

Prognosis evaluation in dental aesthetic rehabilitations using 2 types of ceramic veneers in a Romanian study group



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Abstract

Aims and Objectives. The objectives of this study are the comparison of survival rate of feldspathic and pressed lithium-disilicate ceramics veneers, survival analysis, failure types, clinical factors that may influence their lifespan in a Romanian study group.

Materials and methods The materials used were VITA VM7 (VITA Zahnfabrik, Germany) and E.max (Ivoclar Vivadent AG, Liechtenstein). Patient demographics, treatment and any subsequent failure dates were recorded. 170 patients with 507 veneer-treated teeth were divided into 2 groups: patients with and without therapeutic failures.

Results 48 veneers failed. Most failures were fractures (35.36%), followed by debonding and chipping. The most affected veneers in general were the feldspathics (19.9%) compared to lithium disilicate (8.8%) at 10 years.

Conclusion Regardless of their superior aesthetics, feldspathic veneers are less mechanically resistant than pressables, but other clinical parameters must also be considered such as the age of the prosthetic rehabilitation or the number of teeth involved. Since study results are consistent with current literature data, Romanian patients can be considered in the international context of veneer treatments.

Keywords: feldspathic, pressable, veneers, failure, Romanian

INTRODUCTION

Aesthetic rehabilitation is one of the most common demands in the modern dental practice and involves multiple psycho-social factors [1]. If until the mid-1980s the main reason for coming to the dental office was dental pain, towards the end of the 20th century and the beginning of the 21st century a rise in aesthetic requirements was observed, mainly due to the media which was increasingly promoting „the perfect smile” [2,3]. The great challenge that dentists are facing at the present moment is to successfully combine the patients’ aesthetic requirements with the achievement of all functional objectives in restorative treatments, while simultaneously respecting biological parameters [4]. An important contribution in achieving these goals is represented by the digital technological advances that allow better communication between the dentist and the dental technician, and also permit the patient to witness the estimated treatment outcome [5,6]. Minimally invasive treatments have become accessible in restorative dentistry due to the association of adhesive techniques and restorative materials with translucent properties [7]. Materials such as lithium-disilicate ceramics have properties similar to natural teeth, thus increasing the chances of an aesthetically favourable result [8]. The success of the treatment is conditioned by a series of factors and steps that must be strictly carried through in order to allow optimal completion[9].

Aim and objectives

The objectives of this study are the survival rate of feldspathic ceramic veneers compared to those of pressed lithium-disilicate ceramics, survival analysis, failure types, taking the clinical factors that may influence their lifespan into account.

MATERIALS AND METHODS

The present study is an analytical, observational and retrospective study, which took place in 2019, using the database of a private dental clinic in Cluj-Napoca. The observation charts of patients that were treated between 2008 and 2019 with ceramic veneers reconstructions, both feldspathic (VITA VM7, VITA Zahnfabrik, Bad Sackingen, Germany) and pressable lithium-disilicate - e.max (Ivoclar Vivadent AG, Schaar, Liechtenstein), respectively, were used. The inclusion criteria for our study were: adult patients, clinically healthy - without comorbidities, without periodontal disease and with proper oral hygiene. Applying these criteria, we established a study group of 170 subjects, 139 female subjects (82%) and 31 male subjects (18%), including a number of 507 teeth which were restored with dental veneers. At the first presentation in the dental clinic, each patient completed an observation chart that included personal data, general physiological, pathological and dental history, and patient chief complaint. Observation sheets were stored in the clinic’s archives and were later on completed with further interventions in case of an accident or treatment failure. To conduct the study, we collected data on the patients’ age, gender, occupation, the materials used for the veneers, the date of treatment completion, and any accidents and/or complications that occurred later and the time elapsed in-between. In case of failures, we recorded the time interval between the time of application and moment of accident occurrence (measured in months). Subsequently, we classified the failures as follows:

1. veneer fracture;
2. veneer chipping;
3. veneer debonding;
4. veneer cracking;
5. accidents recorded during bonding;

6. changes in colour;
7. failures due to non-compliance of the patient with the instructions given by the dentist and with the recall schedule;
8. other types of failures.

Depending on the success of the aesthetic rehabilitation treatment, the studied group was divided into two subgroups: a first subgroup with patients without therapeutic failures (85.3% of the subjects), also called control group, and a second subgroup of subjects with therapeutic failures (14.7% of patients), also called study group. The two subgroups were comparatively observed regarding clinical parameters: gender, age, number of visits to the dentists, time elapsed from initial intervention until occurrence of the registered failure, the number of teeth involved in the aesthetic rehabilitation, the restorative material used and its influence on the treatment prognosis.

Statistical analysis was carried out using the Statsoft Statical 12 software program. Quantitative data was characterised by the median and the arithmetic mean±standard deviation (SD) with a confidence interval (CI) of 95%. Qualitative data was expressed as frequency and percent. Comparisons between groups were performed using the Mann-Whitney or chi-squared tests, whenever appropriate. Spearman's ρ (Spearman's rank correlation coefficient) was used for examining correlation between continuous variables. The level of statistical significance was established at $p < 0.05$, while $p < 0.1$ was noted to show a tendency towards statistical significance.

RESULTS

The subjects included in the therapeutic failures group showed a number of recorded failures between 1 and 5 (median=1), with an average of 2.05 ± 1.7 (95% CI: 1.7 - 2.45).

Among female subjects, 13.6 % had at least one therapeutic failure, while the percentage was higher amongst men, 19.3%, respectively.

Table 1. Therapeutic failure depending on the gender distribution of the group

<i>Gender</i>	With therapeutic failure	Without therapeutic failure	Total
<i>Female</i>	19 (13.6%)	120 (86.4%)	139 (82%)
<i>Male</i>	6 (19.3%)	25 (80.7%)	31 (18%)
Total	25 (44%)	145 (56%)	170

Upon statistical analysis, no association at statistically significant values between gender and the presence of therapeutic failure was identified ($p=0.548$).

The clinical indicators measured in this study and their presence in the study group are found in table no. 2.

Table 2. The main clinical indicators studied

Variable	Minimum and maximum recorded values	Mean ± SD	CI of 95%	Median
Age	19.9; 62.4	37.1 ± 9.9	35.7 → 38.6	36
No. of visits	1; 15	2.1 ± 1.8	1.9 → 2.4	1

Variable	Minimum and maximum recorded values	Mean \pm SD	CI of 95%	Median
Recorded failures	1; 5	2.05 \pm 1.7	1.7 \rightarrow 2.4	1
Time elapsed from bonding	1; 131	53.9 \pm 33.1	48.9 \rightarrow 58.9	61
Average time elapsed until 1 st failure	1; 92	26.6 \pm 24.1	20.8 \rightarrow 32.4	19
Average time elapsed from last corrective intervention	1; 47	16.91 \pm 15.6	9.4 \rightarrow 24.4	14
No. of teeth treated/patient	1; 13	2.96 \pm 2.0	2.6 \rightarrow 3.3	2

The age of the patients included in this study was between 19.9 years and 62.4 years (median = 36), with a mean age of 37.15 \pm 9.9 years. Subjects who showed no therapeutic failure were aged between 20.5 and 62.2 years, with a mean age of 36.77 \pm 9.5 years (95% CI: 34.8 - 38.60). In the group that registered therapeutic failure, the age of the subjects was between 19.9 years and 62.4 years, with an average of 37.64 \pm 10.4 (CI 95%: 35.2 - 40.05). The age difference between the two groups was 0.88 years, with no statistical significance in correlation with the presence of therapeutic failure. Patients who received e.max veneers had a mean age of 35.73 \pm 9.81 years, lower than patients with feldspathic veneers (38.6 \pm 9.77), with no statistical significance (p=0.058) between them.

The number of visits to the dental office was between 1 and 15 visits, with an average of 3.44 \pm 2.0 for the study group and 1.15 \pm 0.5 for the control group, with a statistically significant value (p=0.001).

The ceramics' age varied between 1 and 131 months, with a total average of 53.93 \pm 33.9 months, and with an average of 46.06 \pm 34.0 months for the control group and an average of 64.27 \pm 28.9 months for the study group, the difference being statistically significant (p = 0.001). In the study group, the time elapsed from the moment of bonding until the first failure was recorded to having occurred between 1 and 92 months, with an average of 26.63 \pm 24.1 months (95% CI: 20.8-32.42). The time elapsed since the last repair was between 1 and 47 months, with an average of 16.91 \pm 15.6 months.

The number of teeth involved in the prosthetic rehabilitation varied from one patient to another, ranging between 1 and 13 teeth, with an average of 2.96 \pm 2. For the control group, the average of teeth rehabilitated with dental veneers/patient was 3.39 \pm 2.4, and for the study group that had registered failures was 1.92 \pm 0.9 teeth, without this difference having a statistically significant value.

Female patients had fewer visits to the dental office (an average of 1.82 \pm 1.56 for women compared to 2.22 \pm 1.84 for men), and fewer failures/patient (an average of 1.76 \pm 1.18 for women and 2.08 \pm 1.69 for men) when compared to male patients. The statistical analysis did not reveal any significant difference between the two genders regarding the parameters listed above. The average number of teeth involved in prosthetic rehabilitation/patient did not differ according to gender (2.89 for women and 2.91 for men). The average time elapsed between the application of veneers and first incidents was 26.27 \pm 23.74 months for men and 28.5 \pm 27.13 months for women. Therefore, male patients presented failure earlier than their female counterparts, but the difference between the two was small.

Regarding the material used for the veneers, 53% of the patients received feldspathic veneers and 47% pressable ceramic veneers. For feldspathic ceramics, the failure rate at 10 years was 19.9%, and in the case of pressable ceramics, failure rates were found at 8.8% (table no. 3), a statistically significant difference ($p=0.002$) associated with a favourable prognosis for patients receiving pressable lithium-disilicate ceramic veneers. From a total of 31 men included in the study, 16 of them had feldspathic veneers and 15 received e.max veneers. The distribution of restorative ceramics in the 139 female patients was as follows: 74 received feldspathic ceramics and 65 pressable ceramics.

Table 3. Failure rate according to the type of ceramic used/patient

Type of ceramic/patient	With failure (no. of patients)	Without failure (no. of patients)	Total
Feldspathic	18 (19.9%)	72 (80.1%)	90 (53%)
e.max	7 (8.8%)	74 (91.2%)	80 (47%)
Total	25	145	170

The values of clinical parameters observed in relation to the material used can be found in table no. 4. They indicated a statistically significant correlation between the age of the treatment and the material used ($p=0.000$), in the sense that the feldspathic veneers had a longer average age than that of the e.max veneers, but this is due to the fact that e.max was later introduced in the clinic's current practices. The average age of patients with feldspathic ceramic veneers was greater than the age of patients with pressable ceramic veneers, but this finding indicated only a trend in this regard ($p=0.05$).

Table 4. Correlation between the material used and the observed clinical parameters

Clinical parameters (average values)	e.max veneers	Feldspathic veneers	P
Patients' average age	35.73±9.81	38.65±9.77	$p=0.05$
No. of failures/patient	1.6±2.09	1.9±1.3	$p=0.532$
No. of visits/patient	2.17±2.11	2.12±1.42	$p=0.240$
No. of treated teeth/patient	3.18±2.42	2.73±1.56	$p=0.673$
Veneer average age (in months)	42.54±31.69	65.72±30.37	$p=0.000$
Time elapsed from bonding until failure	27.82±27.01	25.66±21.80	$p=0.714$
Time elapsed from last repair	17.83±16.68	15.88±15.26	$p=0.794$

The total number of teeth treated and included in our study was 507, out of which 268 received feldspathic veneers and 239 received pressable ceramic veneers. Out of these, 48 veneers had accidents or failures throughout the studied period. The incidence of different types of failure, depending on the material used, can be found in table no. 5. Most accidents are represented by veneer fracture (35.36% of the total failures), especially in the case of feldspathic ceramics (24.99%), followed by debonding and chipping. The most affected veneers were feldspathic ceramics, proving the low stress resistance of these veneers

compared to those made out of pressable ceramics. Also, colour changes are more common in feldspathic veneers rather than in pressable veneers.

Table 5. Incidence of failures/type of material

Type of failure	No. and percentage of total failures	Feldspathic veneers (pcs./percent)	e.max veneers (pcs./percent)
Veneer fracture	17 (35.36%)	12 (24.9%)	5 (10.4%)
Chipping	5 (10.4%)	3 (6.25%)	2 (4.16%)
Debonding	12 (24.99%)	10 (20.83%)	2 (4.16%)
Cracking	4 (8.33%)	2 (4.16%)	2 (4.16%)
Accidents during bonding	3 (6.25%)	3 (6.25%)	0 (0.0%)
Colour changes	3 (6.25%)	3 (6.25%)	0 (0.0%)
Patient error	1 (2.08%)	1 (2.08%)	0 (0.0%)
Other causes	2 (4.16%)	1 (2.08%)	1 (2.08%)

DISCUSSIONS

Nowadays, ceramic dental veneers are an excellent therapeutic alternative in cases with outstanding aesthetic requirements, especially in the anterior area [10]. Having an excellent marginal fit, ceramic veneers manage to restore the teeth's natural appearance and improve the patient's smile. They are especially indicated in cases of discolouration and shape modifications, implying only minimally invasive interventions and having good predictability over time [11].

According to this study, we found that the demand for veneer treatments is higher among female patients than among male patients, demonstrating women's increased interest in aesthetics, but also in maintaining oral health, according to data found in the literature [12].

Male patients required more visits after bonding the veneers, indicating a predisposition of male patients to accidents, due to lifestyle and working conditions, but also their lower interest in protecting aesthetic treatments. Similar results were obtained by Della Bona A. et al. in their study conducted in 2010 on 1177 subjects who were treated with 2562 ceramic veneers, proving the influence of gender on the survival rate of the restorations [13].

In our study, the average age of patients who were treated with ceramic veneers was 37 years, proving that young patients have a greater interest in aesthetic restorations, and that they also prefer minimally invasive interventions that preserve the natural dental structures.

The 10-year survival rate of veneers varies according to the study design [14]. In two studies from 2012 which were carried out in Austria [15,16] and which reported similar data, the survival rate of veneers at 10 years was 93.5%, a value greater than that of our study (90.53%), but the number of teeth included in their study was smaller (318 compared to 507 teeth), and the veneers included in the study were made only out of pressable ceramics. For the latter, our recorded survival rate was of 91.2%. Furthermore, one must consider the differences/similarities of medical cultures in these 2 countries. Other data on the overall survival rate of veneers in studies published to date are 94.4% at 12 years in M. Fradeani's study [17], 91% at 10 years in H. Dumfahrt's study [18] and 97.5% in D'Arcangelo's study [19] at 5 years post-bonding.

Furthermore, the results of this research, similar to other data found in literature, indicate a more frequent use of feldspathic veneers due to their superior aesthetic quality (close to that of the natural appearance when compared to the e.max [20]). However, feldspathic ceramics prove to be more susceptible to accidents due to various causes (87% for feldspathic ceramics, compared to 94.6% for pressable ceramics in our study), demonstrating once more the lower resistance of this type of veneers in comparison with e.max [21]. The survival rate of feldspathic ceramic veneers is estimated in the literature to be between 64% and 95% at 10 years [22]. However, a meta-analysis published in 2012 indicated a survival rate at 5 years with statistically significant differences between the two types of veneers, aesthetic rehabilitation success being conditioned by multiple other factors besides the material used [23].

Following this research, we found that most failures occur due to veneer fracture, followed by debonding and chipping, similar to data already reported in the literature [24,25]. Blunck U. et al. managed to demonstrate in vitro in 2020, that after 3 million masticatory cycles, the frequency of failures changed: cracks were more frequent than fractures (22 cracked veneers out of the total of 80, depending on the thickness of the preparation [26]), indicating the involvement of clinical factors in defining the success rate of veneers. All failure indicators were higher for feldspathic veneers compared to e.max veneers in our study, one explanation being the average age of these veneers, 65.7 months, respectively, compared to 42.5 months for e.max veneers.

Underline new, important aspects of the study. Do not repeat in detail data which have been presented in previous sections. Include implications of revealed aspects and their limitations, including implications for future studies. Connect your observations to other relevant studies. Relate the results to the aim proposed for the study. [Book Antiqua, 11 point, normal, justified alignment].

CONCLUSIONS

The present study proves that, despite the fact that aesthetic parameters are superior for feldspathic veneers, mechanical resistance is superior for pressable veneers, but it is also conditioned by other clinical parameters such as the age of the prosthetic rehabilitation or the number of teeth involved. Among the registered failures, the highest incidence was veneer fracture, followed by debonding and chipping, but their incidence was low, which rendered ceramic veneers as an optimal alternative for aesthetic restorations, especially in the anterior area. As can be observed, our results are consistent with data already published in the literature in the field. Therefore, the importance of the study results is the inclusion of Romanian patients in the global context of ceramic veneer treatments.

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