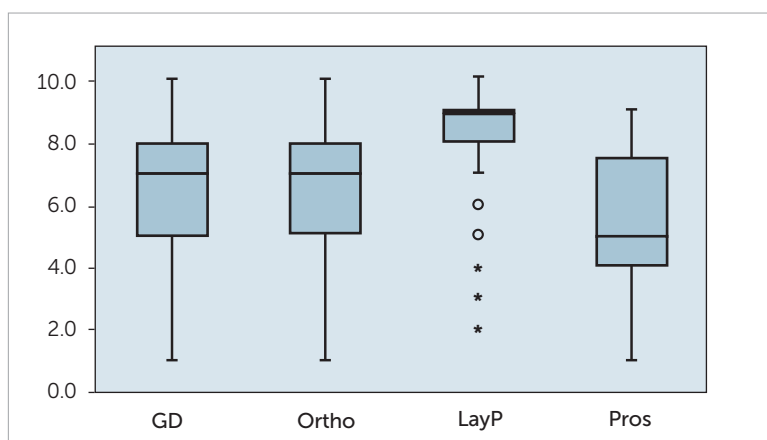


Fig 6 Kruskal-Wallis test for Fig 2: final photograph with asymmetric canines.

known in dental and gingival asymmetry,^{8,16,18,19} this is important in determining which canine to reproduce and with what degree of form. The authors of the present study concur with Howells and Shaw,²⁰ who found that photographs are a valid and reliable instrument to evaluate the esthetics of the smile.

Four photographs were used in the present study, while other studies have sometimes used more.^{9,11,12,16,21,22} The reason for using a small number of photographs was to maintain the participants' interest, which could wane if too many photographs need to be considered. Many studies have used digitally modified photographs or digital models to evaluate various esthetic parameters.^{8,9,11,14,18,19,22,23-25} The images in the present study were limited to the framework of the lips so as to reduce the effect of possible confusion induced by other factors. This corresponds to the methodology of various other studies.^{8,14,16,27,28} Flores-Mir et al²⁹ concluded that the esthetic impact of dental occlusion was less when the full face was visible compared with when only the teeth or the bottom third of the face was shown.²⁹

To obtain an overall esthetic opinion, the four groups of evaluators were asked to score the photographs from 1 to 10 on a Likert scale.³⁰ Although this is more objective than interviews and is simpler and faster,^{15,16,19} it is in contrast with the study by Howells and Shaw,²⁰ who found that numerical measurements have advantages over visual scales.

The results of the present study show that small teeth are considered less esthetic, with all groups finding larger canines to be more esthetic. This accords with the theory of the golden ratio. To find the golden ratio, the width of the canine is multiplied by a value set to the golden ratio of 0.61803, which is approximately 62%. This tooth proportion is noted from the central incisors toward the posterior teeth.^{31,32}

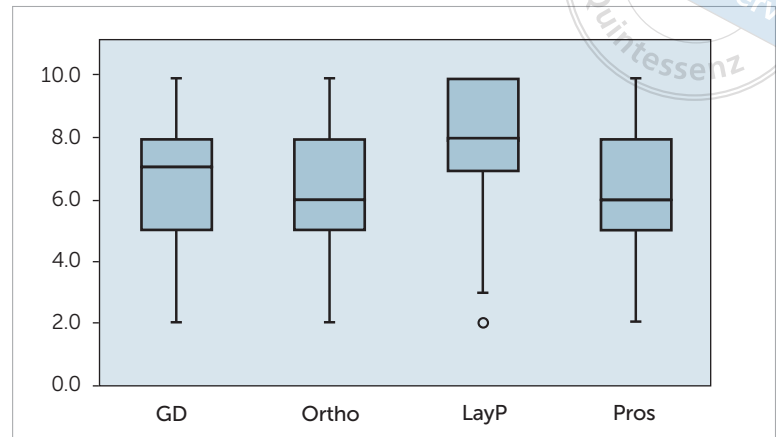


Fig 7 Kruskal-Wallis test for Fig 3: final photograph with symmetric smaller canines.

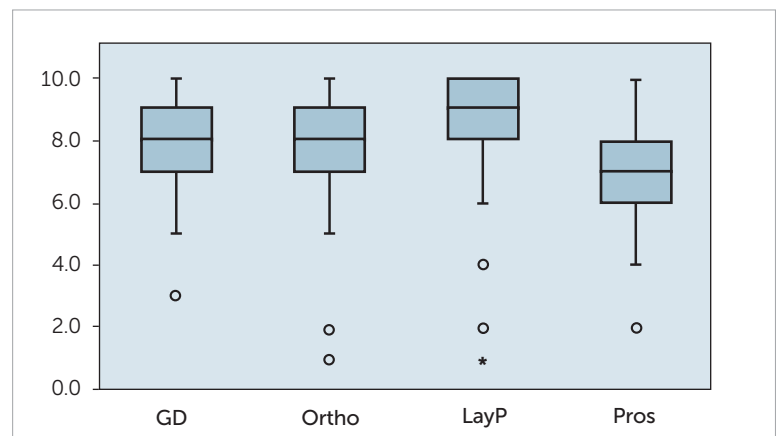


Fig 8 Kruskal-Wallis test for Fig 4: final photograph with symmetric larger canines.

The most important element is the correlation of the dimensions, ie, the dental proportions. Two ratios should be considered: the relationship between the height and width of each tooth, and the ratio between the teeth. The relative ratio between the crown heights of the anterior teeth was proposed by Gillen et al³¹ and is widely used. It suggests that the height of the clinical crown of the maxillary lateral incisor should be 82% of the height of the crowns of the central incisor and canine. The image with a larger canine was initially in a more ectopic position, and orthodontic correction, even with torque compensation, held the crown and made it



larger. This resulted in a high gingival margin (compared with the contralateral side).

In proportion to the central incisor, this was the canine that was chosen as most esthetic by all observer groups. This can be justified because this choice varies less with the shape and size of the nearest central incisor.³³ It has a balanced gingival margin, with < 5 mm difference and with good heights, zenith positions, and points of contact.¹¹ It is in proportion to the size and shape of the maxillary central incisors and left canine.

The more esthetic option is a larger canine. Increasing the symmetry of the canines is easier. The smallest canine should have the gum positioned closer to the right incisor. This could increase the clinical crown. To improve the shape, esthetic remodeling is used with composite resin or ceramic veneers. This resembles the contralateral tooth, ie, the canine is increasingly considered to be more esthetic.

The smaller tooth can be used to copy the other tooth, but it is challenging to decrease the contralateral clinical crown. This would require a gingival graft using the tunneling technique. The literature suggests that this technique achieves better results for the preservation of tissues, but there could be relapses and changes in the gingival color.³⁴ This technique should be considered for treatments in the anterior esthetic zone. Proper care and attention are needed in the planning and execution of the treatments to achieve the best results.

The present study showed the best approaches to rehabilitating teeth in an esthetic way. Patients are increasingly demanding and have more access to information, but they do not necessarily agree with the professionals. However, treatments are more

and more multidisciplinary, which facilitates the final esthetic outcome. Thus, while this study was subjective and transverse, it was important because it helped to highlight the trend toward more esthetic options that imitate asymmetric canines. This information can be helpful when it comes to proper communication with colleagues, especially for MLIA protocols but also for other procedures to close gaps between teeth.

This study is consistent with evidence-based dentistry (MDBE),³⁵ the purpose of which is to allow clinicians to use the best scientific evidence and integrate their expertise in the best interests of their patients. Thus, this study will be useful to help clinical analysis, minimize misdiagnosis, and ensure clinical decisions and choices that support the best therapeutic interventions. The insight provided by this study can be used in the clinic.³⁵

Conclusion

All subjects found the initial photograph to be the least esthetic. After orthodontic treatment, there was considerable improvement in the positioning, with the right canine being smaller than the left. However, the photograph that was manipulated to create symmetry of the canines was considered the most esthetic by all groups. In proportion to the central incisor, larger canines were considered to be more esthetic.

When analyzed together, there are significant differences of opinion between the professionals and the laypeople regarding the most and least esthetic approach. In general, the laypeople are more easily impressed than the professionals, while the dental specialists are more demanding.

Clinical significance

The lack of lateral superior incisors has a major impact on esthetics and performance, which leads to a continuous demand for orthodontics and/or restorative solutions. Orthodontic treatment can lead to asymmetric positioning of the canine mesially, but it is sometimes difficult to decide which canine to copy at the time of rehabilitation. Thus, it is important to know which option is considered more esthetic by professionals and laypeople.

Acknowledgment

This work was funded by CESPU through the MLIA-CESPU-2018 project.

Disclosure

The authors have no financial interest in the companies whose materials were used for this study.

References

- Mattheeuws N, Dermaut L, Martens G. Has hypodontia increased in Caucasians during the 20th century? A meta-analysis. *Eur J Orthod* 2004;26:99–103.
- Pinho T, Maciel P, Lemos C, Sousa A. Familial aggregation of maxillary lateral incisor agenesis. *J Dent Res* 2010;89:621–625.
- Robertsson S, Mohlin B. The congenitally missing upper lateral incisor. A retrospective study of orthodontic space closure versus restorative treatment. *Eur J Orthod* 2000;22:697–710.
- Turpin DL. Treatment of missing lateral incisors. *Am J Orthod Dentofacial Orthop* 2004;125–129.
- Zachrisson BU, Rosa M, Toreskog S. Congenitally missing maxillary lateral incisors: canine substitution. *Point. Am J Orthod Dentofacial Orthop* 2011;139:434,436,438.
- Wilson TG Jr, Ding TA. Optimal therapy for missing lateral incisors? *Am J Orthod Dentofacial Orthop* 2004;126:22A–23A.
- Park JH, Okadakage S, Sato Y, Akamatsu Y, Tai K. Orthodontic treatment of a congenitally missing maxillary lateral incisor. *J Esthet Restor Dent* 2010;22:297–312.
- Kokich VO, Kikich VG, Kiyak HA. Perceptions of dental professionals and laypersons to altered dental esthetics: asymmetric and symmetric situations. *Am J Orthod Dentofacial Orthop* 2006;130:141–151.
- Bukhary SM, Gill DS, Tredwin CJ, Moles DR. The influence of varying maxillary lateral incisor dimensions on perceived smile aesthetics. *Br Dent J* 2007;203:687–693.
- Dueled E, Gotfredsen K, Tram Damsgaard M, Hede B. Professional and patient-based evaluation of oral rehabilitation in patients with tooth agenesis. *Clin Oral Implants Res* 2009;20:729–736.
- Brough E, Donaldson AN, Naini FB. Canine substitution for missing maxillary lateral incisors: the influence of canine morphology, size, and shade on perceptions of smile attractiveness. *Am J Orthod Dentofacial Orthop* 2010;138:705.e1–e9.
- Robertsson S, Mohlin B. The congenitally missing upper lateral incisor. A retrospective study of orthodontic space closure versus restorative treatment. *Eur J Orthod* 2000;22:697–710.
- Kokich V. Esthetics and anterior tooth position: an orthodontic perspective. Part I: Crown length. *J Esthet Dent* 1993;5:19–23.
- Kokich VO Jr, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent* 1999;11:311–324.
- Abu Alhaja ES, Al-Shamsi NO, Al-Khateeb S. Perceptions of Jordanian laypersons and dental professionals to altered smile aesthetics. *Eur J Orthod* 2011;33:450–456.
- Pinho T, Bellot-Arcis C, Montiel-Company JM, Neves M. Esthetic Assessment of the Effect of Gingival Exposure in the Smile of Patients with Unilateral and Bilateral Maxillary Incisor Agenesis. *J Prosthodont* 2015;24:366–372.
- Priest G, Priest J. Promoting esthetic procedures in the prosthodontic practice. *J Prosthodont* 2004;13:111–117.
- Rosa M, Olimpo A, Fastuca R, Caprioglio A. Perceptions of dental professionals and laypeople to altered dental esthetics in cases with congenitally missing maxillary lateral incisors. *Prog Orthod* 2013;14:34.
- Fernandes L, Pinho T. Esthetic evaluation of dental and gingival asymmetries. *Int Orthod* 2015;13:221–231.
- Howells DJ, Shaw WC. The validity and reliability of ratings of dental and facial attractiveness for epidemiologic use. *Am J Orthod* 1985;88:402–408.
- De-Marchi LM, Pini NI, Pascotto RC. The relationship between smile attractiveness and esthetic parameters of patients with lateral agenesis treated with tooth recontouring or implants. *Clin Cosmet Investig Dent* 2012;17:43–49.
- De-Marchi LM, Pini NI, Ramos AL, Pascotto RC. Smile attractiveness of patients treated for congenitally missing maxillary lateral incisors as rated by dentists, laypersons, and the patients themselves. *J Prosthet Dent* 2014;112:540–546.
- Mota A, Pinho T. Esthetic perception of maxillary lateral incisor agenesis treatment by canine mesialization. *Int Orthod* 2016;14:95–107.



24. Pinho S, Ciriaco C, Faber J, Lenza MA. Impact of dental asymmetries on the perception of smile esthetics. *Am J Orthod Dentofacial Orthop* 2007;132:748–753.
25. Correa BD, Vieira Bittencourt MA, Machado AW. Influence of maxillary canine gingival margin asymmetries on the perception of smile esthetics among orthodontists and laypersons. *Am J Orthod Dentofacial Orthop* 2014;145:55–63.
26. Lombardo L, D'Ercole A, Latini MC, Siciliani G. Optimal parameters for final position of teeth in space closure in case of a missing upper lateral incisor. *Prog Orthod* 2014;15:63.
27. Martin AJ, Buschang PH, Boley JC, Taylor RW, McKinney TW. The impact of buccal corridors on smile attractiveness. *Eur J Orthod* 2007;29:530–537.
28. Moore T, Southard KA, Casco JS, Qian F, Southard TE. Buccal corridors and smile esthetics. *Am J Orthod Dentofacial Orthop* 2005;127:208–213.
29. Flores-Mir C, Silva E, Barriga MI, Lagravere MO, Major PW. Lay person's perception of smile aesthetics in dental and facial views. *J Orthod* 2004;31:204–209.
30. McDowell I. *Measuring Health: A Guide to Rating Scales and Questionnaires*, ed 3. OUP, 2006.
31. Brandão RC, Brandão LB. Finishing procedures in orthodontics: dental dimensions and proportions (microesthetics). *Dental Press J Orthod* 2013;18:147–174.
32. Mashid M, Khoshvaghti A, Varshosaz M, Vallaei N. Evaluation of "golden proportion" in individuals with an esthetic smile. *J Esthet Restor Dent* 2004;16:185–192.
33. Figún M, Garino R. *Anatomía Odontológica Funcional e Aplicada*. Artmed, 2003.
34. Xavier I, Alves R. Enxerto de tecido conjuntivo tunelizado – a propósito de um caso clínico. *Rev Port Estomatol Cir Maxilofac* 2015;56:256–261.
35. Mata AD, Marques D, Silveira J, Marques J. *Medicina Dentária Baseada na Evidência: Novas Opções para Velhas Práticas*. *Rev Port Estomatol Cir Maxilofac* 2008;49:31–37.