



An Assessment of the Maxillary Canine Torque's Aesthetic by Prosthodontists, Orthodontists, and Laypeople

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How to cite this paper: Lahcen, O., Kenza, K., Salma, S., Zineb, S. and Farid, E.Q. (2024) An Assessment of the Maxillary Canine Torque's Aesthetic by Prosthodontists, Orthodontists, and Laypeople. *Open Access Library Journal*, 11: e11196.
<https://doi.org/10.4236/oalib.1111196>

Received: January 10, 2024
Accepted: February 25, 2024
Published: February 28, 2024

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Abstract

Our work aims to assess the perception of practitioners in the field of orthodontics and prosthodontics regarding aesthetics, as well as the assessment of laypersons consulting at the Casablanca dental consultation and care center (CDCC), in regard to the torque of the maxillary canine. Based on the level of significance (alpha) of 0.01 and the effect size of 0.90, the sample size was calculated to achieve 80% power. This calculation showed that 24 subjects in each group were necessary. Five photographs have been modified by the Adobe Photoshop Software from an initial photo of a natural aesthetic smile without prior orthodontic treatment. The modifications concern the torque of the two maxillary canines having initially a negative torque on the 23 and a positive one on the 13. The photos were then organized in a power point presentation format, with the same rate of increase and centering within the slide. Of the 72 participants only 68 responded to the survey. 4 participants could not participate for personal reasons. Once the results were obtained, all the data were integrated into the Excel table and processed by statistical analysis. Given the findings of our investigation, after the right and left symmetrical negative torque, the negative asymmetric torque on one side and zero on the other was also appreciated and well noted by the 3 categories of participants. We can conclude that the subjects did not experience any discomfort from a small asymmetrical torque between the two contralateral canines.

Subject Areas

Dentistry

Keywords

Maxillary Canine Torque, Perception, Aesthetics, Prosthodontics, Orthodontics, Laypeople

1. Introduction

It is essential to define torque from a mechanical and therapeutic standpoint. In terms of mechanics, it describes how a structure spins around its longitudinal axis to produce a twist angle. It is an orthodontic adaption used to define rotation around an x-axis and clinically depicts the buccopalatal crown/root inclination of a tooth. It characterizes the activation produced by twisting an archwire in a bracket slot [1]. Orthodontists define torque in relation to the dental arch so that the curvature of the arch is followed by the x-axis. In this context, torque would be defined as rotation that is perpendicular to the tooth's long axis [2]. The orthodontic literature seems to use the terms "moment," "torsional moment," "couple," "biomechanical torque," and "third-order torque" interchangeably to refer to the same loading condition, even though understanding their biomechanical implications does not always translate into pure torque [2].

Bracket design evolved over time in the field of orthodontics, moving from the traditional edgewise bracket to the newer preadjusted bracket. Tooth movement and, in particular, sliding mechanics were made simpler and easier with the creation by Andrews [3] of a customized bracket that specifically considered the torque and desirable tip of the tooth. Andrews invented the fully programmable bracket system with the intention of using arches without bends. Even though these brackets are designed with optimal torque characteristics, there are situations when extra or specific torques must be applied to certain teeth [4]. Professionals had access to brackets featuring three torque settings for the canines. There are types of brackets for the maxillary canines, and they offer three different torque options: -7° , 0° , and $+7^\circ$, and types of brackets offering three torque options (-6° , 0° , and $+6^\circ$) for the mandibular canines [5].

A noticeable aesthetic outcome is provided by the torque integrated into the anterior teeth, allowing the orthodontist to leave his imprint on the patient's smile. Evaluating beauty is always subjective, a smile analysis is a crucial step in the diagnosis, planning treatment, and outcome of any dental procedure that aims to achieve aesthetic goals. Individuals with diverse backgrounds and experiences have differing opinions about how appealing a smile is. Layperson's perceptions of smile discrepancy are quite subjective and can be impacted by age, gender, ethnicity, and culture [6] [7]. Nonetheless, minor discrepancies in ideal smile parameters are readily noticeable by skilled dental professionals who have received the necessary training to objectively assess smile attractiveness [8]. In our study, we focused on three categories of participants to evaluate their aesthetic perception of the maxillary canine's torque, orthodontists, prosthodontists

and laypersons who represent the patient category.

The objective of this study is to evaluate the esthetic perception of these 3 categories regarding the torque of the maxillary canines.

2. Material and Methods

Our work aims to assess the perception of practitioners in the field of orthodontics and prosthodontics regarding aesthetics, as well as the assessment of laypersons consulting at the Casablanca dental consultation and care center (CDCC), in regard to the torque of the maxillary canine. Based on the level of significance (alpha) of 0.01 and the effect size of 0.90, the sample size was calculated to achieve 80% power. This calculation showed that 24 subjects in each group were necessary.

Five photographs have been modified by the Adobe Photoshop Software from an initial photo of a natural aesthetic smile without prior orthodontic treatment (**Figure 1**). The modifications concern the torque of the two maxillary canines having initially a negative torque on the 23 and a positive one on the 13, the modifications carried out are as follows:

Photo 1: An asymmetrical variation of a single canine putting it at zero-degree torque.

Photo 2: An asymmetric variation from a single canine to a positive torque of 5°.

Photo 3: A symmetrical variation between the 2 canines putting them at 0°.

Photo 4: A symmetrical variation between the 2 canines putting them at 5°.

Photo 5: A symmetric variation between the 2 canines putting them at -5°.

Once the variation of the 5 photos made, we then organized them in a power point presentation format, making sure to present the images in the same rate of increase and with the same centering within the slide so as not to disturb the evaluation of the participants. The support of the validated survey was subsequently presented for a pre-survey which made it possible to identify on the ground the changes necessary for the completion of the survey.

The study's participants include patients who consult the CDCC center (Ibn Rochd University Hospital of Casablanca) for varied care as well as residents, specialists, and professors of the center's two orthodontic and prosthodontic departments. We made contact with three prosthodontists and two orthodontists who had completed their specialization and left the CHU in order to reach the sample size required for the study.

The inclusion criteria under consideration are:

- CCDC residents, specialists and professors, practicing within the CHU or not.
- Specialties concerned: Orthodontics and fixed prosthesis.
- For laypersons: No initial training in dental medicine or any dental background; with variations in age, sex and socio-economic levels.

Any participant who didn't fit these requirements was immediately excluded from the study.

The analog visual scale (AVS), ranging from 0 to 10, was used to evaluate the aesthetic perception. A smile scoring 0 was thought to be the least attractive, and a smile scoring 10 was the most attractive. The assessment focused on how the new torque was integrated into the smile. The aim was to define from which degrees of torque a same smile can transition from pleasing to unsightly.

A total of 68 people were given the survey's support; four of them declined to take part in the study for private reasons. Descriptive statistics were presented as means and standard deviations. Differences in mean scores were evaluated using one way analysis of variance (ANOVA) with the Tukey post-hoc test. The level of significance was established at 5%.

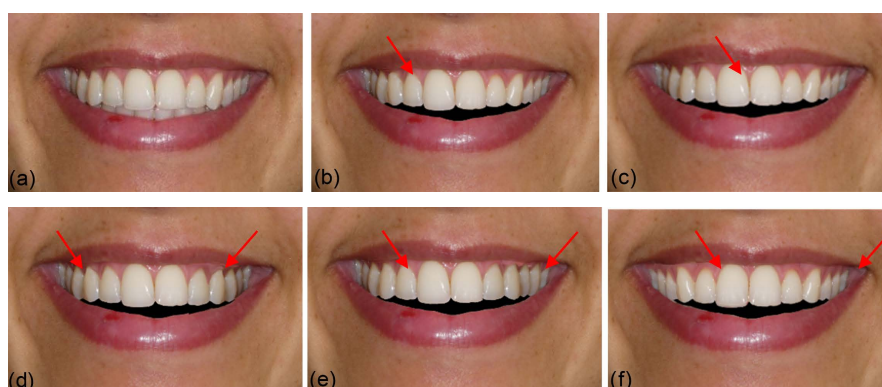


Figure 1. Occlusal views with torque changes. (a) Initial; (b) Asymmetrical 0°; (c) Asymmetrical +5°; (d) Symmetrical 0°; (e) Symmetrical +5°; (f) Symmetrical -5°.

We make sure to obtain the consent of each participant before starting the assessments.

3. Results

Of the 72 participants only 68 responded to the survey. 4 participants could not participate for personal reasons. Once the results were obtained, all the data were integrated into the Excel table and processed by statistical analysis.

3.1. Description of the Sample

The sample included 68 participants with an overall average age of 38.5 years with a standard deviation (SD) of 10.2. For each category, the corresponding age averages are as follows: for the orthodontic department 37.1 years with a SD of 7.77; for the prosthodontics department 38.0 years with a SD of 6.77 and for laypersons 40.2 years with a SD of 14.2.

For gender we were able to note a participation with a total of 63.2% for women and a percentage of 36.8% for men. The participation of each gender by category is shown in **Table 1**.

3.2. Description of Results

Once the data was collected, we calculated the average response for each photo

presented with the One Way ANOVA (Fisher's) test (**Table 2**).

Table 1. Participation rates by gender.

Profile		Gender		Total
		F	M	
Ortho	Observed	14	8	22
	% within row	63.3%	36.4%	100.0%
Prostho	Observed	17	5	22
	% within row	77.3%	22.7%	100.00%
Laypersons	Observed	12	12	24
	% within row	50.0%	50.0%	100.00%
Total	Observed	43	25	68
	% within row	63.2%	36.8%	100.0%

Table 2. Descriptive analysis of data by the One Way ANOVA (Fisher's) test.

	Mean (SD)			p Value
	OrthoD	ProsthoD	Laypersons	
Photo 1	6.00 (2.00)	5.91 (1.77)	6.96 (1.49)	0.086
Photo 2	4.59 (1.82)	5.32 (1.91)	5.63 (1.81)	0.161
Photo 3	6.70 (1.79)	6.32 (1.52)	5.21 (1.86)	0.013
Photo 4	4.93 (1.79)	5.64 (1.94)	4.63 (2.24)	0.227
Photo 5	7.55 (1.37)	7.36 (1.50)	7.88 (1.23)	0.439

Based on these findings, we can conclude that image 5 is the most preferred image by the three categories and image 3 is the one that differs statistically significantly. **Table 4** explored this difference by the Post Hoc Test.

The photos were also analyzed by global average with the 3 categories combined.

Thus, based on the results above (**Table 3**), we can see that photo number 5 had the highest average, with a mean of 7.60 (SD 1.36). This image comprises a symmetrical variation between the 2 canines putting them at -5° . This torque modification was appreciated by the 3 categories with the highest means.

We generate the following ranking by sorting the images according to the observed averages: Photo 5 followed by Photo 1, Photo 3, Photo 2 and Photo 4. By examining the torque changes made we obtain the following results: Participants chose symmetric negative torques to canines (Photo 5), which were followed by a torque asymmetry that had a zero torque and a negative one (Photo 1). The

third preference was a zero torque symmetrically (Photo 3), followed by a torque asymmetry with a negative torque and a positive on the other canine (Photo 2). The last and least preferred change was the introduction of a positive torque symmetrically to both maxillary canines (Photo 4).

Photo 3 shows a statistically significant difference with the other photos. This difference is discussed in **Table 4**.

Table 3. Descriptive analysis of data by the One Way ANOVA (Fisher's) test.

	Photo 1	Photo 2	Photo 3	Photo 4	Photo 5
N	68	68	68	68	68
Mean	6.31	5.19	6.05	5.05	7.60
SD	1.80	1.87	1.83	2.02	1.36

Table 4. Tukey Post-Hoc Test - Photo 3.

		OrthoD	ProsthOD	Laypersons
OrthoD	Mean difference	-----	0.386	1.50
	p-value	-----	0.742	0.013
ProsthOD	Mean difference		-----	1.11
	p-value		-----	0.085
Laypersons	Mean difference			-----
	p-value			-----

Through these results, we can note that the difference exists between orthodontists and the general population regarding photo number 3. This one was considered more esthetic by orthodontists with a p-value of 0.013.

4. Discussion

Through this study, we aim to determine how orthodontists, prosthodontists, and laypeople perceive the torque of the maxillary canine in terms of aesthetics. Based on the acquired results, we were able to conclude from this survey that the right and left symmetric negative torque is the most valued torque at the maxillary canine level.

A key aspect of face attractiveness is a pleasing smile. Numerous features of smile attractiveness, such as buccal corridor spaces, arch widths, smile arcs, mid-line deviations, gingival displays, occlusal plane inclinations, and face measures, have been the subject of in-depth research. It has recently been established that the buccolingual inclination of the posterior teeth has a significant role in both occlusion and smile aesthetics. Some people consider a wide, full smile with little buccal corridor space to be a desirable aesthetic characteristic [9].

Due to its placement on the dental arch's corner, where the anterior and lateral segments of the teeth are joined, the maxillary canine may be very significant in terms of smile aesthetics. The maxillary canine is important for both the occlusal function and smile aesthetics. It promotes proper laterality motions by intervening in them [10]. The six keys of proper occlusion defined the concept of "inclination of teeth" and established ideal norms for buccolingual inclinations. According to Andrews' "Six Elements of Orofacial Harmony," each tooth's root should be positioned in the middle of the basal bone's labiolingual boundaries, and each crown should be angled to allow for optimal gnathological function and full interface [11].

Regarding buccolingual root inclination and limits of expansion tolerated, maxillary expansion is a notion that needs to be handled carefully. For results to remain stable over the time, bone and biological restrictions must be observed. To reduce the chance of relapse, the intercanine distance must be maintained. Keeping the arch form and minimizing the chance of relapse are two crucial goals of orthodontic therapy. In addition to producing a pleasing aesthetic outcome, installing a negative torque in the lateral regions enables a good root position within the alveolus, guaranteeing adequate stability of the tooth displacement produced and the intercanine distance over time [11].

Given the findings of our investigation, after the right and left symmetrical negative torque, the negative asymmetric torque on one side and zero on the other was also appreciated and well noted by the 3 categories of participants. We can conclude that the subjects did not experience any discomfort from a small asymmetrical torque between the two contralateral canines. Clinically speaking, the major causes of variations in maxillary unilateral torque include changes in dental morphology and anatomy, the effects of use on the teeth, the presence of porcelain veneers or composite restorations, and orthodontic tooth movement. In light of this, the process of determining how to adjust maxillary canine torque must take these factors into consideration in order to produce the best possible aesthetic outcome. With its ability to administer torque in the bracket-wire configuration individually, orthodontic treatment is a crucial component of all treatment regimens to rectify canine torque variations [12].

To our knowledge, few studies have addressed the esthetic appreciation of the torque of the maxillary canine. Lemos et al in their study, dealing with the unilateral variation of canine maxillary torque, were able to obtain similar results where the palatal negative torque was the most appreciated by orthodontists and laypeople; the 2 categories tested by these authors [12]. According to their findings, the most attractive smiles for orthodontists were the control (no unilateral torque variation) and the -5° and -10° palatal crown torque. For the laypeople, the most attractive smiles were the control, the -5° , -10° , -15° and $+5^\circ$. For both groups, the lowest scores were assigned to the smiles with unilateral buccal crown torque of $+10^\circ$ and $+15^\circ$ ($p < 0.05$) [12]. Hui Xu et al in their study [9] also conducted on the same topic, were able to conclude that: It could be esthetically satisfying to position the teeth within the ranges of 0 to -7° of inclination for the

canines and -3° to -11° of inclination for the premolars, as assessed by the orthodontists, or of 3° to -10° of inclination for the canines and 5° to -11° of inclination for the premolars, as assessed by the laypersons; what complements our findings [9].

The limit of our study lies in its nature, we chose a study with a single factor evaluation. We used a series of digitally altered smiles from 1 smile to execute a single-factor analysis (inclination of maxillary canine torque) in order to minimize the impact of confounding factors. A smile's aesthetic appeal is influenced by a variety of elements, such as the soft tissues, tooth sizes, arch shapes, and smile arc. Which indicates that the findings obtained by our study relate exclusively to the torque of the maxillary canine taking only this esthetic factor into consideration and not the esthetics of the smile in its entirety. That's the limitation of single-factor studies.

5. Conclusion

The maxillary canine presents a major interest concerning aesthetics and function. At the end of this study, we concluded that the 3 categories of participants prefer a negative and symmetric canine torque. A slight asymmetry between the right and left torques is still tolerated.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Wagner, J.A. and Nikolai, R.J. (1985) Stiffness of Incisor Segments of Edgewise Arches in Torsion and Bending. *The Angle Orthodontist*, **55**, 37-50.
- [2] Archambault, A., Lacoursiere, R., Badawi, H., Major, P.W., Carey, J. and Flores-Mir, C. (2010) Torque Expression in Stainless Steel Orthodontic Brackets. A Systematic Review. *The Angle Orthodontist*, **80**, 201-210. <https://doi.org/10.2319/080508-352.1>
- [3] Andrews, L.F. (1979) The Straight-Wire Appliance. *British Journal of Orthodontics*, **6**, 125-143. <https://doi.org/10.1179/bjo.6.3.125>
- [4] Andrews, L.F. (1989) Straight Wire: The Concept and the Appliance. L.A. Wells, San Diego, 407 p.
- [5] Streva, A.M., Cotrim-Ferreira, F.A., Garib, D.G. and Carvalho, P.E. (2011) Are Torque Values of Preadjusted Brackets Precise? *Journal of Applied Oral Science*, **19**, 313-317. <https://doi.org/10.1590/S1678-77572011005000003>
- [6] Singla, D., Stan, N., Mittal, S., Bhullar, M., Aggarwal, I. and Hassan, R. (2019) Esthetic Perception of Various Forms of Anterior Diastemas during Smiling. *Dental Journal of Advance Studies*, **7**, 103-109. <https://doi.org/10.1055/s-0039-3402302>
- [7] Cotrim, E.R., Vasconcelos Jr., Á.V., Haddad, A.C.S.S. and Reis, S.A.B. (2015) Perception of Adults' Smile Esthetics among Orthodontists, Clinicians and Laypeople. *Dental Press Journal of Orthodontics*, **20**, 40-44. <https://doi.org/10.1590/2176-9451.20.1.040-044.oar>
- [8] Sabri, N.A.B.M., Ridzwan, S.B.B., Soo, S.Y., Wong, L. and Tew, I.M. (2023) Smile Attractiveness and Treatment Needs of Maxillary Midline Diastema with Various

Widths: Perception among Laypersons, Dental Students, and Dentists in Malaysia. *International Journal of Dentistry*, **2023**, Article ID 9977868. <https://doi.org/10.1155/2023/9977868>

- [9] Xu, H., Han, X., Wang, Y., Shu, R., Jing, Y., Tian, Y., Andrews, W.A., Andrews, L.F. and Bai, D. (2015) Effect of Buccolingual Inclinations of Maxillary Canines and Premolars on Perceived Smile Attractiveness. *American Journal of Orthodontics and Dentofacial Orthopedics*, **147**, 182-189. <https://doi.org/10.1016/j.ajodo.2014.10.029>
- [10] Abu Alhaija, E.S., Al-Shamsi, N.O. and Al-Khateeb, S. (2011) Perceptions of Jordanian Laypersons and Dental Professionals to Altered Smile Aesthetics. *European Journal of Orthodontics*, **33**, 450-456. <https://doi.org/10.1093/ejo/cjq100>
- [11] Andrews, L.F. (2000) The Six Elements of Orofacial Harmony. *Andrews Journal of Orthodontics and Orofacial Harmony*, **1**, 13-22.
- [12] Lemos, T.C.B., Vasconcelos, J.B., Santos, B.M.D. and Machado, A.W. (2019) Influence of Maxillary Canine Torque Variations on the Perception of Smile Esthetics among Orthodontists and Laypersons. *Dental Press Journal of Orthodontics*, **24**, 53-61. <https://doi.org/10.1590/2177-6709.24.1.053-061.oar>