dental materials xxx (2017) xxx–xxx

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.intl.elsevierhealth.com/journals/dema

Effect of luting agent on the load to failure and accelerated-fatigue resistance of lithium disilicate laminate veneers

Marco M.M. Gresnigt[a,*], *Mutlu Özcan*[b], *Marco Carvalho*[c], *Priscilla Lazari*[c], *Marco S. Cune*[a], *Peywand Razavi*[a], *Pascal Magne*[d]

[a] *University of Groningen, University Medical Center Groningen, Center for Dentistry and Oral Hygiene, Department of Fixed and Removable Prosthodontics, Groningen, The Netherlands*

[b] *University of Zurich, Dental Materials Unit, Center for Dental and Oral Medicine, Clinic for Fixed and Removable Prosthodontics and Dental Materials Science, Zurich, Switzerland*

[c] *Piracicaba Dental School, University of Campinas, Department of Prosthodontics and Periodontology, Piracicaba, Sao Paulo, Brazil*

[d] *Herman Ostrow School of Dentistry of USC, University of Southern California, Restorative Sciences, Los Angeles, USA*

ARTICLE INFO

Article history:
Received 10 March 2017
Received in revised form
30 August 2017
Accepted 16 September 2017
Available online xxx

Keywords:
Adhesion
Bonding
Cementation
Ceramic
Fatigue
Fracture
Laminate
Veneer

ABSTRACT

Objective. The aim of this study was to investigate the influence of the luting agent on the application of laminate veneers (LVs) in an accelerated fatigue and load-to-failure test after thermo-cyclic aging.

Methods. Sound maxillary central incisors (N = 40) were randomly divided into four groups to receive LVs ($Li_2Si_2O_5$) that were adhesively bonded: Group CEMF: Adhesive cement (Variolink Esthetic LC), fatigue test; Group CEMLF: Adhesive cement, load-to-failure test; Group COMF: Resin composite (Enamel HFO), fatigue test; Group COMLF: Resin composite, load-to-failure test. The specimens were thermo-mechanically aged (1.2×10^6 cycles at 1.7 Hz/50 N, 8000 cycles 5–55 °C) and then subjected to either accelerated fatigue (5 Hz, 25 N increasing after each 500 cycles) or load to failure (1 mm/min). Failure types were classified and data analyzed using chi-square, Kaplan Meier survival, Log Rank (Mantel–Cox) and independent-samples t-test.

Results. After thermo-mechanical aging, fracture resistance ($p < 0.000$) was higher in the composite groups. Kaplan Meier survival rates showed significant difference ($p < 0.001$) between the composite (mean load: 1165 N; mean cycles: 22.595) and the cement groups (mean load: 762.5 N; mean cycles: 14.569). The same differences were observed in the load to failure test (cement M = 629.4 N, SD ± 212.82 and composite M = 927.59 N, SD ± 261.06); $t(18) = -2.80$, $p = 0.01$. Failure types were observed as fractures and chipping in group CEMF, all other groups were predominantly adhesive failures between the luting agent and the laminate veneer.

* *Corresponding author at*: Department of Fixed and Removable Prosthodontics, Center for Dentistry and Oral Hygiene, University Medical Center Groningen, University of Groningen, Antonius Deusinglaan 1, 9713 AV, Groningen, The Netherlands. Fax: +31 50 363 2696.

E-mail address: marcogresnigt@yahoo.com (M.M.M. Gresnigt).

https://doi.org/10.1016/j.dental.2017.09.010

0109-5641/© 2017 The Academy of Dental Materials. Published by Elsevier Ltd. All rights reserved.

Please cite this article in press as: Gresnigt MMM, et al. Effect of luting agent on the load to failure and accelerated-fatigue resistance of lithium disilicate laminate veneers. Dent Mater (2017), https://doi.org/10.1016/j.dental.2017.09.010

Significance. The delivery of laminate veneers using a direct restorative composite rather than a resin cement resulted in significantly less chipping and fractures, higher fracture strength in both accelerated fatigue and load-to-failure.

© 2017 The Academy of Dental Materials. Published by Elsevier Ltd. All rights reserved.

1. Introduction

Laminate veneers (LV) are indicated as minimal invasive treatment options as an alternative to full coverage crowns. Since retention of the LV restorations does not rely on mechanical retention principles, durable adhesive luting of such restorations is crucial for long-term clinical success [1,2]. In clinical studies, survival rates of ceramic LVs range between 82 and 96% in 10–21 years [3–8]. Fractures of ceramic (5.6–11%) and marginal defects (12–20%) are the main reasons for failure [3,4,8–12]. Successful luting increases the retention, fracture resistance of the tooth and the restoration, and reduces the incidence of micro-leakage [2,13]. Adhesively bonded restorations offer the advantage of sealing the margins of the restorations, while solubility of cements is avoided. Also, adhesive luting of bonded restorations does not only provide minimal invasive restorations but also reinforces the glassy matrix ceramics [1].

For the conditioning of glassy matrix ceramics, hydrofluoric acid (HF) etching followed by the application of a silane coupling agent is a well established method [14–17]. For the luting of LVs, in most laboratory and clinical studies a photo-polymerized resin composite is suggested [2,5,8,18–21]. This kind of resin luting agent has some advantages over dual-polymerized ones. Photo-polymerized resin cements have better handling properties and they allow increased time for the clinician to seat the restoration. Furthermore, in some studies, with photo-polymerized resin materials increased bond strength was reported when compared to dual-polymerized resin cements [22–28]. In a study by Kameyama et al. [22], a dual-polymerized resin cement was compared with a direct composite as a luting material for ceramic inlays in a micro-tensile bond-strength test. The direct resin composite experimental group resulted in ca. 30 MPa of bond strength with only 1 pre-test failure whereas dual-polymerized resin composite cement delivered values below 10 MPa with almost half of the specimens presenting pre-test failures [22].

When testing durability of restorative materials in a laboratory setting, different aging methods are proposed. Besides different aging protocols such as water storage, thermo-cycling or thermo-mechanical aging, two different methods for fracture testing could be applied, namely load to failure test or accelerated fatigue test [26]. No consensus is available as to which method of durability test should be used to simulate the intra-oral situation ideally.

The objectives of this study were to (a) compare two different LV luting agents, (b) compare the outcome of the two different test methods on the survival of the bonded laminate veneers. The following null-hypothesis were tested: (a) aging would not have a significant effect on ceramic LVs luted with two resin composite materials (b) different luting materials would not have an influence on the survival rate or fracture resistance, (c) the test method would not have an influence on the outcome of the LVs.

2. Material and methods

2.1. Experimental groups and specimen preparation

The brands, types, main chemical compositions, manufacturers and batch numbers of the materials used for the experiments are listed in Table 1. Schematic description of the experimental design is presented in Fig. 1.

Sound human maxillary central incisors (N = 40) of similar size, free of restorations and root canal treatment were selected from a pool of recently extracted teeth. All teeth were screened on the presence of cracks under ultraviolet light and those with cracks were eliminated and replaced with new teeth. The teeth were then randomly divided into 4 groups (n = 10).

CEMF: Ceramic LV, Photo-polymerizing luting agent, accelerated fatigue test.

CEMLF: Ceramic LV, Photo-polymerizing luting agent, load-to-failure test.

COMF: Ceramic LV, Restorative resin composite, accelerated fatigue test.

COMLF: Ceramic LV, Restorative resin composite, load-to-failure test.

Prior to the LV preparation, impressions were made using a condensation silicone (Provil Novo putty fast set, Heraeus, Hanau, Germany) in order to obtain moulds for the provisional restorations. Window type tooth preparations without incisal overlap were made under an optical microscope (OPMI pico, Zeiss, Oberkochen, Germany). After marking the preparation outline, depth cuts of 0.3 mm were made (801-014, Komet, Besigheim Germany), preparations were finalized using a round-ended tapered diamond chamfer bur (879m-014 FG, Komet, Besigheim, Germany). The preparations ended completely in enamel, 1 mm above the cemento-enamel junction. Smooth margins were created to prevent stress concentration zones using finishing discs (Sof-Lex Contouring and Polishing Discs, 3M ESPE, St Paul, Minnesota, USA). After preparations were finished and enamel surfaces were polished, impressions were made using an polyvinyl-silicon impression material (Aquasil Ultra Heavy and XLV, Dentsply, Milford, USA) and these were checked for irregularities under an optical microscope (×10 magnification, OPMI pico, Zeiss). Provisional LVs (Protemp 4, 3M ESPE, St Paul, Minnesota, USA) were made and applied using a spot etch technique where etching was performed for 10 s in the cervical and incisal part of the preparation. After adjusting the temporary restorations using

Download English Version:

https://daneshyari.com/en/article/7858960

Download Persian Version:

https://daneshyari.com/article/7858960

Daneshyari.com