Clinical Assessments and Patient Evaluations of the Esthetic Quality of Maxillary Anterior Restorations

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Purpose: Dental esthetics has increasingly become an important and rewarding discipline in dentistry as patients have begun to request anterior restorations of high esthetic quality. Clinicians must be prepared to meet the esthetic demands and high expectations of their patients. Different variables may influence the esthetic quality of restorations. Quality evaluations may vary with clinical or patient assessments. This study attempted to assess the esthetic quality of maxillary anterior restorations in order to determine the percentage of restorations with satisfactory quality, examine variables affecting esthetic quality, and make comparisons between agreements and disagreements in clinical and patient evaluations. ***Materials and Methods:*** Restorations in patients attending different dental clinics in Irbid, Jordan were examined. Clinicians compared the color and shape of the restorations with those of a natural tooth using Ryge criteria, and patients evaluated the same parameters and the surface texture using a Visual Analogue Scale (VAS). Evaluations ranked the quality as good, satisfactory, or poor. ***Results:*** The percentage of esthetic complaints was 32.4%, whereas the percentage of satisfactory restorations revealed was 43.8% and 67.6% by clinical and patient assessments, respectively. Restorations yielded significantly better scores on both evaluations when they were prepared by dental students, made in the Dental Teaching Centre (DTC), or were less than one year old. The number of agreements between clinical and patient rankings was significantly less than disagreements. ***Conclusions:*** There were statistically significant disagreements on the esthetic quality between clinicians and patients. Age, gender, practice sector, qualification of the operator, type, and longevity of restoration significantly affected the assessments.*Int J Prosthodont 2009;22:65–71.*

Traditionally, restorative dentistry has focused mainly on eliminating of dental caries and restoring the function of defective teeth with suitable direct or indirect restorations. However, the last 2 decades have witnessed a decline in the prevalence of dental caries, an increased dental awareness, and the development of new techniques and materials that collectively have shifted the emphasis toward esthetic restorations.[1,2]

Dental esthetics is a major concern for patients seeking the restoration of maxillary anterior teeth. Patients prefer to have a pleasing dental appearance that contributes positively to their overall appearance and boosts self-confidence. It has been reported that excellent dental appearance is perceived to relate positively to personality and character, while poor dental esthetics is linked to a personality lacking self-confidence.[1,3]

The mandatory type of dental treatment is usually decided by the clinician and respected by the patient. However, when the treatment is elective and cosmetic, patients like to participate in deciding the components of their esthetic restorations. They anticipate restorations of high esthetic quality, especially after they have agreed to meet the high cost of having them. Clinicians should plan to construct meticulous restorations in order to meet their patient's esthetic demands and expectations. However, a patient's satisfaction with a

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restoration's appearance is rather subjective and varies from one person to another[4] depending on his or her social and cultural backgrounds.[5,6]

It has been reported that clinicians are more capable of identifying deviations from the so-called ideal appearance of restorations than lay people.[7] However, most clinicians interpret esthetic attitudes based on their own opinions rather than on those of the patient.[8] The clinician's opinion on dental esthetics might be dissimilar with the subjective view of the patient.[9] Therefore, it has been recommended that the treatment plan should clearly consider the esthetic impact on the patient; otherwise, the outcome may be disappointing.[10]

Several factors may have a significant influence on the esthetic quality of anterior restorations. These include tooth color, shape, and surface texture. Each factor may be considered individually, but all components interplay in concert and produce their esthetic influence collectively.[1]

There is little information on the clinical assessment of the quality of anterior restorations. Moreover, patient satisfaction with the esthetic elements of restorations has not been measured on a large scale. The aims of this study were to undertake clinical assessments and patient evaluations of the esthetic quality of anterior restorations in relation to color, shape, and surface texture in order to: *(1)* determine the percentage of satisfactory restorations, *(2)* examine variables affecting the quality, and *(3)* compare the quality rankings of the two evaluations.

Materials and Methods

The subjects of this study were recruited from different dental clinics in Irbid, Jordan: the Dental Teaching Center (DTC), the dental sections of Princess Basmah and Prince Rashid public hospitals, and two private dental clinics. Patients older than 18 years of age with maxillary anterior direct or indirect tooth-colored restorations attending those clinics during the last 3 months of the year 2006 were included in the study.

Patients were interviewed on the dental chair; the study protocol was explained to them and their consent to participate in the study was obtained. They were then examined for the presence of any maxillary anterior restorations. Prior to an assessment, patients were asked to brush their teeth for 3 minutes with a toothbrush and toothpaste. The esthetics of each restoration were then evaluated by two objective and subjective procedures. The clinical objective assessments were carried out by calibrated clinicians and the subjective evaluations were performed by the patients themselves. A recorder filled out a form with the details of any significant findings as well as personal data of the patient.

Prior to the actual study, the first author explained the clinical procedures of the assessments to four examiners and two recorders; calibration was undertaken during a week-long period by means of a pilot study. Each examiner used Ryge criteria to examine 30 restorations, including 7 composite fillings, 9 porcelain-fused-to-metal (PFM) crowns, 10 crowns with acrylic facing, and 4 all-porcelain crowns. The recorder was positioned so that the voice of the examiner could be easily heard, but the latter could not readily see the recording form. The duties of the recorder were to ask twice, in a clear voice, for the type of restoration to be examined, the esthetic components (ie, color or shape), and the rating (eg, good, satisfactory, or poor). The examiner's duties were to give answers to the recorder in the same sequence as the questions asked. The recorder filled out the appropriate box of the evaluation form with the details dictated to him by the examining clinician. Evaluations were carried out by two examiners consecutively. The recorder resolved any disputed rating through a joint examination by both examiners. The results of each examiner for every type of restoration were recorded and compared statistically with other examiners. Examinations were repeated until the acceptable 95% inter- and intraexaminer performance was achieved. Moreover, the pilot investigation tested the procedural methods and obviated any problems before the actual experiment commenced.

Clinical Examination

The lips were retracted by placing cotton rolls in the labial sulcus, and restorations in the anterior teeth were dried using a three-in-one syringe. The oral cavity was illuminated and the clinical examination was carried out using an explorer and a dental mirror to evaluate the color and shape of anterior restorations. The clinical assessments were based on the Ryge criteria.[11]

Evaluation of color and shape match of the restoration was made at a distance of 45 cm, equivalent to the distance of close conversation. The color and shape were compared to those of the same, adjacent, or the nearest mesially available tooth according to the following criteria:

- No mismatch (good): The color or shape of the tooth and the restoration was completely matching.
- Mild mismatch (satisfactory): The color or shape difference between the restoration and tooth was mild.
- Gross mismatch (poor): The color or shape of the restoration is grossly mismatching with the natural tooth.

Table 1 Patient Evaluations and Clinical Assessments of the Quality of All Esthetic Restorations According to Variables

	Patient evaluations		Clinical assessments	
Variable	Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory
Age group (ys)				
15–29	101	53	79	75
30–44	59	38	41	56
45–59*	53	14	19	48
60 and above	6	0	3	3
Total (%)	219 (67.6%)	105 (32.4%)	142 (43.8%)	182 (56.2%)
Gender				
Male*	114	32	70	76
Female	105	73	72	106
Total (%)	219 (67.6%)	105 (32.4%)	142 (43.8%)	182 (56.2%)
Practice sector				
Private sector	135	78	77	136
Prince Rashid clinics	22	15	12	25
Princess Basmah clinics	4	2	2	4
DTC*†	58	10	51	17
Total (%)	219 (67.6%)	105 (32.4%)	142 (43.8%)	182 (56.2%)
Qualification of the operator				
Specialists	27	11	17	21
Postgraduate	23	10	18	15
Dentist	133	80	73	140
Undergraduate*†	36	4	34	6
Total (%)	219 (67.6%)	105 (32.4%)	142 (43.8%)	182 (56.2%)
Type of restoration				
PFM†	81	17	59	39
AF*	57	31	7	81
All-ceramic*†	8	0	8	0
Direct	73	57	68	62
Total (%)	219 (67.6%)	105 (32.4%)	142 (43.8%)	182 (56.2%)
Approximate age of restoration				
Less than 1 y*†	72	8	57	23
1–5 ys	55	47	37	65
More than 5 years	83	43	48	78
Patient didn't know	9	7	0	16
Total (%)	219 (67.6%)	105 (32.4%)	142 (43.8%)	182 (56.2%)

*Significant patient satisfaction.
†Significant clinical assessment.
PFM = porcelain-fused-to-metal; AF = acrylic facing.

The form and contents of the questionnaire used for data collection were based on the results of the pilot study and were designed to include spaces for the following data:

- Sociodemographic data of the subjects, including their gender, age, and occupation.
- Data of the restoration, including its type, longevity, and the place where the restoration was provided.
- Qualification of the clinician who provided the restoration.
- Data of the patient's esthetic evaluation of the restoration.

Three different scaled lines were used to evaluate each of the factors (color, shape, and surface texture) separately using a visual analog scale (VAS). This scale was a horizontal line having 10 digits. It started with 0 on the right side and ended with 10 on the left. The digit 0 indicated total dissatisfaction and the digit 10 meant complete satisfaction. Patients were asked to place a vertical line that indicated the extent of their satisfaction with the appearance of their restoration on the scaled lines. Then the distance from the mark 0 to the assessment line drawn by the patient was measured and divided by the total length of the scaled line. The result was recorded out of 10 as patient satisfaction. The VAS measurements were used for comparison with the assessments of the clinicians and therefore were divided according to the following criteria:

- Poor: VAS values ranging from 0 to less than 3.33.
- Satisfactory: VAS values ranging from 3.34 to less than 6.66.
- Good: VAS values ranging from 6.67 to 10.

Table 2 Clinical Assessments and Patient Evaluations of All Restorations

Esthetic component/ Patient perception	Clinical assessment			
	Good	Satisfactory	Poor	Total (%)
Shade				
Good	46*	83	46	175 (54%)
Satisfactory	12	31*	38	81 (25%)
Poor	0	14	54*	68 (21%)
Total (%)	58 (17.9%)	128 (39.5%)	138 (42.6%)	324 (100%)
Shape				
Good	109*	52	39	200 (61.7%)
Satisfactory	42	25*	12	79 (24.4%)
Poor	4	20	21*	45 (13.9%)
Total (%)	155 (47.9%)	97 (29.9%)	72 (22.2%)	324 (100%)

*Agreement between clinician's assessment and patient perception.

Table 3 Patient Evaluations of Surface Texture of All Restorations

	Direct (%)	Indirect (%)	All (%)
Good	81 (62.31)	165 (85.05)	246 (75.93)
Satisfactory	20 (15.38)	11 (5.67)	31 (9.57)
Poor	29 (22.31)	18 (9.28)	47 (14.50
Total	130 (100)	194 (100)	324 (100)

Patients were also asked to make an overall evaluation of the restoration by drawing another line on a separate VAS scale. Restorations were considered satisfactory if the drawn line was beyond the halfway mark of the scale. This assessment was used to study variables affecting the esthetic quality of the color and shape of restorations.

Clinicians based their acceptable or unacceptable decision of the general assessment on whether the restoration required a remake or not. Restorations with a poor esthetic quality of shape or color were labeled with the word "remake" in the data-collection sheet.

Data analysis was carried out using the Statistical Package for Social Science (SPSS) version 13.0. A chi-square test was used to estimate the relationship between the clinician's clinical examination and patient's perceptions of different aspects of esthetics. A *P* value of $< .05$ was considered significant. The Pearson correlation test was used to correlate different variables with overall esthetics satisfaction.

Results

The sample of this study comprised 160 patients, 55% female and 45% male; their ages ranged from 20 to 70 years.

There were 324 direct and indirect maxillary anterior restorations. Of these, 130 restorations in 84 patients were direct and 194 restorations in 76 patients were indirect. The latter restorations comprised 142 fixed partial denture units and 52 crowns.

Esthetics accounted for 32.4% of the various complaints. Most of the patients ranked color as the most important aspect in esthetics; shape was yielded as the second most important and was followed by surface texture.

The patient evaluations and clinical assessments of the quality of esthetic restorations according to variables are detailed in Table 1. The majority of restorations, 67.6%, were satisfactory for patients and of those, 43.8% were also satisfactory to clinicians with no poor color of shade defects.

Patients of the age group 45 to 59 years seemed to be significantly more satisfied with their restorations than others ($P < .05$). They were significantly content with acrylic facing (AF) restorations. Males were significantly more satisfied with their restorations compared to females ($P < .001$).

The esthetic quality of porcelain-fused-to-metal and all-ceramic restorations was significantly more satisfactory than any other type for patients and examining clinicians. Patient and clinical assessments agreed that restorations placed for patients in the DTC were significantly more satisfactory than those placed in any other region ($P < .01$). Likewise, restorations produced by undergraduates were significantly satisfactory in both clinical and patient evaluations ($P < .05$). Restorations less than 1 year old were ranked significantly better than other restorations in both assessments ($P < .001$).

The patient evaluations and clinical assessments of the esthetic components of all anterior restorations can be found in Table 2.

Shade

The percentage of restorations with a shade that was evaluated by patients and clinicians concurrently as good and satisfactory was 23.8%, whereas poor was 16.7%. Clinician and patient evaluations of the shade of restoration were matching in 40.5% of occurrences.

Shape

The results revealed that 41.4% of the restorations were judged by clinicians and patients as restorations with good and satisfactory shape; in contrast, 6.5% were characterized as being poor. Dentists and patients agreed on the shape quality of 47.9% of restorations.

Surface texture match

The majority, 85.5%, of restorations were both good and satisfactory. The rest were poor (Table 3).

Discussion

The Ryge criteria for clinical evaluation of restorative materials were established by Cvar and Ryge in 1971.[11] Visual comparisons between a restoration and the adjacent tooth structure are used to determine ratings according to whether the restoration and the adjacent tooth structure are a perfect match and, if not, whether the mismatch is outside the normal range of tooth color.[12] The criteria have been proven as simple standards to clinically assess esthetic aspects of direct restorations and laminate veneers.[13–15] The clinical assessment procedures determining color and shape match were based upon these criteria with minor modifications and our ratings were good, satisfactory, or poor.

Many researchers are discouraged from conducting appropriate studies due to the lack of well-defined measures of clinical performance. Rating scales offer the possibility of producing meaningful clinical information rapidly and inexpensively. The VAS is a simple and economical technique for evaluating subjective experience.[16]

Patients have relied on clinicians to determine the most suitable appearance of their restorations. However, having the patients themselves evaluate their dental esthetics has been employed, as the esthetic values of the clinician may not necessarily reflect those of the patient.[17] A combination of patient self-evaluations of their restorations and clinical assessments has been used in this study, and agreements and disagreements between the two schemes have been verified.

When the variable effects on patient satisfaction were analyzed, there were significant relationships between satisfaction and both gender and age. Males were significantly more satisfied with the esthetic quality of their direct and indirect restoration, a result which is in agreement with another report.[4] Patients of older age groups tended to be significantly more satisfied with the esthetics of their restorations than those of younger age groups. This finding was consistent with other reports.[4,18] It seems that the importance of appearance decreases when the psychological self becomes stronger and clearer, and the identity is formed.[4]

It is interesting to note that composite restorations performed by undergraduate students at the DTC were the best among clinical assessments and patient evaluations. The clinical work of students is overseen and assessed by their teachers. This might reflect the abidance of students to clinical guides and teaching protocols, as students do their best to demonstrate their potential and receive good marks.

A good number of metal crowns with acrylic facing were satisfactory to patients. This treatment option is not uncommon among Jordanian clinicians. It is practiced more in the private sector and may have been inherited from older clinicians. The popularity of restorations with acrylic facing may have risen, in part, from its low cost. The durability of these restorations is limited though, as acrylic is susceptible to staining, wear, and deterioration over time.[19–21] All-ceramic restorations were clinically assessed and perceived by patients as being good restorations. This reflects their inherent superior esthetic quality. All-ceramic crowns can be built with a translucent core and provide an appearance that mimics the natural tooth.

Data obtained by clinical assessments from the public sector showed a high number of poor restorations. These clinics are quite busy and clinicians have to treat a large number of patients to reduce long waiting lists. Their primary goal is to alleviate pain, which makes esthetics a secondary concern to them.

Nearly 34% of the restorations evaluated in this study were provided to patients in the public sector at a relatively low cost, and only 24% of them were unsatisfactory. Patients may not place high expectations on the esthetic quality of the restorations provided to them in the public sector, as they get them almost for free. Patients covered with a state pension fund or dental insurance tend to have higher satisfaction with the esthetic quality of low treatment cost.[22] They are thankful for any noticeable improvement in their dental esthetics. In contrast, approximately 66% of the restorations were provided in the private sector and of these,

36.6% were considered substandard to patients. Private practice patients are demanding and their expectations rise to a level of esthetic quality excellence parallel to the cost of the restorations.

The perception of esthetic quality is subjective, especially for color and translucency.[23] The determination of any object's color, including dental restorations, is dependent, amongst other factors, on previous eye experience, the material used, and surface texture.[24] Individuals vary in their ability to match color, and their color perception may not be consistent from time to time.[12] Clearly, the task of clinicians involved in the provision of esthetic restorations is challenging. They would have to take into consideration these variables while deciding the treatment plan. Most patients appreciate a full and frank discussion about what is achievable. Time spent at this reversible stage to demonstrate and decide the shade and shape values can save a lot of embarrassment, heartache, or expense later on during the irreversible stages of the treatment.

High-quality esthetic restorations can only be achieved with the help of well-trained dental technicians. It is important to foster a team approach and establish good communication with technicians. Technicians appreciate proper and clearly written instructions with diagrams showing regional variations in shade and special characteristics.[25] It is wise to involve the technician during chairside staining and when there are difficulties in recording the shade.[23]

Clinical assessments and patient evaluations showed significant disagreements between the two opinions. The patients rated their restorations more positively in all esthetic parameters studied. The agreement between clinician and patient on the shade was less than that of shape. Direct restorations are placed within the confinement of the tooth, and patients compare their shade directly to that of the tooth. Any abrupt changes could be readily detected. The color of an indirect restoration is usually compared with the color of an adjacent tooth, if available, or the color of the nearest available tooth. A difficulty may arise when there is no maxillary anterior tooth available for comparison. In this case, comparison would be made with mandibular anterior teeth, premolars, or both. The geometrical perception of shape, on the other hand, may not be as sensitive as judging a color match. This yielded more agreements between examining dentists and patients. The presence of a contralateral tooth acts as a standard pattern to which comparisons can be made.

The number of restorations with good and satisfactory surface texture was higher than those deemed as being poor; these are, to a large extent, more reliable than clinical examinations which depend on manual dexterity and feel. Patients are able to detect foreign objects placed in their oral cavity. They could use the tip of their tongue to assess the shape, size, and roughness of restorations.[26]

Conclusions

The percentage of satisfactory restorations revealed by patient evaluations was 67.6% and those demonstrated by clinical assessments was 43.8%.

There were significant effects of the variables gender, age, practice sector, qualification of operator, type, and longevity of restoration on patient satisfaction.

There were statistically significant differences between the results of clinical assessments and patient evaluations.

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Literature Abstract

Computerized tomographic findings in bisphophonate-associated osteonecrosis of the jaw in patients with cancer

There were three objectives of this retrospective clinical study: to investigate *(1)* the computerized tomography (CT) findings of the bisphophonate-associated osteonecrosis of the jaw (BONJ), also considering the changes over time; *(2)* the correlation with the clinical presentation and possible criteria for early diagnosis; and *(3)* the diagnostic performance of CT vs dental panoramic radiograph (DPR). Thirty-two patients (12 men, 20 women; mean age: 66 years old) with painful exposed bone in the jaws after treatment with bisphosphonates for various neoplastic diseases were included in this study. Each of these patients had at least one DPR and one CT scan done during radiologic examination. A specialized radiologist who was blinded to the clinical features of each patient evaluated all images. Each case was assessed for the following radiographic signs: *(1)* structural alteration of trabecular bone, *(2)* cortical bone erosion, *(3)* osteosclerosis, *(4)* small (less than 15 mm) sequestrum, *(5)* extensive (more than 15 mm) sequestrum, and *(6)* presence of periosteal new bone. Hierarchical cluster analysis was used to group the 32 patients into categories on the basis of both CT and DPR scan signs. Agreement between CT and DPR clusters were analyzed by the kappa index (κ). The clinical extension measurements of the lesions were analyzed for each CT and DPR cluster using a Chi-square test while the Kruskal-Wallis test was used for age, duration, and type of therapy. Ten cases of BONJ in the maxilla and 22 in the mandible were related to tooth extraction. BONJ occurred spontaneously in 10 cases. Differences were considered statistically significant with a P value of < .05. Cluster analysis of CT signs showed four categories of patients: (A) two patients with no signs; (B) five patients with signs 1 and 2; (C) 12 patients with signs 1, 2, 3, and 4; (D) 13 patients with signs 1, 2, 3, 5, and 6. For DPR cluster analysis, there was a different categorization: (E) 14 patients with no signs and one patient with only sign 1; (F) one patient with signs 1, 2, and 3; (G) six patients with signs 1, 2, and 4 and 5 patients with signs 1, 2, 3, and 4; (H) four patients with signs 1, 2, 3, and 5 and 1 patient with signs 1, 2, 3, 5, and 6. There was a significant association between clinical extension measurements and age ($P = .024$). There was a low agreement between DPR clusters and CT clusters ($P = .021$). There was significant greater clinical extension found in CT categories C and D than in A and B ($P = .002$) but no statistical differences were found within the DPR categories as such. DPR missed the correct diagnosis about sequestra in 15 cases. CT detected 13 cases of periosteal new bone reaction (sign 6) while only one case was detected by DPR. The authors concluded that a staging of BONJ as deduced by DPR was unreliable, given that there was a lack of correlation between clinical extensions and DPR clusters, thereby underestimating the lesions. The authors suggest that the use of CT scan may be justified for the information on the extension of the BONJ lesion, but they cautioned that even with the routine use of CT, a very early diagnosis of BONJ may be impossible. This may be due to possible ambiguity in radiographic patterns that cannot differentiate early BONJ lesions from extraction sites or that osteosclerosis may be difficult to differentiate from previous odontogenic inflammation.

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