2057 Factors affecting the chance of post-operative sensitivity in indirect porcelain onlays.

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The aim of this clinical study was to evaluate the effect of two luting cements and a glass ionomer lining on the incidence of post-operative sensitivity following the insertion of indirect porcelain onlay restorations in vital posterior teeth. Patients requesting a tooth-coloured restoration for one or more hypoplastic posterior teeth were carefully screened to exclude any signs of pre-operative pulpal, periodontal and/or periapical pathosis. The teeth were prepared for an indirect porcelain onlay and the restorations were cemented with either Panavia TC or Flexoceram. Approximately half of the teeth in each group received a Vitrebond lining on all exposed dentine surface prior to the construction of the restoration. A total of 54 onlays were placed in 19 patients (mean age=22.9 years). These patients were reviewed two weeks after cementation.

The results showed that post-operative sensitivity occurred in 29 out of the 54 restored teeth, i.e. 53.7%. Logistic regression model showed that the layer of lining was significant in reducing the chance of having post-operative sensitivity with this type of restoration (p=0.034, odd ratio=0.2758). The influence of the luting cement was not significant (p=0.121, odd ratio=0.3995). It was concluded that a layer of glass ionomer cement lining to protect any exposed dentine should be recommended for indirect porcelain onlays placed over a vital tooth.

2058 Clinical Evaluation of Ceramic Inlays and Onlays after Four Years.*

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Instead of amalgam and other metal restorations ceramic fillings are used as esthetic and suitable alternatives to restore even widely destroyed teeth. But only few clinical data about adhesive inlays or onlays fixed proximal in dentin are available. Therefore in a prospective, controlled clinical study, the performance of IPS EMPRESS® for inlays and onlays with cusp reconstructions or the margins below the cemento-enamel junction should be examined. 96 IPS EMPRESS®-fillings (73 Class-II-inlays, 23 onlays / 39 premolars, 57 molars) on 34 patients were performed by seven experienced dentists. The restorations were fixed with four different resins (Telric®, Dual Cement®, Variolink® low, and Variolink® ultra). In each case a glass ionomer base covered the dentin close to the pulp. In addition to the acid-etch-technique the dentin bonding system Syntac® was applied. At baseline, after 6 months, one year, two and four years the restorations were examined by two calibrated investigators with modified USPHS-criteria [Pelka 1994].

From 96 investigated fillings seven had to be replaced (failure rate 7%; survival analysis by *Kaplan-Meier* algorithm). Three teeth needed to be endodontically treated because of pulpitis, four inlays had cohesive fractures. 87 of the fillings (90%) were in good condition. In comparison of the four investigations (A 6 months, B 1 year, C 2 years, D 4 years) we got significant differences (Friedman 2-way Anova; p<.05) in the following criteria ("excellent", "good" (="alpha"), "sufficient" (="bravo"), insufficient (="charlie"), poor (="delta") in %): **marginal adaption** A 40/60/0/0/0 B 35/60/5/0/0 C 17/65/18/0/0 D 7/65/27/1/0; **inlay integrity** A 96/3/1/0/0 B 93/5/2/0/0 C 92/3/4/0/1 D 79/11/3/2/5; **tooth integrity** A 84/16/0/0/0 B 90/9/1/0/0 C 78/21/1/0/0 D 53/41/6/0/0. After four years 79% of the cases showed marginal ditchings. The absence of enamel did not limit the adhesion and the margin quality of the restorations. No considerable difference could be detected in the following criteria at the last investigation [%]: **surface roughness** 45/55/0/0/0, **colour** 74/25/1/0/0, **proximal contact** 87/11/2/0/0, **radiographic diagnosis** 92/5/3/0/0, **hypersensitivity** 100/0/0/0/0, **satisfaction** 94/0/6/0/0. **In conclusion, after four years IPS EMPRESS® inlays and onlays in connection with the dentin bonding system Syntac® clinically convinced to restore even widely destroyed teeth.** *This study was supported by Vivadent, Schaan, Liechtenstein.

2059 In Vitro Accuracy and Fit of Milled 'Natural Inlays'.

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With the recent development of copy-milling systems for porcelain, it is now possible to construct close fitting restorations from natural human tooth substance. Using the CELAY system (Mikrona Technologie AG), class II inlays can be produced from extracted teeth with enamel and dentine in the desired location and a clinically acceptable fit (Moscovich and Creugers, J Dent, 1997). The purpose of this study was to compare the accuracy and fit of milled 'Natural Inlays' (NIs), to those of industrial porcelain inlays (PIs) milled in the same way (Control). Three NIs and 3 PIs were milled in the CELAY machine, using a slightly tapered rectangular metal pro-inlay constructed for calibration of the machine. The inlays were cemented in acrylic models copied from the original calibration-model, using Panavia Ex 21 Dental Adhesive (Cavex, Kuraray) under constant pressure of 2 kg for 30 min. After storage of 1 day in water the specimens were sliced bucco-lingually in a horizontal rotation sawing machine. For each specimen, two slices were photographed using a light-microscope, giving pictures at ~50 times magnification. Two independent sets of measurements were carried out directly on the pictures using callipers with an accuracy up to 50µm. The actual accuracy level was therefore 1µm, due to the magnification factor of the pictures. Using a transparent matrix placed at identical positions over the pictures, the bucco-lingual widths of the inlays were measured at 5 fixed locations per slice. The Wilcoxon test showed no significant differences between the bucco-lingual widths of NIs and PIs at any point (P>0.05). Using a different matrix, the bucco-lingual interfaces between the inlays and the acrylic models were measured at 4 fixed points per slice, 2 on each side. The Wilcoxon test showed no significant difference between the interfaces of the NIs and PIs. In view of these investigations it can be concluded that the accuracy and fit of milled 'Natural Inlays' is in the same order as the accuracy and fit of milled porcelain inlays.

2060 One Year Clinical Evaluation of Bonded Etched Porcelain Onlays.

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Etched porcelain bonded to enamel restorations (porcelain veneers) have demonstrated predictable clinical results with low incidence of debonding, fracture, microleakage or discoloration. In-vitro investigations of etched porcelain bonded to dentin using new generation of dentinal adhesives have reported bond strength in excess of cohesive strength of porcelain. The purpose of this study was to evaluate clinical performance of posterior etched porcelain bonded restorations in the forms of on-lays and overlays. A total of twelve adult male and female patients treatment planned for one or two posterior occlusal full coverage restorations (a total of 21) were recruited for this study from the patient pool of the Outpatient Dental Clinic at UTHSCSA. Patient consent was obtained before treatment. Patients with signs of parafunctional habits (bruxism and clinching) were excluded from the study. Porcelain restorations were fabricated from a high leucite content porcelain (Fortress, Chameleon Dental Prod.) and bonded with a dual cure luting resin (FLC, Chameleon Dental Prod.). All teeth preparations were supragingival with margins on enamel. Two investigators performed intraoral procedures and one ceramist fabricated the restorations. Recalls were performed by two investigators for debonding, fracture, marginal leakage, tooth sensitivity, caries and possible discoloration of the luting resin. At six months recall only three patients reported minor sensitivity to heat and cold. At one year all restorations have remained bonded with no cracks or cohesive fracture of the porcelain. No recurrence of caries at the margin, marginal gap formation related to luting resin or marginal discoloration was recorded. This preliminary data of a three year clinical evaluation of posterior etched porcelain bonded restorations reveals 100% retention of restorations at one year with no marginal discoloration, fracture or ditching.

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2061 Effect Of Thermal And Mechanical Fatigue On Microleakage Of Inlays.

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Thermal and mechanical changes may induce tensile and compressive forces which can destroy interfacial bonds and lead to microleakage. This investigation evaluated the effect of thermal and mechanical cycling on the microleakage of porcelain and composite inlays. Duceram LFC (DC) ceramic (Degussa), and Tetric (TET) and Heliomolar (HM) composite resins (Vivadent) were used to make 120 indirect inlays. MOD cavities were prepared locating one gingival margin in enamel (EN) and the other in dentin (DN). The inlays were cemented using a bonding agent (All-Bond 2, Bisco) and a resin cement (Duo-Link, Bisco). Each group was divided into four subgroups (n=10). The controls were subjected to no fatigue (NF), and the others to either thermal fatigue (TF = 2400 thermocycles at 5 to 55°C), mechanical fatigue (MF= 960000 loadcycles at max=15kg), or both thermal and mechanical (TMF) in 0.5% basic fuchsin dye. The teeth were sectioned and microleakage was scored on a 0-4 scale. Median (sd) microleakage scores are presented. The 2-Way (MAT x TX) repeated measure (EN,DN) ANOVA indicated that factors TX and margin location significantly affected the microleakage scores. No significant difference in microleakage was found between porcelain and composite inlays. Supported by Egypt and OSU.

TX	NF		TF		MF		TMF	
MAT	EN	DN	EN	DN	EN	DN	EN	DN
DC	0.0 (0.0)	0.0(0.1)	0.0(0.6)	0.0 (0.7)	0.0 (0.9)	0.3 (1.2)	0.0(1.1)	0.3(1.2)
TET	0.0 (0.1)	0.0(0.2)	0.0(0.5)	0.3 (0.7)	0.1 (0.9)	0.3 (1.0)	0.1(1.5)	0.6(1.4)
HM	0.0 (0.2)	0.0(0.2)	0.0(0.7)	0.0 (0.9)	0.3 (1.0)	0.4 (1.0)	0.4(1.3)	0.5(1.4)

2062 Thermal Cycling Effects on the Strength of Optimal Pressable Ceramic.™

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The purpose of this study was to examine the flexural strength of colored and translucent OPC ceramic core material before and after thermal cycling. Thirty modulus of rupture test bars, 2mm x 2mm x 25mm, were pressed from body core shade A-2 and thirty from translucent core shade I-35. Fifteen of the A-2 and 15 of the I-35 ceramic core samples were fractured following fabrication (no thermal cycling after pressing) using a self-aligning four-point test apparatus (10-mm inner span 20-mm outer span) with a constant strain rate of 0.2 mm/min. (Model 1125 Electromechanical Testing System, Instron Corp., Canton, MA). Fifteen of the A-2 samples were thermal cycled three times each under vacuum at 60°C/min. to 968°C first fire, 949°C second fire, and 938°C third fire. Fifteen of the I-35 samples were thermal cycled one time each to 938°C. The thermal cycling followed manufacturer recommendations, and simulated the processing required to obtain an esthetic restoration in the dental laboratory. The thermal cycled samples were then fractured as previously described. The mean fracture strength was 82.0 ± 14.4 MPa for A-2 OPC , 93.56 ± 14.8 MPa for thermal cycled A-2, 109.17 ± 8.18 for I-35 translucent OPC and 101.29 ± 12.85 for thermal cycled I-35. Statistical analysis (ANOVA and Tukey) revealed that the as-formed and thermal cycled I-35 OPC were significantly stronger than the as-formed A-2 core ($p<0.001$). In addition, the as-formed I-35 was significantly stronger than the thermal cycled A-2 core ($p<0.01$). However, there was no significant difference in the strength of the thermal cycled I-35 and thermal cycled A-2 core materials. No significant changes in strength were noted as a result of the thermal cycling of any of the materials.

2063 Thermal Coefficient of Expansion of Optimal Pressable Ceramic™.

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Dental ceramic restorations provide an aesthetic alternative to traditional metal ceramic restorations. Numerous dental ceramics have become available within the past fifteen years including Dicor, IPS-Empress, In-Ceram Alumina and In-Ceram Spinell. Most recently, Optimal Pressable Ceramic™ (OPC) has been introduced, claiming improved aesthetic and mechanical properties. The final aesthetic result for all ceramic restorations is achieved either through the application of surface colorants or veneering porcelains. To provide optimal mechanical properties, the Thermal Coefficient of Expansion (TCE) of these materials should be closely matched. With the OPC system, a single veneering and surface coloring porcelain kit is provided for achieving the final aesthetics of both the colored and non-colored core materials. The purpose of this study was to examine the TCE of colored and translucent OPC core materials. Four specimens (2mm x 2mm x 10mm) of body core shade A-2 and four of translucent core shade I-35 were fabricated following manufacture's recommendations. Samples were placed in a water-cooled Linseis L75/34C Differential Dilatometer (Princeton, NJ.). To simulate normal firing conditions, the TCE was determined at a rate of 50° C/min. over the temperature range of 0° C to 1000° C. The mean TCE was determined to be 19.600 x 10^{-6} / °C and 19.625 x 10^{-6} / °C for the A-2 and translucent OPC materials respectively. Both colored and uncolored Optimal Pressable Ceramic materials posses a similar thermal coefficient of expansion, and therefore, a single veneering and coloring porcelain kit should be compatible with both.

2064 Effects of Pressing Programs on Optimal Pressable Ceramic™ Strength.

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Following strength and fracture surface analysis of Optimal Pressable Ceramic (OPC), a characteristic surface pore was identified as the fracture origin in the colored core ceramic. The purpose of this study was to determine if changes in the processing parameters could be used to reduce the surface pore size, and therefore, improve the strength of the material. A total of sixty modulus of rupture test bars, 2mm x 2mm x 25mm, (15 per group) were pressed from body core shade A-2 using the following variables:

	Pressing Temp	Hold Time	Pressing Time
Group I	1150 °C	20 min.	15 min.
Group II	1160 °C	20 min.	15 min.
Group III	1180 °C	25 min.	21 min.
Group IV	1200 °C	25 min.	21 min.

The Group I and II processing parameters are preprogrammed into the manufacturer's equipment. The Group III and IV processing variables were customized by the investigators. Samples were fractured using a self-aligning four-point test apparatus (10-mm inner span 20-mm outer span) with a constant strain rate of 0.2 mm/min. (Model 1125 Electromechanical Testing System, Instron Corp., Canton, MA). All Group I bars resulted in incomplete pressing as they did not completely fill the mold, and therefore, were too short to be tested. Statistical analysis (ANOVA and Tukey) revealed no significant difference between Group II and Group III, 82.0 ± 14.3 MPa and 82.5 ± 11.2 MPa respectively. The strength of Group IV, 69.2 ± 13.3 MPa, was significantly less than group II and III ($p<0.05$). The forming variables have a significant effect on the strength of OPC. Increasing the temperature beyond the manufacturers recommended 1180° C results in a decrease in strength.