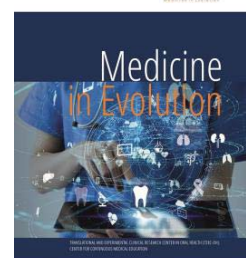


Patient-Reported Esthetic Outcomes After Anterior Ceramic Restorations: A Retrospective Observational Study of Demographic and Clinical Factors

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Abstract

Aim: To evaluate patient-reported esthetic satisfaction 5–9 years after anterior ceramic restorations and its association with demographic and clinical factors. **Methodology:** This retrospective observational study included 217 patients with 667 anterior ceramic restorations made of lithium disilicate, feldspathic ceramic, or zirconia. Satisfaction was assessed using a study-specific questionnaire with a binary response and a five-point rating scale. **Results:** Overall, 198 patients (91.2%) were satisfied. Satisfaction did not differ significantly by ceramic material ($p = 0.775$), age ($p = 0.261$), or sex ($p = 0.342$). Dissatisfied patients had more restorations per patient ($p = 0.027$). Clinical complications were documented in 24 patients (11.1%) and were associated with higher odds of dissatisfaction (OR = 19.57, 95% CI 6.71–57.07; $p < 0.001$). Shade discrepancy was the most frequent primary complaint. **Conclusions:** Patient-reported esthetic satisfaction was high after 5–9 years. Documented complications, particularly shade discrepancy, were associated with dissatisfaction, whereas no statistically significant association was observed for ceramic material, age, or sex.

Keywords: anterior ceramic restorations; patient satisfaction; esthetic dentistry; patient-reported outcomes; lithium disilicate; feldspathic ceramic; zirconia

INTRODUCTION

The increasing demand for esthetic dental treatment has changed the way outcomes of anterior restorative procedures are evaluated. Ceramic restorations are widely used to correct alterations in tooth color, shape, position, proportions, and surface morphology, particularly in patients seeking an improvement in smile appearance. Advances in ceramic materials, adhesive procedures, and laboratory techniques have also made increasingly conservative treatment approaches possible, with greater emphasis on preserving sound dental tissues. Although restoration survival and the occurrence of technical complications remain essential parameters when evaluating treatment, they do not fully describe its success. In the anterior region, where esthetics is often one of the main reasons for intervention, the patient's own perception of the final result represents an important additional outcome.

Clinical assessment and patient perception are closely related, but they cannot be considered equivalent. A restoration may satisfy conventional clinical criteria while the patient remains dissatisfied with certain aspects of the result, such as color, tooth dimensions, symmetry, surface appearance, or integration within the smile. Conversely, minor clinical imperfections may have little influence on the patient's overall perception of treatment. A recent long-term study evaluating ceramic veneers after 9-10 years showed discrepancies between professional clinical assessment and patient-reported outcomes, indicating that restoration survival alone may not reflect the way treatment is experienced by the patient [1].

Esthetic perception is inherently subjective and may also be influenced by individual demographic characteristics. Age and sex are among the factors most frequently investigated in relation to dental appearance. In an observational study conducted in Switzerland, Zaugg et al. found that both age and sex influenced several aspects of orofacial esthetic perception. Women reported lower satisfaction with their dental appearance and showed a greater willingness to undergo corrective treatment, while attitudes toward esthetics also differed between younger and older participants [2]. These findings suggest that apparently similar clinical situations may not necessarily be perceived in the same way by different patients.

The influence of demographic characteristics, however, is not consistent across all populations. Tin-Oo et al. evaluated satisfaction with dental appearance among adult dental patients and reported that women were more likely than men to be dissatisfied with their overall dental appearance. Female participants were also more frequently dissatisfied with tooth color. In contrast, age was not significantly associated with general satisfaction in that population [3]. Such differences between studies indicate that demographic variables should not be regarded as isolated determinants of satisfaction but rather as factors that may interact with individual expectations, previous dental experiences, and the characteristics of the treatment received.

Clinical characteristics of the treated tooth and restoration may have an additional influence on the final esthetic result. Ceramic type, tooth vitality, substrate discoloration, restoration thickness, preparation design, and the amount of preserved enamel may affect both the optical integration and clinical behavior of anterior ceramic restorations. Feldspathic ceramic has traditionally been used for veneers because of its favorable translucency and its ability to reproduce the optical characteristics of natural dental tissues. In a retrospective evaluation of 170 feldspathic ceramic veneers followed for up to seven years, Mihali et al. reported an overall survival rate of 91.77%. Fourteen veneers required replacement because of fracture, while additional cases of ceramic chipping were managed conservatively [4]. These findings illustrate that favorable long-term survival does not exclude the occurrence of events that may influence either the clinical or esthetic perception of the restoration.

The extent of tooth preparation is another relevant consideration in contemporary anterior rehabilitation. Preservation of enamel is particularly desirable for adhesive ceramic restorations, which has led to increased interest in minimally invasive and no-preparation approaches. De Angelis et al. retrospectively evaluated a no-preparation porcelain veneer protocol and reported a survival rate of 97.4% after an observation period ranging from 36 to 60 months. Most restorations were clinically acceptable, although minor fractures, chipping, and limited marginal discoloration were identified in a small number of cases. The authors emphasized that predictable outcomes with a no-preparation approach depend on strict patient selection and appropriate treatment planning [5].

Similar considerations have been reported for ultrathin ceramic veneers. Gonzalez-Martin et al. evaluated 194 ceramic veneers placed using conventional preparation, minimal-preparation, or no-preparation protocols over a 36-month period. Fractures occurred predominantly among minimally prepared restorations, although catastrophic failure was uncommon. Patient satisfaction remained high, and all participants reported that they would not choose a thicker restorative approach merely to reduce the potential risk of fracture [6]. This finding is particularly relevant because it illustrates that the patient's judgment of treatment cannot always be inferred directly from the presence or absence of a clinical complication.

Other clinical factors may be important even when they do not compromise restoration survival. Shade discrepancy, marginal discoloration, chipping, fracture, changes in gingival contour, or periodontal alterations occur in a highly visible region and may therefore influence the patient's perception of treatment. The initial condition of the tooth may also affect the difficulty of achieving an optimal esthetic result. A severely discolored or devitalized substrate, for example, may require greater masking than a tooth with a favorable initial color. Consequently, similar restorative techniques may produce different perceived outcomes depending on the underlying clinical situation.

Despite the extensive literature addressing the survival and technical performance of ceramic veneers and other anterior ceramic restorations, comparatively fewer studies have investigated patient-reported esthetic satisfaction together with demographic and clinical characteristics. Studies focused primarily on restoration survival cannot determine whether clinically successful treatment is perceived equally favorably by all patients. Conversely, investigations of general dental appearance often include individuals who have not undergone a defined restorative intervention and may therefore provide limited information regarding satisfaction after ceramic rehabilitation.

The aim of the present retrospective observational study was to evaluate patient-reported esthetic satisfaction following ceramic restorations in the anterior region and to investigate whether available demographic and clinical factors were associated with the reported outcome. The null hypothesis was that demographic and clinical variables would not be significantly associated with patient-reported esthetic satisfaction following anterior ceramic rehabilitation.

Aim and objectives

The aim of this retrospective observational study was to evaluate patient-reported esthetic outcomes after long-term anterior ceramic rehabilitation and to identify demographic and clinical factors associated with patient satisfaction. The study specifically assessed whether satisfaction differed according to ceramic material, age, sex, tooth vitality, presence of dyschromia, preparation approach, dental arch, number of restorations, and documented clinical complications. A further objective was to determine which clinical events were most closely associated with dissatisfaction and to evaluate the relationship between long-term clinical performance and the patient's perception of the final esthetic result.

MATERIAL AND METHODS

This retrospective observational study was conducted at Dental Concept by Dr. Mihali, Timișoara, Romania, within the framework of the doctoral research project entitled “Ceramic Restorations in the Anterior Region, Indications, Limitations, Clinical Performance, and Patient Satisfaction.” The research project received approval from the Scientific Research Ethics Committee of the “Victor Babeș” University of Medicine and Pharmacy Timișoara (Approval No. 77/14.12.2018, revised 2025). The study was conducted in accordance with the Declaration of Helsinki, and written informed consent was obtained from the participants included in the approved research project. For the present analysis, data were retrospectively extracted from the clinic’s electronic patient database during one week in September 2026. No new clinical intervention was performed for the purpose of the present analysis.

The study included patients treated with ceramic restorations in the anterior region with a documented clinical follow-up ranging from 60 to 108 months (5–9 years). The final cohort comprised 217 patients and 667 anterior ceramic restorations. The primary analysis was performed at patient level, regardless of the number of restorations present in the same patient. Patients were eligible if they were at least 18 years old, had one or more ceramic restorations involving maxillary or mandibular anterior teeth, had been treated with lithium disilicate, feldspathic ceramic, or zirconia restorations, and had complete clinical records regarding the restorative material, type of restoration, tooth vitality, dental arch, follow-up period, and recorded clinical complications. Patients were included when at least 60 months of documented clinical follow-up from restoration placement were available.

Patients were excluded if their restorations were located exclusively in the posterior region, the restorative material or relevant clinical information could not be reliably identified, the available follow-up was shorter than 5 years, or the clinical documentation was incomplete. Patients without a completed satisfaction questionnaire available in the study records were also excluded. The occurrence of a complication or restoration failure was not considered an exclusion criterion when sufficient clinical information was available.

The following variables were retrieved from the clinical database: age, sex, ceramic material, restoration type, preparation approach, tooth vitality, presence of dental dyschromia, dental arch, number of restorations, and time in clinical service. All included restorations were clinically evaluated by the same dentist using consistent criteria. Shade discrepancy was defined as a clinically perceptible mismatch in value, chroma, or hue between the restoration and the adjacent dentition. Chipping was defined as a localized loss of ceramic material without complete structural fracture, whereas fracture referred to a structural loss involving a larger portion of the restoration. Gingival recession was recorded when apical displacement of the gingival margin adjacent to the restoration was observed. Debonding was defined as partial or complete loss of restoration retention. Marginal discoloration was recorded when visible pigmentation was present along the tooth–restoration interface, while secondary caries was defined as a newly detected carious lesion adjacent to the restoration margin. A patient was considered to have a clinical complication when at least one of these events was identified in one or more included anterior restorations.

Patient-reported esthetic outcome had been assessed as part of the approved research project using a brief study-specific questionnaire. Patients were asked whether they were satisfied or dissatisfied with the overall esthetic result and were also asked to rate their overall satisfaction on a five-point scale ranging from 1 (very dissatisfied) to 5 (very satisfied). Patients reporting dissatisfaction were asked to indicate the main reason for their response. The questionnaire was used as a study-specific measure of patient satisfaction and was analyzed together with the demographic and clinical variables retrieved from the patient records.

Continuous variables were summarized using mean and standard deviation or median and interquartile range, as appropriate, while categorical variables were presented as absolute frequencies and percentages. Comparisons among the three ceramic material groups were performed using the Kruskal-Wallis test for continuous or ordinal variables. Categorical variables were compared using the Chi-square test when its assumptions were met; for sparse contingency tables, Fisher's exact test or its extension for larger contingency tables was used, as appropriate.

Associations between patient-reported satisfaction and continuous variables were evaluated using the Mann-Whitney U test, while categorical variables were assessed using the Chi-square test or Fisher's exact test, as appropriate. For binary clinical variables, odds ratios (ORs) with 95% confidence intervals (95% CIs) were calculated to estimate the strength of association with dissatisfaction. Ninety-five percent Wilson confidence intervals were calculated for proportions presented graphically. Analyses of individual clinical complications were considered exploratory because of the relatively small number of events. All statistical tests were two-sided, and statistical significance was set at $p < 0.05$. Statistical analyses were performed using Python version 3.13.5 (Python Software Foundation), with SciPy version 1.17.0 and statsmodels version 0.14.6. Custom scripts were used for statistical analysis and figure generation.

RESULTS

The final analysis included 217 patients with 667 anterior ceramic restorations. There were 116 women (53.5%) and 101 men (46.5%), and the mean age was 39.6 ± 10.2 years. Follow-up ranged from 60 to 108 months, corresponding to 5–9 years of clinical service, with a median of 80 months (IQR 73–88). Patients had a mean of 3.1 ± 1.9 restorations each. The material distribution comprised 44 patients treated with lithium disilicate, 105 with feldspathic ceramic, and 68 with zirconia.

The three material groups were not identical with respect to all clinical characteristics. Age differed significantly between groups (Kruskal-Wallis $H = 14.04$, $p < 0.001$), with the zirconia group being older on average. Tooth vitality was also distributed differently ($\chi^2 = 20.93$, $p < 0.001$), as were the preparation approach ($\chi^2 = 44.57$, $p < 0.001$), dental arch ($\chi^2 = 11.53$, $p = 0.003$), and number of restorations per patient ($H = 24.56$, $p < 0.001$). By contrast, sex distribution and follow-up duration were comparable across material groups ($p = 0.857$ and $p = 0.159$, respectively). Feldspathic ceramic was used predominantly for veneers, while zirconia was mainly represented by single crowns and fixed dental prostheses. The main demographic and clinical characteristics of the three material groups are summarized in Table 1.

Table 1. Demographic and clinical characteristics of the study cohort according to ceramic material

Variable	Lithium	Feldspathic	Zirconia (n=68)	Overall (n=217)	p-value
Age, years, mean $\pm$ SD	40.8 $\pm$ 10.0	36.8 $\pm$ 9.4	43.0 $\pm$ 10.6	39.6 $\pm$ 10.2	<0.001
Female sex, n (%)	25 (56.8%)	56 (53.3%)	35 (51.5%)	116 (53.5%)	0.857
Follow-up, months, median [IQR]	80 [75–94]	79 [71–87]	82 [74–87]	80 [73–88]	0.159
Restorations/patient, mean $\pm$ SD	2.6 $\pm$ 1.6	3.8 $\pm$ 2.2	2.2 $\pm$ 1.0	3.1 $\pm$ 1.9	<0.001
Restoration type, n (%)					<0.001
Veneer	19 (43.2%)	103 (98.1%)	0 (0.0%)	122 (56.2%)	
Single crown	25 (56.8%)	2 (1.9%)	52 (76.5%)	79 (36.4%)	
Fixed dental prosthesis	0 (0.0%)	0 (0.0%)	16 (23.5%)	16 (7.4%)	
Vital teeth, n (%)	33 (75.0%)	90 (85.7%)	37 (54.4%)	160 (73.7%)	<0.001

Dyschromia, n (%)	9 (20.5%)	35 (33.3%)	19 (27.9%)	63 (29.0%)	0.279
No-prep approach, n (%)	2 (4.5%)	39 (37.1%)	0 (0.0%)	41 (18.9%)	<0.001
Maxillary restorations, n (%)	30 (68.2%)	84 (80.0%)	38 (55.9%)	152 (70.0%)	0.003

SD, standard deviation; IQR, interquartile range. Continuous or ordinal variables were compared using the Kruskal–Wallis test. Categorical variables were compared using the Chi-square test or an exact test, as appropriate. The p-value for restoration type was obtained using an exact test because of sparse cells

Patient-reported esthetic satisfaction was high. A total of 198 patients (91.2%) described the final esthetic result as satisfactory, whereas 19 (8.8%) were dissatisfied. The overall satisfaction score was 4.41 ± 0.80 on the five-point scale, with a median of 5 (IQR 4–5). Satisfaction was reported by 41/44 patients with lithium disilicate (93.2%), 94/105 patients with feldspathic ceramic (89.5%), and 63/68 patients with zirconia (92.6%). The differences were not statistically significant (exact test, $p = 0.775$). Satisfaction scores likewise showed no significant difference between materials ($H = 1.14$, $p = 0.567$) (Figure 1).

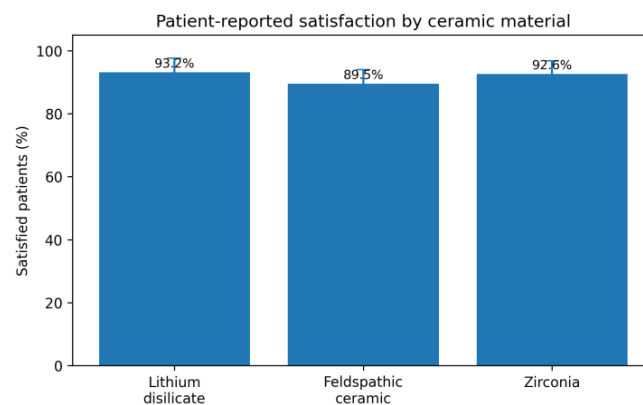


Figure 1. Patient-reported esthetic satisfaction according to ceramic material. Error bars indicate 95% Wilson confidence intervals

The reasons reported by dissatisfied patients were predominantly esthetic rather than mechanical. Shade discrepancy was the most frequent primary complaint, accounting for 8 of the 19 dissatisfied patients (42.1%). Four patients reported another nonspecific esthetic concern, while unmet esthetic expectations and concerns related to shape or contour were each recorded in two patients. Gingival recession, fracture, and chipping were each identified as the main reason for dissatisfaction in one patient. The distribution of patient-reported reasons is shown in Figure 2.

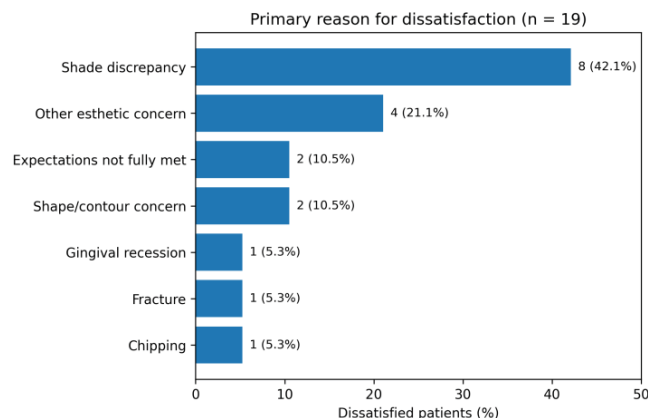


Figure 2. Primary reason for dissatisfaction among the 19 patients who reported an unsatisfactory esthetic outcome

No significant association was identified between satisfaction and either age or sex. The mean age was 39.8 ± 10.3 years among satisfied patients and 36.7 ± 9.3 years among dissatisfied patients ($U = 2175$, $p = 0.261$). Among women, 108/116 (93.1%) were satisfied, compared with 90/101 men (89.1%; Fisher's exact test, $p = 0.342$). Follow-up duration was also similar between the two outcome groups (80.6 ± 11.7 vs. 82.4 ± 9.3 months; $p = 0.344$). The number of restorations per patient was higher among dissatisfied patients (3.95 ± 1.99) than among satisfied patients (2.99 ± 1.92 ; $U = 1315$, $p = 0.027$). Dyschromia, tooth vitality, preparation approach, dental arch, and restoration type were not significantly associated with the reported satisfaction outcome. These comparisons are summarized in Table 2.

Table 2. Demographic and clinical factors according to patient-reported esthetic satisfaction

Variable	Satisfied (n=198)	Dissatisfied (n=19)	p-value
Age, years, mean $\pm$ SD	39.8 ± 10.3	36.7 ± 9.3	0.261
Female sex, n (%)	108 (54.5%)	8 (42.1%)	0.342
Follow-up, months, mean $\pm$ SD	80.6 ± 11.7	82.4 ± 9.3	0.344
Restorations/patient, mean $\pm$ SD	2.99 ± 1.92	3.95 ± 1.99	0.027
Ceramic material, n (%)			0.775
Lithium disilicate	41 (20.7%)	3 (15.8%)	
Feldspathic ceramic	94 (47.5%)	11 (57.9%)	
Zirconia	63 (31.8%)	5 (26.3%)	
Restoration type, n (%)			0.443
Veneer	109 (55.1%)	13 (68.4%)	
Single crown	73 (36.9%)	6 (31.6%)	
Fixed dental prosthesis	16 (8.1%)	0 (0.0%)	
Dyschromia, n (%)	58 (29.3%)	5 (26.3%)	1.000
Devitalized teeth, n (%)	54 (27.3%)	3 (15.8%)	0.414
No-prep approach, n (%)	37 (18.7%)	4 (21.1%)	0.763
Maxillary arch, n (%)	139 (70.2%)	13 (68.4%)	1.000
Any clinical complication, n (%)	13 (6.6%)	11 (57.9%)	<0.001

SD, standard deviation. Continuous variables were compared using the Mann-Whitney U test. Binary categorical variables were assessed using Fisher's exact test where appropriate. Ceramic material and restoration type were assessed using the Fisher-Freeman-Halton exact test for 2×3 contingency tables

Clinical complications were uncommon overall. At least one complication was documented in 24 patients (11.1%). The corresponding proportions were 13.6% for lithium disilicate, 9.5% for feldspathic ceramic, and 11.8% for zirconia. There was no significant difference in the overall complication rate between the three materials (exact test, $p = 0.688$). Shade discrepancy was the most frequently recorded individual event (14 patients, 6.5%), followed by gingival recession (9, 4.1%) and marginal discoloration (8, 3.7%). Mechanical events were infrequent: chipping was observed in 4 patients, fracture in 3, and debonding in 3. Secondary caries was recorded in three patients. The distribution of individual complications across ceramic materials is presented in Table 3 and Figure 3. None of the individual complication categories differed significantly between materials. Patients with at least one complication had a somewhat longer mean follow-up than those without complications (83.1 ± 10.4 vs. 80.4 ± 11.6 months), but the difference was not statistically significant ($U = 1968$, $p = 0.231$).

Table 3. Distribution of documented clinical complications according to ceramic material

Complication	Lithium disilicate (n=44)	Feldspathic ceramic (n=105)	Zirconia (n=68)	Overall (n=217)	p-value
Shade discrepancy	2 (4.5%)	6 (5.7%)	6 (8.8%)	14 (6.5%)	0.669
Gingival recession	4 (9.1%)	2 (1.9%)	3 (4.4%)	9 (4.1%)	0.109
Marginal discoloration	1 (2.3%)	4 (3.8%)	3 (4.4%)	8 (3.7%)	1.000
Chipping	2 (4.5%)	1 (1.0%)	1 (1.5%)	4 (1.8%)	0.329
Fracture	1 (2.3%)	2 (1.9%)	0 (0.0%)	3 (1.4%)	0.592
Debonding	1 (2.3%)	1 (1.0%)	1 (1.5%)	3 (1.4%)	0.779
Secondary caries	1 (2.3%)	1 (1.0%)	1 (1.5%)	3 (1.4%)	0.779

p-values were obtained using exact tests because of the small number of events in individual complication categories

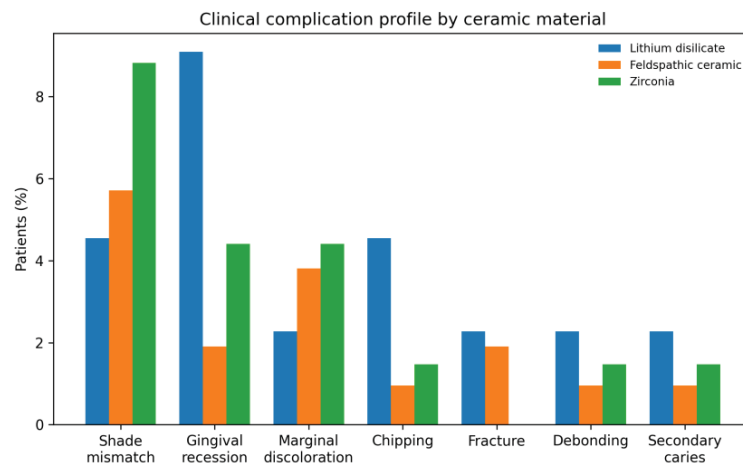


Figure 3. Clinical complication profile according to ceramic material

The presence of a clinical complication was strongly related to the patient-reported outcome. Satisfaction was recorded in 185/193 patients without complications (95.9%), compared with 13/24 patients who had at least one documented complication (54.2%). The odds of dissatisfaction were higher in the presence of a complication (OR = 19.57, 95% CI 6.71–57.07; Fisher's exact test, $p < 0.001$) (Figure 4). Among individual findings, shade discrepancy showed the clearest relationship with dissatisfaction ($p < 0.001$). Chipping, fracture, gingival recession, debonding, marginal discoloration, and secondary caries were also more frequent among dissatisfied patients in exploratory univariable comparisons, although these estimates were based on small numbers of events.

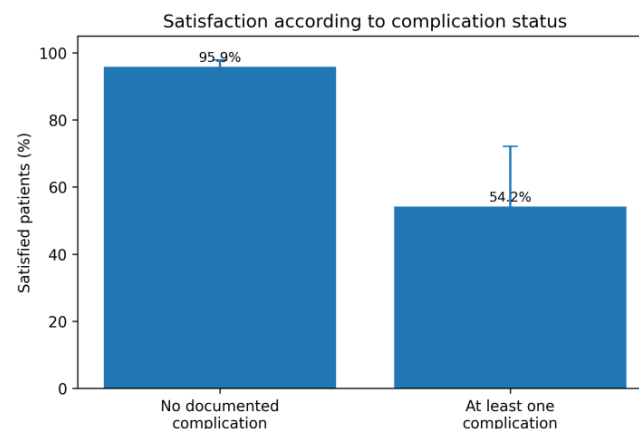


Figure 4. Patient-reported satisfaction according to the presence or absence of a documented clinical complication. Error bars indicate 95% Wilson confidence intervals

Overall, the material used for anterior ceramic rehabilitation was not associated with patient-reported satisfaction, and no meaningful difference was observed according to age or sex. Satisfaction remained above 89% in each material group. The findings instead indicated that dissatisfaction was concentrated among patients with documented esthetic or clinical complications, particularly shade discrepancy, while a greater number of restorations per patient was also associated with lower satisfaction. These results support the use of patient-reported assessment alongside conventional clinical evaluation when judging the long-term outcome of anterior ceramic restorations.

DISCUSSIONS

Patient-reported esthetic outcomes are an important part of the long-term evaluation of anterior ceramic restorations. Clinical survival remains essential, but it does not always reflect how the patient perceives the final result. In our cohort, 91.2% of patients were satisfied after 5–9 years of clinical service. Satisfaction was similar for lithium disilicate, feldspathic ceramic, and zirconia restorations, and no significant association was found with age or sex. The factors that appeared to matter more were the occurrence of clinical complications and the extent of the rehabilitation, as dissatisfied patients had a higher number of restorations per patient.

The generally favorable level of satisfaction observed in this study is in agreement with the good long-term performance usually reported for ceramic restorations. AlJazairy, in a systematic review of porcelain laminate veneers, found high survival and success rates, while also pointing out the considerable heterogeneity among clinical studies [7]. This is relevant for our cohort because the three ceramic groups were not identical. They differed in age, tooth vitality, preparation approach, dental arch, and number of restorations per patient. The materials were used according to the clinical situation rather than being randomly assigned, which needs to be kept in mind when comparing them.

Long-term clinical performance of veneers has also been investigated by Morimoto et al., who reported an estimated cumulative survival of 89% over a median follow-up of 9 years [8]. Fracture and chipping were among the more frequent complications in that analysis. In our study, mechanical complications were less common, with chipping recorded in 1.8% of patients and fracture in 1.4%. Even so, these events occurred more often among patients who were dissatisfied. This illustrates an important difference between restoration survival and treatment success from the patient's point of view. A restoration may still be in place and functioning while a relatively small visible defect is enough to affect satisfaction.

Material choice is another factor frequently discussed in the literature. A recent systematic review and meta-analysis reported long-term survival rates of 96.13% for feldspathic ceramic, 93.70% for leucite-reinforced glass-ceramic, and 96.81% for lithium disilicate [9]. Lower rates of technical, esthetic, and biological complications were reported for lithium disilicate. In our cohort, however, patient satisfaction remained above 89% for all three ceramic groups, and neither satisfaction nor the overall complication rate differed significantly according to ceramic material. For the patients included here, the ceramic material itself therefore did not appear to be the main factor determining how the esthetic result was perceived.

The quality of the substrate and the amount of preserved enamel are also important when planning anterior ceramic restorations. A systematic review and meta-analysis found survival and success rates close to 99% when veneers were bonded predominantly to enamel, while greater dentin exposure was associated with less favorable results [10]. Hong et al. also showed that preparation design may influence veneer prognosis, although the effect varied according to the type of preparation and analytical method used [11]. Similarly, Gurel et al.

reported a survival rate of 99% when preparations remained entirely within enamel and a considerably higher risk of failure when veneers were bonded to dentin [12]. Together, these data support conservative preparation whenever the clinical conditions allow it.

In the present cohort, the preparation approach was not significantly associated with satisfaction. This should not be taken to mean that preparation design is unimportant. Preparation is closely related to tooth position, available restorative space, substrate color, the extent of correction required, and the amount of enamel available for bonding. The fact that most no-prep cases in our sample were treated with feldspathic ceramic also shows that preparation strategy and material choice were linked to the clinical indication.

Color stability is particularly important in the anterior region. Fradeani et al. reported a 94.4% survival probability after 12 years, with favorable long-term evaluations of color match, ceramic surface, marginal discoloration, and marginal integrity [13]. In our study, shade discrepancy was the most frequent individual clinical event, recorded in 14 patients, and it was also the most common reason given by dissatisfied patients. Eight of the 19 dissatisfied patients identified shade discrepancy as their main complaint. This was one of the clearest observations in the present study and underlines how sensitive patients can be to color differences in the anterior region.

Soft tissue changes may be similarly noticeable. D'Arcangelo et al. reported a restoration-level survival rate of 97.5% after seven years, together with satisfactory gingival response and good marginal and color stability [14]. Gingival recession affected only 4.1% of our patients, but it occurred more often among dissatisfied patients. Even when the restoration itself remains intact, a change in gingival level may alter symmetry and make the restoration more visible within the smile.

Patient- and tooth-related variables can also influence long-term outcome. Beier et al. reported an estimated 10-year survival of 93.5% and found a higher risk of failure for nonvital teeth and in patients with bruxism. Marginal discoloration was also more frequent among smokers [15]. Tooth vitality was not associated with satisfaction in our sample. Therefore, although vitality may affect technical prognosis, it did not appear to have an important effect on the patient's overall esthetic assessment in this group.

A similar observation was made for dyschromia. Discolored or devitalized teeth are generally more difficult to mask because the final appearance depends on ceramic thickness, translucency, cement, and the optical characteristics of the substrate. A review of porcelain veneers emphasized the role of enamel preservation, adhesive technique, luting material, and oral hygiene in maintaining favorable esthetic and periodontal outcomes [16]. Dyschromia was present in 29.0% of the patients in our cohort, but it was not associated with lower satisfaction. This may indicate that substrate discoloration can often be managed successfully when the ceramic system and treatment plan are selected appropriately.

Patient satisfaction is also influenced by factors that cannot be fully captured during the clinical examination. Expectations and previous dental experiences differ considerably between patients. Meijering et al. reported that restoration type influenced patient satisfaction, with porcelain veneers producing greater satisfaction than direct composite veneers after two years [17]. In our study, neither age nor sex was related to satisfaction. Demographic characteristics therefore seemed less important than the actual clinical condition of the restorations.

The role of minimally invasive treatment has received increasing attention in recent years. A prospective study comparing prepress and minimally invasive ceramic veneers reported high satisfaction in both groups, with slightly higher satisfaction in the prepress group despite the occurrence of some complications [18]. Our results also showed no significant relationship between preparation approach and satisfaction. From a clinical perspective, this supports the idea that preparation design should not be evaluated on its

own. Tooth position, substrate, available space, material thickness, and the intended esthetic change all influence the final treatment plan.

Shade matching deserves particular attention because it was closely related to dissatisfaction in our study. A clinical comparison of polychromatic feldspathic porcelain and hybrid ceramic laminate veneers found acceptable shade matching, color stability, and high patient satisfaction with both materials after one year [19]. Our results likewise showed high satisfaction with all three ceramic groups, but when a visible shade discrepancy was present, dissatisfaction was considerably more common. In an anterior restoration, even a limited color mismatch can be immediately noticed by the patient despite otherwise satisfactory clinical performance.

Longer follow-up may also reveal differences that are not evident during the first years after treatment. Gresnigt et al. reported 100% cumulative survival for ceramic laminate veneers after up to 10 years, compared with 75% for indirect resin-composite veneers, with ceramic restorations also showing better color match and surface characteristics [20]. The high satisfaction found in our patients after 5–9 years is in line with the generally stable esthetic behavior reported for ceramic restorations. In our cohort, follow-up duration itself was not significantly related to satisfaction.

Layton and Clarke also reported five-year survival above 90% for etchable non-feldspathic porcelain veneers, although they emphasized that long-term evidence remains limited for some ceramic systems [21]. This remains relevant because favorable medium-term results do not remove the need for continued clinical monitoring. In our patients, those with complications had a slightly longer follow-up than patients without complications, but the difference was not statistically significant.

High patient satisfaction with ceramic veneers has also been reported by Galiatsatos and Bergou. In their five-year evaluation of 186 porcelain laminate veneers, 98.4% were satisfactory without intervention and patient satisfaction was very high [22]. The 91.2% satisfaction rate in our cohort is somewhat lower but still confirms a favorable long-term patient perception. Direct comparison between studies is difficult because of differences in restorative materials, clinical indications, follow-up periods, and methods used to assess satisfaction.

The strongest association in our study was observed between clinical complications and dissatisfaction. Satisfaction reached 95.9% among patients without complications but fell to 54.2% when at least one complication was documented. The odds of dissatisfaction were approximately 20 times higher in patients with a complication (OR = 19.57, 95% CI 6.71–57.07). Shade discrepancy showed the clearest relationship, while chipping, fracture, gingival recession, debonding, marginal discoloration, and secondary caries were also more frequent among dissatisfied patients. Because the number of individual events was small, the results for specific complications should be interpreted cautiously. The overall pattern, however, was clear: visible or clinically detectable complications had a much stronger relationship with dissatisfaction than the ceramic material itself.

Another interesting result was the number of restorations per patient. Patients who were dissatisfied had a mean of 3.95 restorations, compared with 2.99 in satisfied patients. More extensive anterior rehabilitations are usually more demanding because color, contour, symmetry, tooth proportions, contact areas, and gingival integration must be controlled across several restorations. Patient expectations may also be higher when treatment involves a larger part of the smile. The retrospective design does not allow us to determine why this association occurred, but it deserves further investigation.

From a clinical point of view, these results highlight several practical aspects. Material selection remains important, but it is only one part of treatment planning. Substrate color, remaining enamel, soft tissue conditions, shade selection, restoration number, and the

patient's expectations should all be considered before treatment. In more extensive cases, communication becomes particularly important. Photographs, diagnostic wax-ups, mock-ups, provisional restorations, and digital simulations can be useful for showing the patient what can realistically be achieved before definitive treatment begins.

There are several limitations to the present study. Its retrospective nature means that the analysis depended on the completeness and accuracy of existing clinical records, and the observed associations cannot be interpreted as causal relationships. The three material groups were also different in several baseline characteristics because ceramic selection followed the clinical indication rather than random allocation. In addition, only 19 patients were dissatisfied, which limits the precision of analyses involving individual complications. Finally, satisfaction was evaluated using a brief study-specific questionnaire rather than a fully validated patient-reported outcome measure.

Prospective studies using validated questionnaires would allow patient satisfaction to be evaluated in greater detail. Larger multicenter samples would also permit more robust analysis of the combined effect of material, preparation design, substrate condition, treatment extent, and clinical complications. It would be particularly useful to record patient expectations before treatment and compare them with the final perceived result, especially in larger anterior rehabilitations.

Overall, anterior ceramic restorations were associated with a high level of patient satisfaction after 5–9 years. Ceramic material, age, sex, tooth vitality, dyschromia, and preparation approach were not significantly associated with the reported outcome. Clinical complications, especially visible esthetic changes such as shade discrepancy, had a much greater impact on satisfaction, while patients with a larger number of restorations were also more likely to report an unfavorable outcome. Long-term evaluation of anterior ceramic rehabilitation should therefore include both conventional clinical examination and the patient's own assessment of the esthetic result.

CONCLUSIONS

Patient-reported esthetic satisfaction after anterior ceramic rehabilitation was high, with more than 90% of patients reporting a satisfactory outcome after 5–9 years of clinical service. Satisfaction did not differ significantly according to ceramic material, age, or sex, indicating that these factors alone were not major determinants of the perceived esthetic result. In contrast, the presence of a documented clinical complication was strongly associated with dissatisfaction, particularly in cases involving shade discrepancy and other visible esthetic changes. Dissatisfied patients also had a greater number of restorations than satisfied patients. These findings suggest that long-term success of anterior ceramic restorations should not be assessed solely by material type or restoration survival, but should also include clinical complications and the patient's perception of the final esthetic result.

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Conflicts of Interest

The authors declare no conflict of interest.

Author Contributions

Conceptualization, A.J. and S.G.M.; *Methodology*, A.J., S.G.M. and L.P.; *Investigation*, A.J. and S.G.M.; *Data curation*, A.J.; *Formal analysis*, A.J. and S.G.M.; *Writing – original draft*

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