

Perception of Dental Esthetics: Influence of Restoration Type, Symmetry, and Color in Four Different Countries

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In this study, the influence of restoration type, symmetry, and color on the perception of dental appearance was evaluated. An esthetic questionnaire was completed by 29 patients before and after esthetic rehabilitation. In addition, 94 dentists from four countries (Germany, the United Kingdom [UK], China, and Switzerland) evaluated the influence of the above factors using before-and-after rehabilitation pictures. The most invasive treatment was recommended by Chinese dentists, while German, Swiss, and UK dentists recommended comparable treatment options. As for restorative symmetry, restoration type, and color, significant differences could be found among and within the dentists of the four countries ($P \leq .05$). *Int J Prosthodont* 2015;28:60–64. doi: 10.11607/ijp.4005

For dentists in general, objective and quantifiable measurements are considered to be conventional indicators of esthetic success or failure.¹ Hence, a harmoniously balanced smile judged from a professional perspective is assumed to arise as a result of the ideal interaction of dental and gingival beauty criteria.² However, the first part of this study observed significant differences between patients and dentists' esthetic perception.³ Reasons why judgment of dental esthetics differs may be found in more abstract, psychologic factors such as ideal body image, self-image, and personal motivation.⁴ Moreover, cultural

differences seem to play a significant role.³ To the knowledge of the authors, little is known about influencing aspects of self- and professional assessment and intercultural differences before and after complete oral rehabilitations.

The working hypotheses were as follows:

1. Self- and professional esthetic perception are not influenced by restoration type, symmetry, and color.
2. Treatments are recommended equally in four countries to solve the patients' esthetic problems.

Materials and Methods

The materials and methods were explained in detail in two previous studies.^{1,4} In short, 29 patients (8 men, 21 women) with esthetic dental problems were treated between January 1 and September 30, 2009, in a private clinic in London. All patients received a fixed restoration, including at least one central incisor. The patients were asked to answer a questionnaire regarding "Satisfaction with one's own dental appearance" (QDA; Table 1)³ after the initial pretreatment and 2 weeks after esthetic rehabilitation at the recall session. Dental appearances were assessed professionally on standardized digital photographs (EOS 50D, Canon) before and after oral rehabilitation by 94 dentists from four different countries. The data were statistically analyzed at $P \leq .05$. Since the data were not distributed normally (Kolmogorov-Smirnov and Shapiro-Wilks test), nonparametric tests were employed.

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Table 1 Questionnaire: “Satisfaction with One’s Own Dental Appearance”

No.	Item
Questions 1–6 asked in a positive way	
Q1	I am content with the appearance of my teeth.
Q2	I am content with the size of my teeth.
Q3	I am content with the shape of my teeth.
Q4	I am content with the color of my teeth.
Q5	I am content with the position of my teeth.
Q6	I am content with the appearance of my gums.
Questions 7–11 asked in a negative way	
Q7	I tend to hide my teeth.
Q8	I wish I had other teeth.
Q9	I feel rather old because of my teeth.
Q10	I am dissatisfied with the black hole disease between my teeth.
Q11	I am dissatisfied that my teeth are recognized as artificial.

Table 2 Evaluation of the Main and Additional Treatment Options Preferred by Dentists in Four Countries to Solve the Esthetic Problem

Country	Treatment options chosen (%)						
	Nothing	Whitening	Filling	Veneer	Crown	FDP	RDP
Germany							
Main option	11.3	18.3	28.6	17.8	20.0	3.9	0.1
Additional treatment	57.1	0.1	6.1	11.0	19.2	5.1	1.4
Additional treatment	92.1	0	0.1	1.1	3.8	1.7	1.1
Switzerland							
Main option	21.4	16.5	32.3	13.5	14.0	1.5	0.7
Additional treatment	49.0	4.2	12.8	14.0	16.5	2.0	1.5
Additional treatment	88.4	0.7	1.0	4.4	4.7	0.7	0
China							
Main option	10.1	22.4	3.6	13.0	33.3	14.2	3.3
Additional treatment	84.7	0.7	0.6	4.3	3.9	3.8	2
Additional treatment	98.0	0	0	0.2	0.7	0.1	1.0
United Kingdom							
Main option	11.7	30.2	20.5	19.8	15.5	1.7	0.5
Additional treatment	48.3	0.5	11.4	15	18.6	5.5	0.7
Additional treatment	86.6	0	0.2	3.4	6.2	2.6	1
Patients’ actual treatment							
Main option	0	0	0	44.8	44.8	10.3	0
Additional treatment	41.4	6.9	10.3	34.5	6.9	0	0
Additional treatment	69.0	17.2	6.9	0	0	6.9	0

FDP = fixed dental prosthesis; RDP = removable dental prosthesis.

Results

The entire statistical analysis can be found in Tables 2 to 5. The treatment the dentists suggested for their “virtual” patients varied considerably from the actual work that was performed. Swiss dentists recommended not treating 21% of the patients compared to around 10%

by German, Chinese, and United Kingdom (UK) dentists. If treatment was recommended, Chinese dentists prescribed the most invasive treatment, whereas German, Swiss, and UK dentists showed comparable percentages of treatment suggestions. Comparing asymmetrical to symmetrical treatment, only Chinese dentists rated both equally in esthetic outcome

Table 3 Descriptive Analyses of Factors Potentially Influencing the Difference Between the Dentists of the Four Countries and the Patients

	Patients [†]	Germany		Switzerland		China		United Kingdom	
	Median (25 th ; 75 th Percentile) n	(n = 30)	Percentiles (25 th ; 75 th)	(n = 14)	Percentiles (25 th ; 75 th)	(n = 30)	Percentiles (25 th ; 75 th)	(n = 20)	Percentiles (25 th ; 75 th)
Veneer	91 (83; 99) 13	61	57; 66	58	57; 62	58	48; 63	71	61; 77
Crown	85 (80; 91) 13	61	55; 64	56	53; 60	56	50; 63	70	60; 74
FDP	83 [†] (-; -) 3	55	46; 61	48	38; 57	45	35; 56	65	53; 70
Symmetry									
Yes	88 (81; 96) 22	61	56; 65	56	55; 60	56	48; 62	71	60; 75
No	85 (79; 92) 7	59	53; 62	55	53; 56	56	48; 62	65	59; 75
Color 0									
Before	54 [†] (-; -) 1	25	13; 30	40	23; 50	34	17; 44	42	28; 51
After	84 [†] (-; -) 2	38	18; 54	49	31; 58	48	36; 59	67	53; 74
Color 1									
Before	49 (34; 73) 6	38	33; 44	39	38; 46	34	27; 40	34	30; 36
After	86 (80; 99) 11	64	58; 68	61	57; 65	60	53; 65	70	60; 76
Color 2									
Before	45 (36; 63) 12	33	29; 41	38	35; 40	28	23; 32	34	30; 40
After	90 (85; 94) 10	63	59; 67	57	55; 61	58	50; 64	72	59; 77
Color 3									
Before	46 (21; 61) 10	21	17; 28	31	23; 36	20	17; 26	24	17; 31
After	84 (80; 88) 6	54	46; 60	46	46; 55	41	41; 57	64	56; 68

FDP = fixed dental prosthesis.

*All participants judged the esthetic outcome on a visual analog scale (VAS; endpoints 0 = "not at all" and 100 = "very much"); questions asked in a negative way were transformed (value_transform = value * [-1] + 100). The VAS values for photographs of the anterior teeth with and without lips (P_smile/P_teeth) were pooled. The color 0 indicated a bleach color, whereas A1 to A3 corresponded to the Vita Classical Shade Guide.

[†]As for color, 0 (bleach) n < 3 and for treatment method fixed dental prosthesis n = 3, no percentiles are shown.

Table 4 Statistical Analyses of Factors Potentially Influencing the Differences Between the Dentists of the Four Countries Regarding the Esthetic Perception of the Countries with Each Other Using Kruskal-Wallis Tests and Mann-Whitney *U* Tests

		Mann-Whitney <i>U</i> test for independent samples (<i>P</i> ≤)*					
	Kruskal-Wallis tests	CH-GER	China-GER	UK-GER	China-CH	UK-CH	UK-China
Veneer	<i>P</i> ≤ .0001	.4	.18	.02	.6	.01	.0006
Crown	<i>P</i> ≤ .0001	.3	.3	.024	.8	.0006	.0006
FDP	<i>P</i> ≤ .008	.4	.036	.057	.6	.015	.0006
Symmetry							
Yes	<i>P</i> ≤ .0001	.1	.06	.024	.7	.0006	.0006
No	<i>P</i> ≤ .001	1.0	1.0	.008	1.0	.006	.006
Color 0							
Before	<i>P</i> ≤ .008	.15	.16	.006	1.0	1.0	.3
After	<i>P</i> ≤ .001	.6	.21	.006	.8	.016	.006
Color 1							
Before	<i>P</i> ≤ .07	.8	.4	.4	.35	.06	.9
After	<i>P</i> ≤ .001	.4	.08	.09	.4	.05	.0006
Color 2							
Before	<i>P</i> ≤ .0001	1.0	.01	1.0	.0006	.3	.032
After	<i>P</i> ≤ .0001	.04	1.0	.06	1.0	.0006	.0006
Color 3							
Before	<i>P</i> ≤ .02	.025	1.0	1.0	.012	.16	1.0
After	<i>P</i> ≤ .0001	.4	.3	.008	.8	.0006	.0006

CH = Switzerland; GER = Germany; UK = United Kingdom.

*All *P* values were adjusted according to Bonferroni-Holm for multiple comparisons.

Table 5 Statistical Analyses of the Preferential Factors Potentially Influencing the Differences Within the Dentists of the Four Countries Using Friedman Tests and Wilcoxon Rank Sum Post-hoc Tests

		Germany	Switzerland	China	United Kingdom
Veneer vs crown vs FDP	Friedman test	< .0001	< .008	< .0001	.0003
Color before treatment	Friedman test	< .0001	< .006	< .0001	< .0001
Color after treatment	Friedman test	< .0001	< .0001	< .0001	< .0001
Symmetry vs asymmetry	Wilcoxon rank sum test	.0002	.03	.54	.02
Veneer vs crown	*Wilcoxon rank sum test	.2	.051	.43	.17
FDP vs veneers	*Wilcoxon rank sum test	< .0001	.049	< .0001	.001
Crown vs FDP	*Wilcoxon rank sum test	< .0001	.049	< .0001	.001
Color 0 vs Color 1					
Before		.0016	1.0	.88	.26
After	*Wilcoxon rank sum test	< .0001	.0049	< .0001	.16
Color 0 vs Color 2					
Before		.01	1.0	.11	.59
After	*Wilcoxon rank sum test	< .0001	.033	.0003	.16
Color 0 vs Color 3					
Before		.44	.69	.0004	.0007
After	*Wilcoxon rank sum test	.00051	.46	.49	1.0
Color 1 vs Color 2					
Before		.017	1.0	< .0001	.588
After	*Wilcoxon rank sum test	.25	.009	.27	1.0
Color 1 vs Color 3					
Before		< .0001	.0015	< .0001	< .0001
After	*Wilcoxon rank sum test	< .0001	.0007	< .0001	.00013
Color 2 vs Color 3					
Before		< .0001	.003	< .0001	< .0001
After	*Wilcoxon rank sum test	< .0001	.003	< .0001	< .0001

FDP = fixed dental prosthesis.

*All *P* values were adjusted according to Bonferroni-Holm for multiple comparisons.

($P > .05$). While crowns and veneers were rated esthetically equally, fixed dental prostheses (FDPs) received a significantly lower esthetic score ($P \leq .05$). Regarding the esthetical evaluation of the different colors (Vita Classical Shade Guide, Vita Zahnfabrik) within the countries, dentists showed significant preference patterns ($P \leq .05$).

Discussion

Disagreement between professionals and patients in previous studies regarding their judgment of dental esthetics could be reduced with esthetic guidelines, a standardized treatment concept, and, most importantly, by incorporating the patients' feedback.¹ It seems established that gender, experience, and age do not influence the professional and patients' rating of dental esthetics.¹ However, cultural and educational differences appear to play a significant role in treatment and perception.³

Interestingly, the patients decided to be treated in a much more invasive way than any of the dentists recommended. That means for an improvement in dental esthetics, patients in this study were willing to sacrifice healthy tooth substance in order to improve their dental appearance. This finding was contrary to the literature.⁵

FDPs were rated significantly worse than veneers or crowns, which can be explained by the loss of gingival and dental architecture. The question whether to pursue symmetrical treatment or to save healthy tooth substance is highly dependent on the dental technician, the remaining natural dentition, and the patients' wishes. Based on these study results, it seems to be recommendable to include the patient in the decision-making process and leave it to the patient to choose whether to sacrifice healthy tooth substance in order to gain better esthetics. The same recommendation for professionals can be applied to the choice of the color; patients should be allowed to make their own informed decisions.

Conclusions

Education and cultural background appear to influence the professional perception of dental esthetics.

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Literature Abstract

Zygomatic implants: The impact of zygoma bone support on biomechanics

Zygomatic implants are indicated where there is insufficient bone in the posterior maxilla and are inserted through the residual ridge and sinus to engage the body of the zygomatic bone. The aim of this study was to measure the biomechanical behavior of these long implants (35 to 50 mm) with 10, 15, and 20 mm of bone support using finite element (FE) modeling. A 50-mm-long Nobel Biocare zygomatic implant was scanned and inserted in FE-modeled alveolar bone to the depths noted above. A simulated 150 N load was applied at 45 degrees to the long axis, and FE von Mises stresses were calculated. The results indicated three times greater stress in the bone for the implant with 10-mm versus 20-mm bone insertion. Similarly, the abutment screw had lower stress with greater bone support. Abutment stresses did not differ much with varying bone support. Increasing bone support resulted in lower displacement of the implant fixture, abutment, and abutment screw. The authors concluded that the higher stresses with lower bone support were a result of flexing of the long fixture and recommended that 15-mm bone support, in addition to some alveolar support, is required to reduce the risk of mechanical failure of the implant components and reduce stresses at the implant/bone interface. This study modeled nonsplinted implants and is not reflective of how they are used clinically where splinting might result in a different stress pattern—this would be an interesting comparison.

Romeed SA, Malik R, Dunne SM. *J Oral Implantol* 2014;3:231–237. **References:** 25. **Reprints:** SA Romeed, Department Restorative Dentistry, King's College London Dental Institute, London, UK. Email: shihab.romeed@kcl.ac.uk—Steven Soo, Singapore

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