The effects of camera lenses and dental specialties on the perception of smile esthetics

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ABSTRACT

Background and Aim: The purpose of this study was to investigate whether different camera lenses and dental specialties can affect the perception of smile esthetics.

Methods: In the first phase of this study, 40 female smile photographs (taken from dental students) were evaluated by six orthodontists, three specialists in restorative dentistry, and three prosthodontists to select the most beautiful smiles. The 20 students with the best smile ranks were again photographed in standard conditions, but this time with two different lenses: Regular and then macro lenses. Each referee evaluated the beauty of the smiles on a visual analog scale. The referees were blinded of the type of lenses, and the images were all coded. The data were analyzed using two-way analysis of variance (ANOVA), Kruskal–Wallis and Mann–Whitney U-tests (alpha = 0.05, alpha = 0.0167).

Results: The lenses led to similar scores of beauty perception (Mann–Whitney P = 0.8). There was no difference between subjective beauty perception of specialties (Kruskal–Wallis P = 0.6). Two-way ANOVA indicated no significant role for lenses (P = 0.1750), specialties (P = 0.7677), or their interaction (P = 0.7852).

Conclusion: The photographs taken by a regular lens and then digitally magnified can be as appealing as close-up photographs taken by a macro lens. Experts in different specialties (orthodontics, prosthodontics, and restorative dentistry) showed similar subjective judgments of smile beauty.

Key words: Beauty, digital photography, macro lens, operative dentistry, orthodontics, prosthodontics, smile

INTRODUCTION

Facial and smile esthetics is a major reason for many patients to seek orthodontic and dental treatment.[1-4] Smile esthetics is affected by several factors (such as the occlusion, gingival display, lip position, dentolabial harmony, or dental anomalies like congenitally missing teeth) and is critical for enhancing one's psychological well-being and self-perceived psychological impact.[1-8] Moreover, esthetics is an intricate and subjective matter, affected by various factors such as the prejudiced judgment of attractiveness depending on the observer's psychosocial and cultural condition or the properties of the observed object or the medium on which the scene is visible.[4,8-11]

A photograph of low quality might reduce the patient's satisfaction by affecting their esthetic judgment. Therefore, it would be more desirable to use equipments that can better reflect the reality. Objective camera characteristics

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might guide the clinician in selecting the best device.[4,12] Common sense suggests some correlation between the image quality and the facial esthetics. Nevertheless, it is not known whether the quality improvement by means of better equipment (e.g., a macro lens) can contribute to the esthetics of the smile photographed, as there is no study in this regard. In digital devices, many image properties are affected by the type of the lens.[13,14] Smile photography is a case of close-up imaging. There are brochures suggesting that a macro lens is necessary for close up dental imaging.[4,15,16] Nonetheless, there is no study of any kind on the beauty or subjective quality of dental images taken with macro lenses compared to usual lenses.

Another factor potentially affecting one's sense of beauty might be a set of psychosocial factors including beauty standards installed by media, population anthropometric norms, age, occupational or artistic interests of the evaluator, or education.[2,6,7,9-11] It has been shown that dentists, orthodontists, surgeons, and laypeople might notice different aspects of the smile.[2,6,9-11] Therefore, it would be of interest to know whether dentists from three esthetic-oriented specialties "orthodontics, prosthodontics, and restorative dentistry" might have similar smile esthetic tastes.

In this study, it was hypothesized that an image taken with a normal lens and then digitally enlarged is similar in terms of beauty with a close-up smile image taken using a macro lens. In addition, it was hypothesized that being educated in different dental specialties might affect the beauty judgment of the specialists.

MATERIALS AND METHODS

In the first phase of this study, 40 female dental students with balanced faces and Angle Class I molar relationship were enrolled after evaluating female students of 18–24 years old. The included students needed to be healthy with balanced faces, looking subjectively normal (but not necessarily attractive), with no obvious disharmony between its facial features, or no excessive departures from the population norms subjectively determined by two experienced faculty members of the Orthodontic Department (a dentist and an orthodontist). The Institutional Review Board of the University approved the ethics of the study protocol. All the students and referees signed written consent forms.[4]

Selecting Attractive Smiles

Posed smiles of the subjects were photographed in similar conditions (no makeup, natural head position, a white background, focal spot of 100 mm, distance = 60 mm, f/8, no flashlight, standardized fluorescent light, brightness set at white balance), using a 18.0-megapixel digital single-lens reflex (DSLR) camera (EOS 550D, Canon, Japan) installed on a tripod (Canon) and equipped with a macro lens and a grid visor. The lens was focused on the lower one-third of the face.[4]

Six orthodontists, three prosthodontists, and three specialists in restorative dentistry independently ranked the smile esthetics. The smile photographs were shuffled. Photographs were given to all referees in the same order. Each referee evaluated each image for 20 s, without any rewind. A 100 mm visual analog scale (VAS) was used to rate the beauty of each smile. After 2 weeks, the images were again shuffled into a different random order. The images were handed again to the same referees, who rated the images, as stated above. The VAS scores were converted to ordinal scores 0–10. For each photograph, the ranks were calculated by summing up all the scores given by all referees in both sessions. The total ranks were used to select 20 smiles with the highest scores.[4]

Photography of the Top 20 Most Beautiful Smiles using Two Lenses

The 20 students with the best smile ranks were again called for photography. Digital photographs were taken in standardized situations (no make ups, natural head position, focal spot of 100 mm, distance = 60 mm, standardized fluorescent light) from posed natural smiles of the 20 students, using a camera (EOS 550D, Canon) with a macro lens (100 mm focal spot) and a regular lens. The macro lens was focused on the smile. The images taken with the regular lens were then digitally magnified and cropped to enclose the smile [Figures 1 and 2].

The images were first sorted in a random order. Then they were shown to each referee (the same order of images were given to all judges). Each image was seen for 20 s (by the automatic slide view feature, set at 20 s) without a rewind or without skipping any images. Each referee in the same panel of experts evaluated the beauty of the smiles on a VAS. The VAS was converted to 11 equal ranks (0 – Definitely not pleasing, 10 – Extremely beautiful). The same procedure was repeated 2 weeks later, however, in another (randomly chosen) order. The same random order of images was used for all judges. The average score of each referee given to each image was calculated between two sessions. The referees were blinded of the type of lenses, and all images were coded.[4]

Statistical Analysis

The scores were calculated by a statistical expert blinded of the groups and camera types. The mean score of all referees for each image was considered as the final score of that image. The same calculation was performed for each specialty, all by a blinded statistician. Descriptive statistics were calculated according to the coded lenses and dental specialty. The coded groups were compared using two-way analysis

Figure 1: Smile photographs of two students using a regular lens

of variance (ANOVA), Kruskal–Wallis and Mann–Whitney U-tests. The level of significance was set at 0.05. If the result of Kruskal–Wallis test comparing specialties became significant, pairwise comparisons would be conducted between specialties, using Mann–Whitney U-test. The level of significance for this particular test would be adjusted to 0.0167, according to the Bonferroni method.

RESULTS

There was a significant intra-rater agreement between the smile esthetics scores given by the observers at both sessions (Cronbach alpha = 0.72, $P < 0.05$).

The regular lens resulted in an average beauty score of 5.24 (out of 10), while the average score was 5.73 in the macro lens group [Table 1]. The difference between these scores of beauty perception was not statistically significant according to the Mann–Whitney U-test ($P = 0.8$).

The average scores of smile beauty given by orthodontists, prosthodontists, and specialists in restorative dentistry (both lenses combined, n = 40 observations per field of specialty) were 5.560, 5.545, and 5.285, respectively. There was no statistically significant difference between subjective beauty perception of specialties, according to the Kruskal–Wallis test ($P = 0.6$). Therefore, the *post hoc* test Mann–Whitney U was not performed. The two-way ANOVA indicated no significant differences between the results pertaining to

Table 1: The VAS scores for each lens

Lens	*n*	Mean	SD	CV (%)	Minimum	Maximum	95% CI	
Regular	20	5.24	1.95	19.4	0	10	4.39	6.09
Macro	20	5.73	1.85	19.4	0	10	4.92	6.54

SD – Standard deviation; VAS – Visual analog scale; CI – Confidence interval; CV – Coefficient of variation

Table 2: The VAS scores given by each specialty to images taken using each lens

Specialty	Lens	N	Mean	SD	CV (%)	95% CI	
Orthodontics	Regular	20	5.29	1.9	35.92	4.46	6.12
	Macro	20	5.83	1.91	32.76	4.99	6.67
Prosthodontics	Regular	20	5.18	2.48	47.88	4.09	6.27
	Macro	20	5.91	1.84	31.13	5.10	6.72
Restorative dentistry	Regular	20	5.21	1.39	26.68	4.60	5.82
	Macro	20	5.36	1.71	31.90	4.61	6.11

SD – Standard deviation; VAS – Visual analog scale; CI – Confidence interval; CV – Coefficient of variation

Figure 2: Smile photographs of the same two students shown in Figure 1 in the same order, taken using a macro lens

different lenses ($P = 0.1750$) or specialties ($P = 0.7677$). It also did not show any significant interaction between lenses and specialties [$P = 0.7852$, Figure 3 and Table 2].

DISCUSSION

Various factors contribute to the beauty of smile, such as the buccal corridor, shape of the teeth, asymmetries, arch widths, and gingival display.[8] However, not only the smile itself, but also the evaluation methods matter as well.[8] Some authors find static records (photography) insufficient for esthetic and diagnostic purposes,[17] but some others consider photographs appropriate methods for these purposes.[8,18] Patients' complex clinical appearances are usually difficult to describe in words. Therefore, much of clinicians' professional time is spent in judging and discussing pictures and photographs.[16,19] High-quality photographs are fundamental for pre and postoperative documentation as well as for scientific development and staff training.[16,19]

A DSLR camera is preferable for more predictable dental photography. The lens focuses the reflected flashlight into the camera. The DSLR camera system uses a single lens for both image capture and composition, which allows direct viewing and focusing without parallax error.[15,20] A lens selected for dental purposes must be able to capture diagnostic views of oral structures while the clinician is positioned at a comfortable and convenient working distance from the patient.[15] It is necessary to equip the camera with a lens that enables recording from close distance and with flash,[14] and having a minimum of f/22 aperture. The distance of the object photographed is another factor contributing to the image quality.[14] Macro lenses can capture enlarged images while focusing at a close range.[15] It has been suggested to use a fixed portrait focal length (90–105 mm) high-quality macro lens for both facial and intraoral pictures, to ensure a maximum field depth, with the smallest possible distortion and minimal alteration of colors.[16] Macro lenses with a fixed focal length designation of 100 mm to 105 mm might provide the ideal combination of working distance
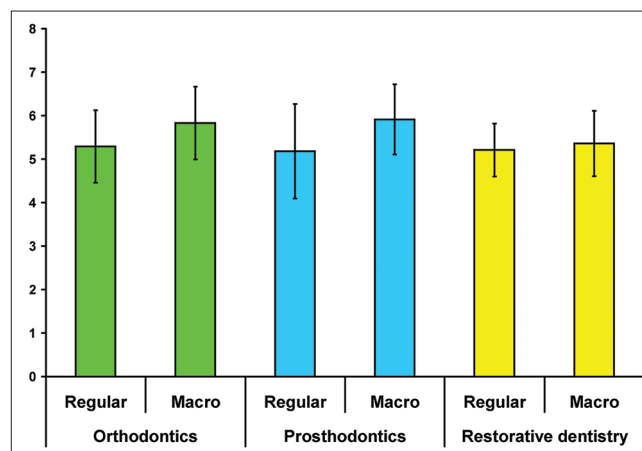

Figure 3: The visual analog scale scores for dental specialists' perception of smile beauty according to the specialty and lens

convenience and magnification ability for dental photography. The quality of the lens has a significant influence on the sharpness, clarity, and ultimate quality of the final image.[15,21] This focal length allows the reproduction of the natural anatomy without the bulging that happens with wide-angle lenses.[16] A dual purpose (portrait/close up) lens is the best option for dental applications. The ideal choice is a macro telephoto lens capable of producing 1:2 or 1:1 (actual size) magnifications, which can provide both functions.[22]

Despite numerous guidelines suggesting that macro lenses are necessary for obtaining high quality close-up images,[4,15,16] it is not supported by scientific evidence. Since advanced camera sensors are high resolution, we believed that by taking the smile image from a far distance and then zooming in digitally, a similar quality of smile might be obtained. The findings of this study indicated that the lenses did not affect the beauty of smile perceived by the specialists. This indicates that with the advent of new high-resolution sensors, more economic regular lenses can be used to document and judge the beauty of smile. In addition, the expertise in the three assessed fields of specialties did not affect the judgment of smile attractiveness. Since there is no similar study in this regard, further comparison and discussing the results was not possible.

This study was limited by some factors. Both digital photography and the notion of beauty are sophisticated matters. Image quality can be affected by numerous factors, including the sensors. However, we had matched the sensors in both groups. Moreover, it was very difficult, if not impossible, to obtain reproducible photographs from a single participant. The only way to eliminate the inevitable inconsistencies between participants' smiles or head positions was to take a single photograph from each participant, and then take pictures from that single photograph, using different cameras. Nevertheless, this method would have its own limitations: As the qualities of the second-hand images would be all overshadowed by the quality of the original image. Moreover, taking pictures from two-dimensional images could not represent three dimensional clinical conditions. The generalizability of our findings was favored by the participation of specialists from three different fields of dentistry. Future studies should predetermine the sample size based on power calculations, and use scores given by general dentists, visual artists, and laypeople, etc., in order to improve the generalizability. On the other hand, the results obtained by a single brand and type of camera cannot be generalized to all other cameras and lenses of the same type. The results of this study might be generalizable also to taking films (instead of photographs) with the same lenses because, in essence, a movie is a fast slideshow of pictures. However, future studies should compare the perception of beauty in digital movies, which are becoming popular with the advent of teleconferences, and can relate to modern treatment planning.

As clinical implications, it was understood that the digital zoom in a photograph taken by a regular lens might serve as similar as a macro lens in the perception of close up image beauty, which is an important part even in dental documentation let alone in multidisciplinary practice. Since there was no similar study on this subject, we could not compare our results and discuss them further. Unless more research is implemented in this regard, making any recommendation seems out of place. Clinicians should take the advantages versus limitations of each lens (and camera) while purchasing a camera.

Given the very close results of the three specialties, it might be concluded that different dental fields have similar esthetic standards, which is favorable in multidisciplinary tasks. Nevertheless, future studies with larger groups of specialists are necessary to verify our preliminary results in this matter.

CONCLUSION

The images created by regular lenses, then cropped, and digitally zoomed are as appealing as photographs taken by macro lenses. Therefore, as long as this factor is the major concern of the clinician or patient, there might be no need to replace the regular lens with a more expensive macro lens. Experts in different specialties (orthodontics, prosthodontics, and restorative dentistry) showed similar subjective judgments of smile beauty.

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Conflicts of Interest
There are no conflicts of interest.

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