A 8-year prospective clinical investigation on the survival rate of feldspathic veneers: Influence of occlusal splint in patients with bruxism

Vincente Faus-Matoses[a], Esther Ruiz-Bell[b], Ignacio Faus-Matoses[c], Mutlu Özcan[d], Sauro Salvatore[e*], Vincente J. Faus-Llácer[f]

[a] DDS, MSc, PhD. Co-director of the Master in Restorative Dentistry and Endodontics, Department of Stomatology, Faculty of Medicine and Dentistry, University of Valencia, Spain.

[b] DDS, Master of Restorative Dentistry and Endodontics, Department of Stomatology, Faculty of Medicine and Dentistry, University of Valencia, Spain.

[c] DDS, MSc, PhD. Professor of the Master in Orthodontics, Department of Stomatology, Faculty of Medicine and Dentistry, University of Valencia, Spain.

[d] DDS, MSc, PhD. University of Zurich, Dental Materials Unit, Center for Dental and Oral Medicine, Clinic for Fixed and Removable Prosthodontics and Dental Materials Science, Zurich, Switzerland.

[e] BSc, PhD. Dental Biomaterials, Preventive and Minimally Invasive Dentistry, Department of Dentistry, School of Health Sciences, CEU-Cardenal Herrera University, Valencia, Spain.

[f] MD, DDS, MSc, PhD. Director of the Master in Restorative Dentistry and Endodontics, Department of Stomatology, Faculty of Medicine and Dentistry, University of Valencia, Spain.

Short title: *Survival rate of feldspathic veneers and influence of occlusal splint in patients with bruxism*

*Corresponding author: Prof. Dr. Salvatore Sauro**.** Dental Biomaterials, Preventive and Minimally Invasive Dentistry, Department of Dentistry, School of Health Sciences, CEU-Cardenal Herrera University, Valencia, Spain. C/Del Pozo s/n, Alfara del Patriarca, 46115 - Valencia, Spain. Tel Office: (+34) 96 136 90 00; Ext. 64304. salvatore.sauro@uchceu.es

ABSTRACT

Objectives: The aim of this study was to perform a 8-year prospective clinical investigation on the survival rate of feldspathic ceramic veneers, as well as analyse the influence of the occlusal splint in patients with parafunctional bruxism.

Methods: Three hundred and sixty-four veneers fabricated using conventional feldspathic ceramic were provided in 64 patients. The patient sample included 40 individuals with bruxism. During the follow-up period, the effect of wearing the occlusal splint on the incidence of failure (fracture and/or debonding) in patients with bruxism was also assessed. The survival rate of veneers was determined using the Kaplan-Meier estimator. Statistical significance was set at $p < 0.05$ with a confidence interval of 95%.

Results: The occurrence of fracture for the feldspathic veneers tested in this study was 7.7%, while only 1.9% of the total number of veneers debonded. The overall survival rate was 93.7% after 3 years, 91% after 5 years, and 87.1% after 8 years. Patients with bruxism using an occlusal splint showed a survival rate of 89.1% after 7 years, while the survival rate in patients with bruxism using no occlusal splint was 63.9% ($p < 0.05$).

Conclusion: This study confirmed that feldspathic veneers may represent a suitable clinical approach for indirect aesthetic restorations. Such a treatment may be an option also for those patients affected by bruxism, as long as they regularly wear an occlusal splint. However, patients with bruxism using no occlusal splint may still present a potential higher risk of failure and/or debonding.

1. INTRODUCTION

Ceramic laminate veneers represent one of the main choices to perform an highly aesthetic restoration of buccal and proximal dental surfaces.[1] indeed, due to excellent optical and biocompatibility properties, feldspathic ceramics represent a suitable material for the fabrication of veneers to restore anterior teeth.[2-4] Certainly, this type of veneers may offer an exceptional conservative treatment option to solve cases of discoloration, fractures, incisal wear, modifications of dental size and shape, as well as for treatment of dental misalignment.[6-8] Moreover, in those cases where palatal/lingual wear and/or erosion is encountered, such veneers can also represent a suitable option to obtain predictable outcomes in terms of aesthetic and functional properties.[9,10]

Feldspathic dental ceramics can be successfully etched using hydrofluoric acid (HF) in order to create micromechanical retentions, which will facilitate the bonding performance of luting and self-adhesive cements.[7,11,12]

Retrospective studies performed to evaluate the clinical performance of indirect veneers showed that the results may vary significantly due to differences in study design, operators, and inclusion criteria.[1,13,14] Indeed, the failure rate for feldspathic veneers after 10 years may range between 5%[15] and 47%,[14] while after 5 years the range is between 2%[15] and 42%[16]. Fractures and debonding are the most common reasons for failure in such a scenario.[17,18] Moreover, a further interesting study showed that only 11% of feldspathic veneers failed due to fractures during a 10-year follow-up period.[19]

The bonding interface between dental ceramics, cement and dental substrates (e.g. enamel and dentine) is a further important factor that may affect the clinical success of dental veneers.[8] Indeed, it has been advocated that excessive dental preparations, which causes exposure of dentine, may increase the risk of microleakage, interface degradation, and therefore consequent debonding of ceramic veneers.[13] Conversely, due to a much

2

more reliable bonding performance, veneers applied in enamel may have a greater resistance to fracture and debonding compared to those bonded to dentine.[17]

Bruxism is a parafunctional habit in which individuals clench and/or grind the teeth during the day and/or night time.[2,5] Several authors have argued that bruxism may represent a contraindication for placement of ceramic veneers, as such a clinical situation may increases the risk for failure.[2,4,7,15] Generally, an occlusal splint is desirable for such patients undergoing prosthodontic treatments, especially in those cases where specific parafunctional habits such as bruxism have been diagnosed.[5] Certainly, a high failure rate might be reduced if the parafunctional activity is appropriately managed[2,4] through the using an occlusal splints.[5] However, there is still little evidence about such a clinical situation, hence the present study was proposed.

The aim of this study was to perform a 8-year prospective clinical investigation on the survival rate of veneers created using feldspathic ceramic, as well as evaluate the influence of wearing occlusal splint in patients with bruxism.

The first hypothesis of this study was that the use of feldspathic veneers would represent an appropriate approach for indirect anterior and posterior (first and second premolar) aesthetic restorations. The second hypothesis was that such a treatment for patients with bruxism would have comparable longevity to treatments performed in patients with no bruxism, as long as they regularly wear an occlusal splint.

2. Materials and methods

2.1 Study design and pre-operative procedures

The study design was performed under approval of the institutional ethical committee (Registration Nº H1514909920703). Sixty-four patients were included in the study and treated with a total of 364 conventional feldspathic ceramic veneers. The veneers were placed between January 2009 and December 2014 by two

fully-trained operators in the field of restorative and aesthetic dentistry, and with more than 20 years of clinical experience, who always followed the same standardised operative protocol.

Clinical and radiographic exploration was performed in each patient, along with intraoral and extraoral photographs. Moreover, a preliminary baseline impression was taken from each patient using alginate and a study model was casted using dental stone. Subsequently, a diagnostic wax-up and mock-up was performed in order to assess in advance the aesthetic, phonetic, and functional parameters, as well as to plan minimally invasive dental preparation in each tooth.

Considering the results of Manfredini et al (2013) [5], who showed that 63% of patients exhibiting bruxism would appear to be higher than what it may be expected in a general population, we have included in the group of patients with night bruxism all those patients presenting any of the following signs: tired/tight jaw muscles, locked jaw that cannot open or close completely, pain of jaw, neck or headache, lesions due to chewing on the cheeks' mucosa and patients who reported teeth grinding during sleep along with mandibula pain in the morning.

2.2 Inclusion and exclusion criteria

All patients selected for this study presented no sign of periodontal disease and acceptable oral hygiene; they were assessed through the periodontal disease index of Ramfjord (PDI) and the simplified oral hygiene index (OHI). Conversely, patients with gingivitis or periodontitis were treated beforehand and only included in this study after they were able to show no sign of gingival inflammation, along with and acceptable oral hygiene.

Those patients with bruxism, who presented on incisor margins or buccal cusps exposed dentine and/or sign of fracture/chipping, were excluded from this study, because it was not possible to perform the "window" preparation for veneers (see chapter 2.3).

Inclusion criteria: anterior and posterior teeth (up to the second premolar), without extensive loss of dental enamel, with a degree of horizontal mobility of ≤1 mm, vital pulp or stable and well-performed endodontic

treatment, resorption less than one third of the length of the root and correct occlusal relation. Any patients unwilling to comply with the follow-up schedule were excluded from the study. All patients included in this study were recalled every six months for the first year and thereafter annually (up to 8 years) for a session of oral hygiene, where it was also evaluated the compliance of the patience via a questionnaire and through a photographic assessment to evaluate new or complication of previous signs and symptoms of bruxism.

2.3 Dental preparation

As stated before, a diagnostic wax-up and mock-up was performed in order to assess in advance the aesthetic, phonetic, and functional parameters, as well as to plan minimally invasive dental preparation. Dental preparation was carried out through a conservative "window" preparation [6] using Calibrated burs (868B, 314 and 020; Komet Dental, Besigheim, Germany) and tapered, fine-grain, round point, diamond burs (881, 314, 010 and 016; Komet Dental). The window preparation is considered a conservative approach where the veneer is carried out without involving the incisal edge. Such a specific preparation allows the clinician to obtain an acceptable ceramic thickness of 0.4 to 0.7 mm, which can decrease the risk of experiencing porcelain fracture and wear of opposing teeth, and will not interfere with incisal guidance or occlusion in cases of veneers in premolars. [6] Moreover, it has been shown that it may yield to lower level of microleakage compared to other common methods to prepare teeth for veneers.[6, 8] When necessary, contact points were broken with metal strips, and then recreated with the veneers (anterior teeth). Margins were prepared juxtagingivally having a curved chamfer finish line.

After dental preparation, high precision impressions were taken using a silicon impression material (Aquasil Ultra XLV, Dentsply Sirona, Konstanz, Germany). Moreover, the dental shade of the treated teeth colour was obtained using the Vitapan 3D-Master colour guide (Vita Zahnfabrick, Bad Säckingen, Germany). Temporary restorations were performed with acrylic resin (Integrity, Dentsply Sirona). For the adhesion of temporary

restorations, the buccal surface of the treated teeth were acid-etched using a 36% phosphoric acid gel (Detrey® Conditioner 36, Dentsply Sirona) only in the middle third. This was subsequently rinsed off and an adhesive system was applied for 3s (Prime & Bond NT, Dentsply Sirona) and immediatelly light-cured for 10 s using a LED unit with an irradiance of 1200 Mw/cm^2 (SmartLite Focus Pen Style, Dentsply Sirona). Finally, the provisional veneers were applied using a flowable composite (SDR, Dentsply Sirona) and light cured for 20 s. The definitive feldspathic porcelain veneers (Noritake Kisai Co, Japan) were then fabricated by a dental technician using standardised operative protocols.

2.4 Veneers application: adhesive operative procedures

After removing the temporary restorations, the dental surface was polished using a silicon rubber polishing bur (Dentsply Sirona) mounted on a slow handpiece working under continuous irrigation. The veneers were etched using 9.6% of hydrofluoric acid for 2 minutes (Ultradent, Ultradent Products. Inc.) and subsequently copiously rinsed with water and dried. A layer of silane coupling agent (Calibra, Dentsply Sirona) was applied and air-dried, followed by application of the adhesive (Prime & Bond NT, Dentsply Sirona). The enamel surface of each tooth was etched again with a 36% orthophosphoric acid gel for 20 seconds. An adhesive system was applied as per manufacturer's instructions (Prime & BondNT, Dentsply Sirona), but without performing any light-curing procedure.

The resin cement (Calibra, Dentsply Sirona) was applied onto the inner surfaces of the veneers and the enamel and the veneers were applied and light-cured for 3 seconds (SmartLite Focus Pen Style, Dentsply Sirona) in order to be able to easily eliminate the excess of the cement at the outer interface between veneers and the tooth. Subsequently, both the palatine/lingual and buccal surfaces were light-cured for 40 seconds (SmartLite Focus Pen Style, Dentsply Sirona). Finally, glycerine gel was applied to the edges of each veneer to avoid the formation of an oxygen inhibition layer during a final light-curing step of 20 s. The occlusion and

possible presence of pre-contacts were checked with articulating paper (AccuFilm II; Parkell Inc., Farmingdale, NY, USA). The edges of all veneers were then polished with silicone discs (Enhance PoGo, Dentsply Sirona) and interproximal polishing strips (Soft-Lex Finishing Strips, 3M ESPE, USA).

Finally, an impression was taken using alginate and dental stone model was casted. This model was used for the execution of the occlusal splint with a 2-mm-thick self-curing acrylic resin. The splint was finally adjusted in the mouth by using an occlusal paper and finally polished using a slurry of pumice. All materials used during the construction of the occlusal splint were handled according to the manufacturer's instructions. The patients were instructed to wear the occlusal splint overnight and every day.

2.5 Clinical evaluation

Post-treatment follow-up was scheduled at 6 and 12 months after treatment, and thereafter annually for up to 8 years. All data of the exams was entered by a single operator. The follow-up sessions included clinical examination, dental prophylaxis, and the management of any complications such as fracture or debonding. We also evaluated the compliance of the patience via a questionnaire and through photographic report to evaluate new or complication in previous signs and symptoms of bruxism, as well as the state of the occlusal splint. Moreover, patients reported information about the use of the occlusal splint and on frequency of its use, as well as the state of the occlusal splint. In those cases where the splint was broken or damaged, a new one was provided to the patient.

In the clinical examination, the state of each veneer was assessed taking particular care if there was any fracture and/or debonding of the ceramic veneers. The veneers were evaluated following the method of the California Dental Association (CDA) as described in previous studies .[3] It was considered a clinical success when no defect or intervention was required. In details, survival: restorations still in place or with necessity of repair or rebonding; failure: veneers not present *in loco* or totally unusable. Longevity was defined as the

period starting at the moment when the veneer was placed and the period when an irreversible matter occurred.[2-4,17] Patients were also classified in three groups: 1). Non-bruxism; 2). Bruxism using an occlusal splint; 3). Bruxism who failed to use the splint.

2.6 Statistical analysis

Data was submitted to binary logistic regression model using the 'Generalized Estimation Equations' (GEE). The chi-squared test (χ^2) was used to measure the degree of dependence between two variables if there were at least five cases present in contingency tables, otherwise Fisher's exact test was used. Accumulated rates of survival and failure were analysed using Kaplan-Meier test. Survival curves were generated to analyse different independent factors and the comparison was performed using the log-rank test. Statistical significance was set at $p<0.05$ with an interval of confidence at 95%. Statistical analysis was performed using SPSS software (version 15, IBM).

3. Results

The study included 364 veneers (273 anterior and 91 posterior, including first and second premolars), who were followed up for a period of 5 years (287) and 8 years (57); mean follow-up: 5.2 ± 1.7 years. Patients received a number of veneers between 1 and 20. However, each veneer was evaluated individually as a single statistical element. There were 40 women and 24 men (average age: 52 years). Forty patients were found affected by bruxism; in this group 257 veneers were bonded in patients who then used an occlusal splint and 36 veneers in patients who admitted to not follow our recommendation to wear the splint provided.

Twenty-eight veneers (7.7%) fractured in seventeen patients. Ten veneers were fractured in three patients with bruxism that used no occlusal splint. Five patients presented debonding of 7 veneers (1.9%); three of these occurred in a single patient affected by bruxism, who also used no occlusal splint (Figure1).

When the probability of fracture was analysed, it was found that fracture was twofold greater (odds ratio (OR) =1.98) in patients with bruxism, although there was significant difference between the two groups (p=0.205). When the effect of occlusal splint among patients with bruxism was analysed, it was found that the probability of fracture increased significantly seven folds (OR= 6.68) in those patients who failed to use a splint to protect the veneers (p<0.001). However, the use or non-use of the occlusal splint was not a determining factor in the probability of debonding (OR=5.75; p=0.159) (Table 1).

The Kaplan-Meier analysis showed cumulative survival for fracture and debonding of 93.7% after 3 years, 91% after 5 years and 87.1% after 8 years. In this case, it was found that using no occlusal splint could influence the survival rate significantly (p<0.001). The cumulative survival rate among patients with bruxism using the occlusal splint was 89.1% after 8 years, while failure in using the splint reduced it to 63.9% (Figures 2 and 3). An overview of all the results in terms of survival rate in the total sample can be found in Tables 2 (A-H).

The overall survival rate obtained in this current study was 93.7% after 3 years, 91% after 5 years, and 87.1% after 8 years. Layton et al.[21] showed with the results of their meta-analysis study that the survival rate of for feldspathic porcelain veneers was 95.7% after 5 years and 64-95.6% after 10 years. Conversely, the lowest rates were observed only in those studies that evaluated veneers bonded to dentine[13, 17]; as previously stated, bonding in dentine may have less predictable results than those performed in enamel. In such a context, dental preparation should be as conservative as possible in order to preserve the enamel, as the ceramic-enamel bond is "stronger" in terms of long-term performance than ceramic veneers bonded to dentine.[7,10,12,17] That is the reason why in this study it was employed an enamel window preparation technique for indirect veneers; a minimally invasive preparation that preserves the enamel in order to attain a good performance in adhesion and low level of microleakage.[8]

Several studies have emphasised that the main cause for clinical failure in veneers made of feldspathic ceramics is related to fracture.[11,12,18,19] However, Cötert et al.[13] reported that the most frequent type of failure in such veneers was debonding, while Gurel et al.[17] concluded that both fracture and debonding were the most common causes of failure in feldspathic restorations. However, the clinical performance of veneers may vary due to differences in terms of study design, inclusion and exclusion criteria and restorative materials employed. For this reason, it is difficult to make an "ultimate" comparisons between studies, although some data may be comparable to the present study.

The results of the current study may be comparable to those of Gurel et al.[17] who found that veneers fractured with an incidence of 3% and only 2 % debonded over a period of 12 years. However, the reason why they found less incidence in fracture may be due to the use of high-resistance heat-pressed ceramic veneers (e.g lithium disilicate-based ceramics), which have higher strength and less translucency.[22] Peumans et al.[19] evaluated conventional feldspathic ceramic veneers and they obtained a fracture rate of 14% and 0% debonding over a 10-year follow-up. In this case, the fracture rate was higher than that obtained in our study, but with comparable results in the rate of debonding compared to the present study. According to the literature, the rate of failure for feldspathic veneers over different follow-up periods varies between 0 and 14%.[11]

The results of the current study are in accordance with the average survival rate (87%) of conventional feldspathic veneers reported in a systematic review paper published by Morimoto et al.[12] These latter authors also reported that the incidence of fracture was 4% over a maximum period of 8 years. The fracture rate was lower than that observed in the present study; it could be due to the fact that in that article both conventional feldspathic and high-resistance non-feldspathic ceramics were included in the analysis. Moreover, the debonding rate was 2% [12], a result quite similar to that obtained in the current study. However, some of the articles reviewed by Morimoto et al. [12] did not specify whether patients with bruxism were included or excluded in the study; differences in the inclusion/exclusion criteria always influence the fracture rates registered. [1,13,19]

Unfavourable occlusion and parafunctional habits are considered an important risk factor for the failure of ceramic veneers.[10,15,17,18] Indeed, bruxism can be considered a contraindication for veneer placement.[3] Beier et al.[2] found that the probability of failure was eight-time higher among patients with bruxism. Nevertheless, in the present study, the probability of failure was only two-fold higher in such patients affected by bruxism, although no significant difference was encountered when compared to patients with no parafunctions. Likewise, the current study corroborate the results of Gurel et al.[17] who found no significant relationship between the presence of bruxism and restoration failure. However, the use of occlusal splints can reduce the failure rate of ceramic veneers in patients with bruxism; satisfactory general and clinical outcomes have been reported in previous studies.[2] Indeed, Granell et al,[5] who evaluated the effect on the use of occlusal splints on the failures of veneers, found a significant higher rate of fracture in patients with bruxism who used no occlusal splint. Nevertheless, no significant difference was encountered in terms of debonding. The results of our study are in accordance with those presented by Granell et al. [5]; the probability of fracture was seven-fold greater than when the patients used no occlusal splint. However, the use or non-use of the occlusal splint was not a determining factor in the probability of debonding.

5. Conclusions

Considering the limitations of this study, it may be concluded that conventional feldspathic porcelain veneers can be considered an acceptable and predictable treatment with long-lasting performance. Moreover, feldspathic porcelain veneers can be also considered a suitable clinical option for the treatment of patients with bruxism, especially such patients can use regularly an occlusal splint to protect the veneers.

Conflict of interest

The authors did not have any commercial interest in any of the materials used in this study.

REFERENCES

1. Layton DM, Walton TR. The up to 21-year clinical outcome and survival of feldspathic porcelain veneers: accounting for clustering. *International Journal of Prosthodontics* 2012;**25**:604-12.

2. Beier US, Kapferer I, Burtscher D, Dumfahrt H. Clinical performance of porcelain laminate veneers for up to 20years. *International Journal of Prosthodontics* 2012;**25**:79-85.

3. Nejatidanesh F, Savabi G, Amjadi M, Abbasi M, Savabi O. Five year clinical outcomes and survival of chairside CAD/CAM ceramic laminate veneers - a retrospective study. J Prosthodont Res. 2018 Oct;**62**:462-467.

4. Fradeani M, Redemagni M, Corrado M. Porcelain laminate veneers: 6- to 12-year clinical evaluation- a retrospective study. *International Journal of Periodontics and Restorative Dentistry* 2005;**25**:9-17.

5. Manfredini D, Winocur E, Guarda-Nardini L, Paesani D, Lobbezoo F. Epidemiology of bruxism in adults: a systematic review of the literature. *Journal of* Orofacial Pain. 2013;**27**:99-110.

6. Shetty A, Kaiwar A, Shubhashini N, Ashwini P, Naveen D, Adarsha M, Shetty M, Meena N. Survival rates of porcelain laminate restoration based on different incisal preparation designs: An analysis. J Conserv Dent. 2011;14:10-5.

7. Layton DM, Walton T. An up to 16-year prospective study of 304 porcelain veneers. *International Journal of Prosthodontics* 2007;**20**:389-96.

8. Faus-Matoses I, Solá-Ruiz F. Dental preparation with sonic vs high-speed finishing: analysis of microleakage in bonded veneer restorations. *Journal of Adhesive Dentistry* 2014;**16**:29-34.

9. Furuse AY, Soares JV, Cunali RS, Gonzaga CC. Minimum intervention in restorative dentistry with V-shaped facial and palatal ceramic veneers: A clinical report. *Journal of Prosthetic Dentistry* 2016;**115**:527-30.

10. Federizzi L, Gomes ÉA, Báratro SS, Baratto-Filho F, Bacchi A, Spazzin AO. Use of feldspathic porcelain veneers to improve smile harmony: A 3-year follow-up. *Brazilian Dental Journal* 2016;**27**:767-74.

11. Rinke S, Lange K, Ziebolz D. Retrospective study of extensive heat-pressed ceramic veneers after 36 months. *Journal of Esthetic and Restorative Dentistry* 2013;**25**:42-52.

12. Morimoto S, Albanesi RB, Sesma N, Agra CM, Braga MM. Main clinical outcomes of feldspathic porcelain and glass-ceramic laminate veneers: a systematic review and meta-analysis of survival and complication rates. *International Journal of Prosthodontics* 2016;**29**:38-49.

13. Cötert HS, Dündar M, Oztürk B. The effect of various preparation designs on the survival of porcelain laminate veneers. *Journal of Adhesive Dentistry* 2009;**11**:405-11.

14. Burke FJ, Lucarotti PS.Ten-year outcome of porcelain laminate veneers placed within the general dental services in England and Wales. *Journal of Dentistry* 2009;**37**:31-8.

15. Dumfahrt H, Schäffer H. Porcelain laminate veneers. A retrospective evaluation after 1 to 10 years of service: Part II--Clinical results. *International Journal of Prosthodontics* 2000;**13**:9-18.

16. Shaini FJ, Shortall AC, Marquis PM. Clinical performance of porcelain laminate veneers. A retrospective evaluation over a period of 6.5 years. *I Journal of Oral Rehabilitation* 1997;**24**:553-9.

17. Gurel G, Sesma N, Calamita MA, Coachman C, Morimoto S. Influence of enamel preservation on failure rates of porcelain laminate veneers. *International Journal of Periodontics and Restorative Dentistry* 2013;**33**:31-9.

18. Beier US, Kapferer I, Dumfahrt H.Clinical long-term evaluation and failure characteristics of 1,335 all-ceramic restorations. *International Journal of Prosthodontics* 2012;**25**:70-8.

19. Peumans M, De Munck J, Fieuws S, Lambrechts P, Vanherle G, Van Meerbeek B.A prospective ten-year clinical trial of porcelain veneers. *Journal of Adhesive Dentistry* 2004;**6**:65-76.

20. Granell-Ruiz M, Fons-Font A, Labaig-Rueda C, Martínez-González A, Román-Rodríguez JL, Solá-Ruiz MF.A clinical longitudinal study 323 porcelain laminate veneers. Period of study from 3 to 11 years. *Medicina Oral Patologia Oral y Cirugia Bucal* 2010;**15**:531-7.

21. Faus-Matoses V, Faus-Matoses I, Ruiz-Bell E, Faus-Llácer VJ. Severe tetracycline dental discoloration: Restoration with conventional feldspathic ceramic veneers. A clinical report. *Journal of Clinical Experimental Dentistry* 2017;**9**:1379-82.

22. Layton DM, Clarke M, Walton TR. A systematic review and meta-analysis of the survival of feldspathic porcelain veneers over 5 and 10 years. *International Journal of Prosthodontics* 2012;**25**:590-603.

	p-value	OR	CI 95% OR
FRACTURE	<0.001***	6.68	2.86 – 15.6
DEBONDING	0.159	5.75	0.51 – 65.5
FAILURE	0.001**	7.51	2.17 – 26.1

*p<0.05; **p<0.01; ***p<0.001

A.- Survival rate in the total sample: failures according to position (maxillary/mandible) and tooth type.

		Total																
		TOOTH																
		Total		IC		IL		CAN		PM1		PM2		Total		IC	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
FRACTURE	Total	364	100.0%	108	100.0%	89	100.0%	76	100.0%	54	100.0%	37	100.0%	245	100.0%	80	100.
DEBONDING	Total	364	100.0%	108	100.0%	89	100.0%	76	100.0%	54	100.0%	37	100.0%	245	100.0%	80	100.
FAILURE	Total	364	100.0%	108	100.0%	89	100.0%	76	100.0%	54	100.0%	37	100.0%	245	100.0%	80	100.

B.- Survival rate in the total sample: failures according to position (maxillary/mandible) and sector (anterior/posterior).

		Total					
		SECTOR					
		Total		Anterior		Posterior	
		N	%	N	%	N	%
FRACTURE	Total	364	100.0%	273	100.0%	91	100.0%
DEBONDING	Total	364	100.0%	273	100.0%	91	100.0%
FAILURE	Total	364	100.0%	273	100.0%	91	100.0%

C.- Survival rate in the total sample: failures according to position (maxillary/mandible) and tooth type in no-bruxism patient.

		Total											
		TOOTH											
		Total		IC		IL		CAN		PM1		PM2	
		N	%	N	%	N	%	N	%	N	%	N	%
FRACTURE	Total	71	100.0%	26	100.0%	18	100.0%	14	100.0%	11	100.0%	2	100.0%
DEBONDING	Total	71	100.0%	26	100.0%	18	100.0%	14	100.0%	11	100.0%	2	100.0%
FAILURE	Total	71	100.0%	26	100.0%	18	100.0%	14	100.0%	11	100.0%	2	100.0%

D.- Survival rate in the total sample: failures according to position (maxillary/mandible) and sector (anterior/posterior) in no-bruxism patients.

		Total						Total	
		SECTOR							
		Total		Anterior		Posterior		Total	
		N	%	N	%	N	%	N	%
FRACTURE	Total	71	100.0%	58	100.0%	13	100.0%	47	100
DEBONDING	Total	71	100.0%	58	100.0%	13	100.0%	47	100
FAILURE	Total	71	100.0%	58	100.0%	13	100.0%	47	100

E.- Survival rate in the total sample: failures according to position (maxillary/mandible) and tooth type in patients with bruxism and with occlusal splint.

		Total														Total		IC	
		TOOTH																	
		Total		IC		IL		CAN		PM1		PM2				Total		IC	
		N	%	N	%	N	%	N	%	N	%	N	%			N	%	N	%
FRACTURE	Total	257	100.0%	74	100.0%	63	100.0%	54	100.0%	37	100.0%	29	100.0%			172	100.0%	53	100.0
DEBONDING	Total	257	100.0%	74	100.0%	63	100.0%	54	100.0%	37	100.0%	29	100.0%			172	100.0%	53	100.0
FAILURE	Total	257	100.0%	74	100.0%	63	100.0%	54	100.0%	37	100.0%	29	100.0%			172	100.0%	53	100.0

F.- Survival rate in the total sample: failures according to position (maxillary/mandible) and sector (anterior/posterior) in patients with bruxism and with occlusal splint.

		Total						Total	
		SECTOR							
		Total		Anterior		Posterior		Total	
		N	%	N	%	N	%	N	
FRACTURE	Total	257	100.0%	191	100.0%	66	100.0%	172	
DEBONDING	Total	257	100.0%	191	100.0%	66	100.0%	172	
FAILURE	Total	257	100.0%	191	100.0%	66	100.0%	172	

G.- Survival rate in the total sample: failures according to position (maxillary/mandible) and tooth type in patients with bruxism and without occlusal splint.

		Total												Total		IC	
		TOOTH															
		Total		IC		IL		CAN		PM1		PM2		Total		IC	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
FRACTURE	Total	36	100.0%	8	100.0%	8	100.0%	8	100.0%	6	100.0%	6	100.0%	26	100.0%	6	100.0
DEBONDING	Total	36	100.0%	8	100.0%	8	100.0%	8	100.0%	6	100.0%	6	100.0%	26	100.0%	6	100.0
FAILURE	Total	36	100.0%	8	100.0%	8	100.0%	8	100.0%	6	100.0%	6	100.0%	26	100.0%	6	100.0

H.- Survival rate in the total sample: failures according to position (maxillary/mandible) and sector (anterior/posterior) in patients with bruxism and without occlusal splint.

		Total							
		SECTOR							
		Total		Anterior		Posterior		Total	
		N	%	N	%	N	%	N	%
FRACTURE	Total	36	100.0%	24	100.0%	12	100.0%	26	10
DEBONDING	Total	36	100.0%	24	100.0%	12	100.0%	26	10
FAILURE	Total	36	100.0%	24	100.0%	12	100.0%	26	10

Captions to the legends and tables:

Tables

Table 1. Association between veneer failure and bruxism patients who failed to use occlusal splints. Chi^2 test results and odds ratio (OR) and estimation odds ratio (OR) with generalized estimating equations (GEE) for binary logistic regression model. The non-use of the occlusal splint increased the risk of fracture seven times. Non-use of splints was not a determinant factor for debonding.

Tables 2. A-H: Failure rates with respect to the location (Maxillary/mandible), type of the tooth (anterior/posterior) and the association with or without bruxism and patients using or not using occlusal splints.

Figures

Fig. 1 Distribution of incidence of fractures and debonding in patients with or without bruxism and patients using or not using occlusal splints. The failure rate is higher among the group of patients with bruxism who did not use the occlusal splint. Patients with bruxism who did use splints presented a similar failure rate to non-bruxism patients No= Non-bruxism; Splint=Bruxism with splint; No splint=Bruxism no splint. Colour: No= Light Blue; Splint= dark blue; No splint= orange.

Fig. 2 Veneer survival during a maximum follow-up period of 8 years. The survival rate shows a progressively decreasing constant pattern, indicating a constant failure rate over time (95% interval of confidence).

Fig. 3. Veneer survival among patients with bruxism according to use or non-use of occlusal splints over a maximum follow-up period of 8 years. Patients with bruxism who used no splint presented a higher incidence of veneer failure with a decreasing inconstant curve, particularly during the first year. Patients with bruxism who did use splints present a progressively decreasing constant curve over time (95% interval of confidence).

|	p-value	OR	CI 95% OR
FRACTURE	<0.001***	6.68	2.86 – 15.6
DEBONDING	0.159	5.75	0.51 – 65.5
FAILURE	0.001**	7.51	2.17 – 26.1

*p<0.05; **p<0.01; ***p<0.001

Tables 2. A-H: Failure rates with respect to the location (Maxillary/mandible), type of the tooth (anterior/posterior) and the association with or without bruxism and patients using or not using occlusal splints.

A.- Survival rate in the total sample: failures according to position (maxillary/mandible) and tooth type.
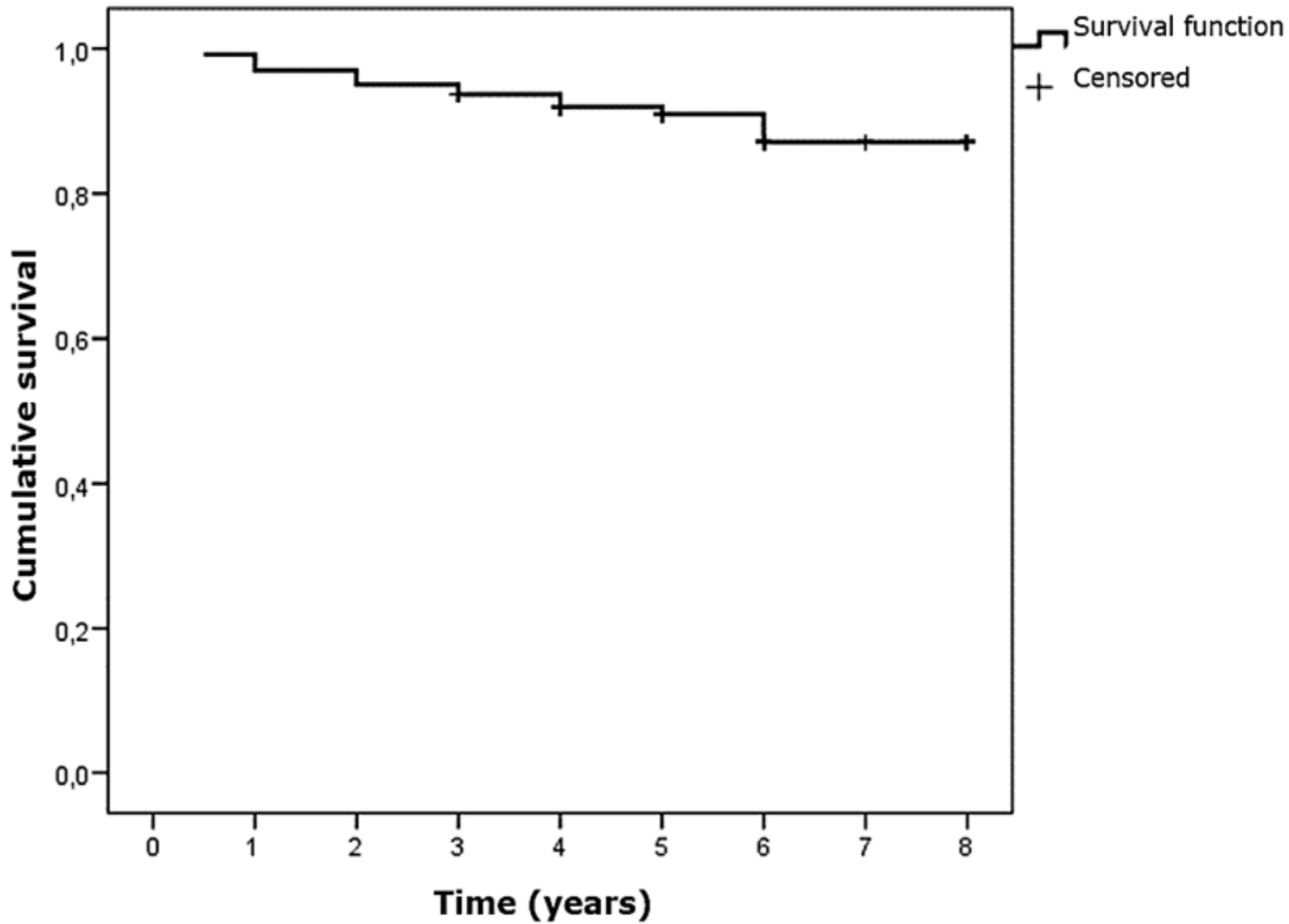
		Total												Maxillary												Mandible											
		TOOTH												TOOTH												TOOTH											
		Total		IC		IL		CAN		PM1		PM2		Total		IC		IL		CAN		PM1		PM2		Total		IC		IL		CAN		PM1		PM2	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
FRACTURE	Total	364	100.0%	108	100.0%	89	100.0%	76	100.0%	54	100.0%	37	100.0%	245	100.0%	80	100.0%	62	100.0%	50	100.0%	31	100.0%	22	100.0%	119	100.0%	28	100.0%	27	100.0%	26	100.0%	23	100.0%	15	100.0%
DEBONDING	Total	364	100.0%	108	100.0%	89	100.0%	76	100.0%	54	100.0%	37	100.0%	245	100.0%	80	100.0%	62	100.0%	50	100.0%	31	100.0%	22	100.0%	119	100.0%	28	100.0%	27	100.0%	26	100.0%	23	100.0%	15	100.0%
FAILURE	Total	364	100.0%	108	100.0%	89	100.0%	76	100.0%	54	100.0%	37	100.0%	245	100.0%	80	100.0%	62	100.0%	50	100.0%	31	100.0%	22	100.0%	119	100.0%	28	100.0%	27	100.0%	26	100.0%	23	100.0%	15	100.0%

B.- Survival rate in the total sample: failures according to position (maxillary/mandible) and sector (anterior/posterior).

		Total						Maxillary						Mandible					
		SECTOR						SECTOR						SECTOR					
		Total		Anterior		Posterior		Total		Anterior		Posterior		Total		Anterior		Posterior	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
FRACTURE	Total	364	100.0%	273	100.0%	91	100.0%	245	100.0%	192	100.0%	53	100.0%	119	100.0%	81	100.0%	38	100.0%
DEBONDING	Total	364	100.0%	273	100.0%	91	100.0%	245	100.0%	192	100.0%	53	100.0%	119	100.0%	81	100.0%	38	100.0%
FAILURE	Total	364	100.0%	273	100.0%	91	100.0%	245	100.0%	192	100.0%	53	100.0%	119	100.0%	81	100.0%	38	100.0%
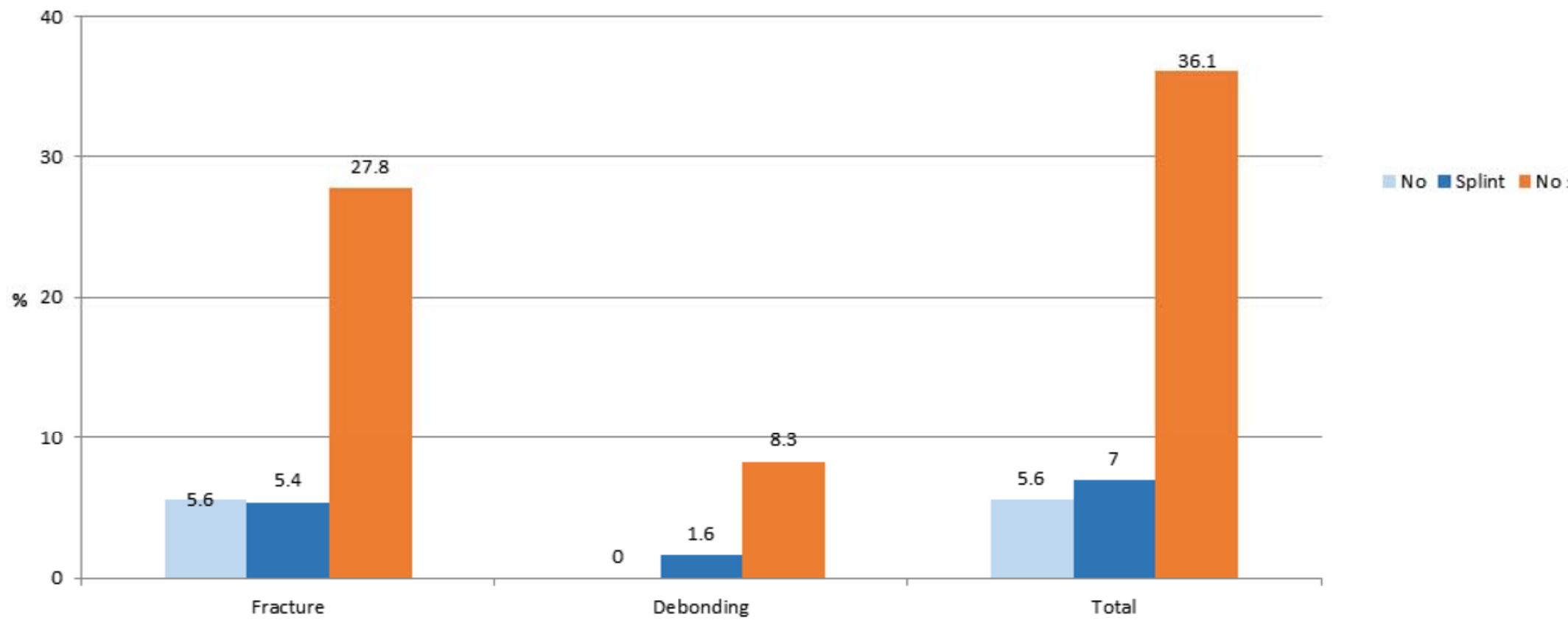
Survival function

Survival function