TEMPERATURE'S INFLUENCE ON WEIGHT LOSS OF RESTORATIVE MATERIALS EXPOSED TO ACID BEVERAGES

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Aim: consumption of acidic beverages and foods could provoke an erosive damage both for teeth and for restorative materials. Temperatures of consumption could influence the erosive effects of these products. The aim of this *in vitro* study is to assess the influence of an acidic challenge on the weight loss of different restorative materials.

Methods: resin composites and Glass-Ionomer Cements (GIC) were tested. The medium storage was Coca-Cola (Coca-Cola, Coca-Cola Company, Milano, Italy) at two different temperatures, 4°C and 37°C, respectively for Group A and Group B. After 7 days, weight was assessed for each sample and the percentage weight loss was calculated.

Results: for all the composite resins (Groups 1-13), no significant weight losses have been noticed (< 1%). Conversely, GIC (Groups 14 and 15) showed a significant weight loss during the acidic challenge, which was reduced in case of those materials including a protective layer applied above. Significant differences were registered with intra-group analysis; weight loss for specimens immersed in Coca Cola at 37°C was significantly higher for almost all materials tested when compared to specimens exposed to cooler medium.

Conclusions: in conclusion, all the composite resins showed a reliable behaviour when exposed to acidic erosion, whereas glass-ionomers cements generally tended to solubilize.

MECHANICAL PROPERTIES OF A NOVEL GRAPHENE-BASED MATERIAL FOR DENTAL RESTORATIONS

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Aim: recently, graphene has attracted both academic and industrial interest because it showed to enhance mechanical, physical and chemical properties of biomaterials. This work aimed at comparing the mechanical properties of a novel graphene-based material and a conventional and commercially available nanohybrid resin-based dental composite, used as control.

Methods: the composites were subjected to the following mechanical tests: 3-point flexural strength (FS) test, compressive strength (CS) test and Vickers hardness (VH) test. For each different mechanical test, ten samples of each composite were prepared (n = 10), according to following specimen design: bar-shaped (2 x 2 x 25 mm) for FS, cylindrical (4 mm diameter, 8 mm height) for CS, disc-shaped (4 mm diameter, 2 mm height) for VH. All tests were performed using a universal testing machine (Lloyd Instruments- LR30KPlus). Means and standard deviations were calculated and compared using the Student-t tests ($P < 0.05$).

Results: in all mechanical tests performed, the ultimate strength/hardness observed for the graphene-based material appeared comparable or slightly increased compared to the nanohybrid resin-based dental composite. Moreover, both the flexural modulus of elasticity (recorded on the FS test) and the compressive modulus of elasticity (recorded on the CS test) were significantly reduced for the graphene-based material, compared to the control.

Conclusions: the experimental graphene-based material tested in this study showed ultimate strength and hardness at least as good as those observed for conventional dental composites. At the same time, the significantly reduced flexural and compressive moduli describe a considerably more elastic material. Further studies are needed, to definitely understand the clinical meaning of the mechanical differences herein observed.

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IN VITRO EVALUATION OF SURFACE AND OPTICAL CHARACTERISTICS OF A REPAIRED CAD/CAM COMPOSITE

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Aim: to evaluate the surface characteristics and optical properties of a CAD/CAM composite block after repair with different resin composites.

Methods: three adhesive/resin composites combinations [One Coat 7 Universal adhesive/Brilliant EverGlow (Coltene), iBond universal adhesive/Venus Pearl (Kulzer), iBond universal/Venus Pearl One (Kulzer)] were used to repair CAD/CAM composite blocks (Brilliant Crios, Coltene; A2 HT 14L) after they were submitted to laboratory aging (10.000 thermocycles, 5-55 °C). Each specimen was tested with a chewing simulator (CS-4.4 SD Mechatronik). Surface roughness, gloss and color (according to the CIE L*a*b* color scale) measurements were repeated at different stages: baseline, after themocycling, after repairing, after chewing simulator. Data were statistically analyzed ($p < 0.05$).

Results: color stability and surface gloss were influenced by thermocycling ($p < 0.05$), chewing simulator ($p < 0.05$) and type of composite ($p < 0.05$). Roughness was only influenced by chewing ($p < 0.05$). Differences were observed between composites ($p < 0.05$), with Venus One showing inferior color changes and higher surface gloss values compared to the other two repairing materials.

Conclusions: although the resin composites used for repairing showed clinically acceptable values in terms of colour, surface gloss and roughness, they could not reproduce the initial characteristics of the CAD/CAM resin composite block.

THE INFLUENCE OF ADHESIVE EVAPORATION ON BONDING PERFORMANCES TO DENTIN

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Aim: to evaluate the effect of two adhesive evaporation techniques on the microtensile bond strength (μTBS) of a universal adhesive to dentin.

Methods: the middle/deep dentin of 20 sound human molars were bonded with a universal adhesive (Quick bond, Tokuyama Inc.) applied in total-etch (TE) or self-etch (SE) modes. Two adhesive evaporation techniques were tested (n = 5): i) TE/Air: the adhesive was air-dried with the disposable air/water syringe; ii) TE/Suction: the adhesive was air-dried with the disposable suction device; iii) SE/Air: the adhesive was air-dried; iv) SE/Air: the adhesive was aspired with the suction device. Then, the adhesive was light-cured for 10s. Direct coronal restoration was performed with two 2mm-thick layers of a resin composite material. After 24 h, the specimens were cut into sticks and submitted to the μTBS test. Fractures were classified and analyzed under SEM. Data were statistically analyzed ($p < 0.05$)

Results: air-drying resulted in significantly higher μTBS values than suction ($p < 0.05$). SE/Air performed significantly better that SE/Suction, TE/Air and TE/Suction. No differences were found between the TE groups. SEM images showed the presence of water-tree formations at the adhesive interface when suction was used for adhesive evaporation.

Conclusions: the use of the air with the disposable syringe should be preferred to air-suction to enhance bonding performances of an ethanol-based universal adhesive, especially when used in the self-etch mode.

DEEP CERVICAL MARGINAL RELOCATION: A RETROSPECTIVE CLINICAL STUDY

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Aim: the aim of the present study was to evaluate the efficacy of different materials in deep cervical marginal relocation (DMR) in deep second class cavities. The null hypothesis tested was that there is no difference between flowable and not flowable materials in DMR neither for the parodontal response (1) nor for the restauration result (2).

Methods: patients with at least a deep interproximal caries in posterior teeth were selected. Initial periodontal parameters were taken (probing depth, recession, plaque index, bleeding on probing). After decay removal, due to the impossibility of rubber dam isolation, gingivectomy without osteoplasty was performed. After sutures, rubber dam was repositioned and standardized adhesive procedures were performed with a two-step self-etch adhesive with enamel pre-etching. Patients were then divided in two groups according to the material used for the first horizontal layer: group 1 (Grandioso Heavy-Flow, Voco) group 2 (Grandioso, Voco). Remaining cavity was filled using the centripetal build-up technique. During follow ups two operators independently calibrated evaluated periodontal tissues health and restoration quality following FDI criteria.

Results: 47 patients were recalled with a mean follow-up of 24.6 months. Chi-square test showed better marginal adaptation ($p = 0.0001$) and periodontal health ($p = 0.0001$) for group 2. Restorations showed clinical acceptable qualities regarding FDI criteria.

Conclusions: the first null-hypothesis could be rejected since flowable composite showed increased BoP than traditional one.

BONDING PERFORMANCES OF SILVER DIAMINE FLUORIDE-TREATED DENTIN

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Aim: to evaluate the effects of two silver diamine fluoride (SDF) surface pre-treatments on the dentin bonding potential and matrix-metalloproteinases (MMPs) activity of a simplified universal adhesive.

Methods: sixty non-carious sound human molars were cut to expose enamel-free coronal dentin. Groups were formed (n=10) according to the dentin surface pre-treatment and etching mode of the universal adhesive (Zipbond, SDI) used for bonding procedures: 1) Zipbond applied in the self-etch mode (SE); 2) Riva Star + SE (RSE); 3) Riva Star Aqua + SE (ASE); 4) Zipbond applied in the total-etch mode (TE); 5) Riva Star + TE (RTE); 6) Riva Star Aqua + TE (ATE). After 24h, the specimens were sectioned into 1-mm thick slices and subjected to microtensile bond strength (μTBS) test and scanning electron microscope (SEM) at baseline (T_0) and after 6 months (T_6) of artificial storage. To investigate the effect of SDF on MMPs activity, 3 additional molars per group were processed for the *in situ* zymography analysis at T_0 and T_6. Data were statistically analyzed ($p < 0.05$).

Results: the dentin pre-treatment, etching mode, aging and their interactions significantly influenced the bond strength and MMPs activity ($p < 0.05$). Both pre-treatments, as well as aging decreased bond strength ($p < 0.05$). Pretreatment (Riva Star > Riva Star Aqua = control), etching and aging increased the MMPs activity ($p < 0.05$).

Conclusions: due to the lower enzymatic activity in the Riva Star Aqua pretreated groups, a more stable hybrid layer might be expected over time compared to Riva Star.

CONVERSION DEGREE STABILITY WITH BULK-FILL MATERIALS: A RAMAN SPECTROSCOPY STUDY

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Aim: to evaluate the degree of conversion before and after thermocycling in high c-factor dental cavities restored with five different bulk composites.

Methods: 50 extracted molars were collected and two first-class cavities, 2 mm and 4 mm deep, were prepared on the occlusal surface. After performing standardized adhesive procedures, specimens were randomly divided in five groups, according to the composite employed: Venus One (Kulzer), Tetric Powerfill (Ivoclar), Tetric Power Flow (Ivoclar), Filtek Posterior (3M), Filtek BulkFill (3M). The composites were placed in the cavity in a unique horizontal layer.

Half of the specimens were submitted to thermocycling (10000 cycles between 5°C and 55°C) and then vertically sectioned to expose the lateral surface of restored cavity, along which Raman Spectroscopy measurement were performed from top to bottom of the restoration. The degree of conversion of the tested materials was calculated and were collected and statistically analyzed with ANOVA test.

Results: in all groups the monomer conversion slightly decreased from the top surface along the depth of the composite restoration. However, any significant differences were found between the tested composites ($p = 0.0672$), while the thermocycling induced a significant reduction of the conversion degree.

Conclusions: bulk-fill materials showed an efficient light transmission trough the composite mass which led to a uniform conversion from monomer to polymer. However, the one-shade composite tested showed a similar trend, probably thanks to its optical properties.

REHABILITATION OF SEVERELY DAMAGED TEETH USING LITHIUM DISILICATE INDIRECT RESTORATIONS

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Aim: to restore function and esthetics of severely damaged teeth exploiting adhesive procedures in order to avoid full crown preparations.

Methods: a 55-year-old male patient came to our clinic complaining pain and discomfort during chewing activity in upper left quadrant. Radiographic and clinical examination showed incongruous restorations on 2.7, 2.6, 2.5, 2.4 and 2.3 with destructive caries on 2.7 and cusp fracture on 2.4. Rubber dam was placed from 2.7 to 2.2 after local anesthesia infiltration. During caries removal procedures pulp were exposed on 2.7 and root canal treatment was performed. All cavities were cleaned simultaneously from 2.6 to 2.3 with diamond and carbide burs, whereupon build-ups from 2.7 to 2.4 and a direct composite restoration on 2.3 were made. Preparations for overlays on 2.7 2.6 2.5 and 2.4 were performed and silicone impressions were taken. After 7 days, lithium disilicate overlays were bonded with multi-step resin cement under rubber dam isolation.

Results: radiographic and clinical examination after 1 month showed good integration, function and esthetics. Patient reported any symptoms or discomfort.

Conclusions: adhesive partial restorations could be a good solution also in cases with severe tooth substance loss and little amount of enamel available, leading to a more conservative and less expensive treatment.

EFFECT OF DIFFERENT CURING PROTOCOLS ON MARGINAL INTEGRITY AND CONVERSION DEGREE OF LUTING CEMENTS

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Aim: the aim of this study is to investigate the influence of the tack-curing process on the conversion degree and marginal adaptation of a dual-curing cement in full-crown luting procedures.

Methods: single-rooted teeth, extracted for periodontal reasons, were selected and prepared for a full-crown with chamfer margin. Crowns were milled using a lithium silicate material (Celtra Duo, Dentsply). Once completed the sintering and glazing/polishing procedures (10 minutes sintering, 10 minutes glazing), the crowns were luted over the prepared specimen using a universal dual-curing cement, which has been applied in self-adhesive mode, following the manufacturer instructions. Samples were then divided in two subgroups, based on the curing protocol: conventional curing (G1); tack-curing (G2). Specimens were scanned with a micro-CT and Raman spectroscopy, before and after thermocycling (10000 cycles between 5°C and 55°C). The degree of conversion and the marginal adaptation were calculated and statistically analyzed with ANOVA test.

Results: both curing protocols tested lead to a good polymerization, without significant differences in the degree of conversion ($p = 0.063$), which was not influenced by the thermocycling, along the cement-tooth interfacial surface. However, marginal adaptation was conditioned by the curing process ($p = 0.0001$), before and after thermal fatigue.

Conclusions: the tack curing protocol seems to be effective in reaching a satisfying degree of conversion but it could lead to a reduced marginal adaptation when luting cements are employed.

EFFECT OF TWO GLUTARALDEHYDE-BASED PRIMERS ON DENTIN BOND STRENGTH AND ENZYMATIC ACTIVITY

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Aim: to evaluate the effects of two glutaraldehyde-based solutions (GLUMA) on the microtensile bond strength (μTBS) and endogenous enzymatic activity (MMPs) of simplified universal adhesives (UAs) to dentin.

Methods: two UAs were used in the self-etch modes: iBond universal (IBU, Kulzer) and Adhese Universal (AU, Ivoclar). The dentin surfaces of sound human molars were pre-treated with GLUMA solutions available in 2 consistencies ($n = 8$): G1: Gluma Desensitizer (GD) + IBU; G2: Gluma Desensitizer Powergel (GG) + IBU; G3: IBU (control); G4: GD + AU; G5: GG + AU; G6: AU (Control). Specimens were cut into sticks and stressed under tension with the μTBS test after 24h of artificial storage at 37°C. The MMPs activity within the hybrid layer was evaluated with the *in situ* zymography ($n = 4$). Data were statistically analyzed (Kruskal-Wallis test and Two-Way ANOVA, respectively) ($p < 0.05$).

Results: the dentin surface pre-treatment, bonding system and their interactions significantly influenced the results ($p < 0.001$). The Gluma primers increased the μTBS of AU to dentin ($p < 0.001$). No differences were found between the IBU groups ($p > 0.05$). The groups treated with both GG and GD showed an immediate lower level of gelatinolytic activity, independent of the UAs ($p < 0.05$).

Conclusions: the effect of the glutaraldehyde-based primers on dentin bond strength is material-dependent. However, they are potentially beneficial to stabilize the adhesive interfaces. The consistency of the solutions did not influence the results.

CEMENTATION OF INDIRECT LITHIUM DISILICATE RESTORATIONS WITH PRE-HEATED COMPOSITE

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Aim: to evaluate the luting ability of pre-heated resin composite for cementation of indirect lithium disilicate restorations.

Methods: a 58-year-old male patient with good general health attended to the Clinic due to dental sensitivity referred to the I quadrant. Clinical and rx examination revealed secondary caries on 1.7, 1.6, 1.5 and 1.4. After professional oral hygiene, data were recorded (photos, videos, rx, impressions, scans). After isolation, the treatment plan foresee removal of the old restorations, removal of the carious lesions and composite build-ups of 1.5 and 1.7 and direct composite restorations of 1.4 and 1.6 (Optibond FL, Kerr+ Empress direct, Ivoclar), preparation of 1.7 and 1.5 and upper, lower and occlusion intraoral scan (Omnicam - Dentsply Sirona). The internal surface of the restorations were sandblasted (AL_20_3 50 µm for 10s), etched with 9% HFI acid for 10s, ultrasonicated in alcohol for 1 min and a silane (Ultradent) applied for 5 min. Cementation was performed under rubber dam with a 3-step adhesive (Optibond FL) and pre-heated resin composite (Empress Direct). After occlusal check the patient was dismissed.

Results: at 1 week, 6 months, 1 – 2- and 3- years recalls no symptoms were referred. The teeth maintained vitality. Occlusal checks and rx revealed good adaptation of the restorations with overall good esthetical satisfaction of the patient.

Conclusions: pre-heated resin composite demonstrated good performances. After 3 years no discoloration, chipping, or marginal infiltration were observed.

COLOR MATCH EVALUATION OF TWO SINGLE SHADE COMPOSITES BEFORE AND AFTER BLEACHING PROCEDURE

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Aim: the aim of this case report was to evaluate instrumental and visual color match of two single shade resin-based composites in human extracted teeth before and after bleaching treatments.

Methods: two extracted human posterior sound teeth were used. Round shaped V class cavities (2x2x4mm) were prepared buccally 2mm away from the CEJ. Two single shade resin composites (ES-Essentia Universal, GC and CL-Clearfill Majesty ES2 Universal, Kuraray) were used for the restorations. Tooth color was measured 1mm beside the cavity and in the center of the restoration using a spectrophotometer (VITA Easyshade V, VITA Zahnfabrik). Visual analysis were carried out by 16 calibrated observers and differences were graded as 0:excellent match; 1:very good match; 2:not so good match; 3:obvious mismatch; 4:huge mismatch. Teeth were then bleached using 40% H_2O_2 (Opalescence Boost PF, Ultradent) and instrumental and visual evaluations were replied after 24 hours.

Results: at baseline, both ES restoration and tooth showed an A3 VITA scale grade, and respectively A2 and C2 after bleaching. Color match visual analysis showed a mean value of 0.25 both prior and after bleaching. At baseline, both CL restoration and tooth showed an A4VITA scale grade, and respectively A3 and C3 after bleaching. Color match visual analysis showed a mean value of 0.87 before and 0.31 after bleaching.

Conclusions: within the limits of a single case report, both composites seem to have excellent color match properties with the surrounding tooth structure, from both instrumental and visual points of view.

A MULTIDISCIPLINARY APPROACH IN MICRODONTIA AND AGENESIS: A CASE REPORT

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Aim: the aim of this case report is to suggest a multidisciplinary approach based on conservative, prosthetic dentistry and orthodontics in order to treat a patient that presents microdontia and agenesis.

Methods: first, we acquired the photographic documentation of the patient's smile and through a caliper we measured the central incisors' size, then following the principles of Digital Smile Design (DSD), we reproduced the right proportions of the central incisors, through Keynote.

We performed the dental reconstruction with resin composites in order to reduce the diastema and obtain the correct shape of the teeth. The last step was the orthodontic treatment that allowed us to achieve the correct spaces and to make room for the congenitally missing lateral incisors that we replaced with two Maryland bridge.

Results: we managed to reduce the diastema and create a correct shape of the central incisors, replace the missing lateral incisors with two Maryland bridge and align the smile of the patient.

Conclusions: a multidisciplinary approach could represent an effective treatment alternative in selected clinical cases that require a collaboration between different dental disciplines.

EPIDEMIOLOGICAL CHANGES IN DENTAL TRAUMATOLOGY IN THE SARS-COV-2 PANDEMIC AT THE HOSPITAL IN MILAN

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Aim: traumatic Dental Injuries (TDI) are an important topic for both its prevalence and frequency. For this reason, we decided to analyze clinical data regarding TDI at IRCSS Cà Granda Fondazione Ospedale Maggiore Policlinico, Milano during the first national lockdown for COVID - pandemic from 8 March to 11 June 2020. To evaluate epidemiological changes, a comparison with an historic sample from the same hospital was made.

Methods: all patients with TDI from 8 March to 11 June 2019 and the same timeframe in 2020 were included. Data regarding age, gender, number and type of teeth, type of injury and trauma etiology were collected. The period in 2019 was used as historic sample for comparison. Furthermore, an electronic search on TDI was performed.

Results: a total of 80 patients were included in the study (61 in 2019 and 19 in 2020). In both periods pediatric patients (< 14 y.o.) were more affected (84% in 2019, 76% in 2020), upper central incisors were mostly involved, and subluxation was the most frequently recorded trauma in deciduous teeth, while crown fractures were more common in permanent teeth. Sex distribution, more male patients in 2019 (62%) and more female in 2020 (58%), as well as trauma etiology (24% sports, 18% school, 16% domestic in 2019 while 81% domestic, 0% school and sports in 2020) differ between the two samples.

Conclusions: Sars-Cov-2 pandemic has changed daily habits of patients, especially due to stay-at-home orders. This decreased overall prevalence of TDI, especially at school and during sports activities. The results agree with data in literature.

SALIVARY BIOMARKERS FOR DIAGNOSIS OF CARIES: A SYSTEMATIC REVIEW

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Aim: the present systematic review aims to answer to the question: "Is there evidence that support the use of salivary biomarkers for diagnosis of dental caries?".

Methods: the systematic review has been approved and registered on PROSPERO. A multiple database research (Medline, Scopus, Web of Science) of the scientific English literature published after 2000 was set. The entry terms "saliva" and "salivary biomarkers" were combined through the Boolean indicator "AND" with "tooth decay" and "dental caries".
Studies performed on healthy subjects with and without dental caries, and providing detailed information concerning clinical diagnosis of caries (DMFT and ICDAS criteria) were included. Conference proceedings, meeting abstracts, short communications, editorials, letters to editor and reviews were excluded. Final eligibility was assessed through full-text evaluation, according to the exclusion and inclusion criteria. Data extraction from each study were summarized into three Excel tables (1: "General characteristics of studies"; 2: "Biochemical techniques for identification and quantification of salivary biomarkers"; 3: "Statistical association of salivary biomarkers and dental caries"). We performed a qualitative analysis of the selected articles, using the JBI Critical Appraisal Checklist for Qualitative Research.

Results: from the initial 12.818 records, 19 papers were included in the review. 17 out of 19 are case-control studies. Selected papers showed 54 salivary biomarkers (e.g.: MUC1, urea etc.) with a statistically different concentration in subjects with and without caries. Some studies included in the review present risk of bias, such as the identification of confounding factors and the clear definitions of the source population.

Conclusions: according to the present systematic review, other studies are needed to improve the quality of scientific evidence and to correlate some salivary biomarkers with the presence of caries.

DIRECT *VS* INDIRECT INLAY RESTORATIONS IN DEEP MARGIN ELEVATION: A MICRO-CT STUDY

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Aim: the aim of the present study was to evaluate interfacial 3D adaptation of different direct and indirect inlay restorations in combination with flowable materials before and after cyclic fatigue in a simulated deep-margin elevation scenario. The null hypothesis tested was that marginal sealing of enamel and dentin cervical margins is not influenced by flowable composites.

Methods: extracted premolars were selected and a class II MOD cavity was prepared with the mesial box with cervical margin 1mm above CEJ and distal box with cervical margin 1mm below CEJ. After performing adhesive procedures, specimens were divided in 4 groups according to the employed materials for horizontal deep-margin relocation: nanohybrid composite with (G1) and without (G2) medium viscosity flowable composite; indirect inlay restoration (Vita Enamic) with (G3) and without (G4) medium viscosity flowable composite. To reveal interfacial gap progression specimens were scanned with a micro-CT, before and after 500000 cycles of thermomechanical chewing simulation (50N, 1Hz). Interfacial gap and internal voids, expressed in mm^3, were collected and statistically analyzed with ANOVA test.

Results: the mean external gap increase was tridimensionally measured as volume. Flowable composites showed significantly more gaps when employed in combination with indirect restoration.

Conclusions: the initial null hypothesis is accepted since flowable resin composites were equally able to seal enamel and dentin cervical margins in deep-margin elevation technique independently of the restoration material.

EFFECT OF THERMOMECHANICAL LOADING ON INTERFACIAL GAP IN V CLASS CAVITIES: AN OCT STUDY

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Aim: the aim of the present study was to evaluate gap at enamel and dentin margin of different flowable materials after thermomechanical fatigue in a class 5 restoration. The null hypothesis tested was that flowable composites are not able to provide enamel and dentin marginal sealing.

Methods: single-rooted teeth were selected. On the buccal surface a standardized class 5 cavity was created. A self-etch adhesive was applied after 30s selective enamel etching. Specimens were divided in 3 groups, according to the materials selected for class 5 restoration: Majesty ES Flow SuperLow (Kuraray): Majesty ES Flow Low (Kuraray); Clearfil Majesty ES-2 (Kuraray). The interfacial adaptation at enamel and dentin margins was evaluated before and after thermomechanical fatigue (500000 cycles of chewing simulation with temperature shift at 5°C and 55°C) using OCT. Five images of each restored tooth were obtained and analyzed using ImageJ software that measured the entire length of the gaps at the enamel/dentin-restoration interface. The length of gaps (μm) was analyzed using ANOVA and the Tukey tests.

Results: there was a significant interaction between materials and chewing simulation ($p = 0.0001$), and a significant difference among all materials ($p < 0.0001$). Increased gaps at the dentin margins were noticed.

Conclusions: the initial null hypothesis is accepted since tested flowable resin composites, independently of their viscosity, showed more gap formation at enamel margin than nanohybrid composites.

INTERFACIAL GAP WITH FLOWABLE COMPOSITES IN V CLASS CAVITIES: AN OCT STUDY

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Aim: the aim of the present study was to evaluate gap at enamel and dentin margin of different flowable materials after thermal fatigue in a V class restoration. The null hypothesis tested was that flowable composites are not able to provide enamel and dentin marginal sealing.

Methods: single-rooted teeth were selected. On the buccal surface a standardized class V cavity was created. A self-etch adhesive was applied after 30s selective enamel etching. Specimens were divided in 3 groups, according to the materials selected for class V restoration: Majesty ES Flow SuperLow (Kuraray): Majesty ES Flow Low (Kuraray); Clearfil Majesty ES-2 (Kuraray). The interfacial adaptation at enamel and dentin margins was evaluated before and after TC (10000 cycles between 5°C and 55°C) using OCT. Five images of each restored tooth were obtained and analyzed using ImageJ software that measured the entire length of the gaps at the enamel/dentin-restoration interface. The length of gaps (μm) was analyzed using ANOVA and the Tukey tests.

Results: there was a significant interaction between materials and TC ($p = 0.001$), and a significant difference among all materials ($p < 0.0001$), before and after TC ($p < 0.0001$). Increased gaps at the enamel and dentin margins were noticed after TC for all groups. Flowable resins seems to better seal margins than nanohybrid composites.

Conclusions: the initial null hypothesis is rejected since tested flowable resin composites, independently of their viscosity, showed less gap formation at enamel and dentin margin than nanohybrid composites.

3D ANALYSIS OF THE ADHESIVE INTERFACE IN DEEP MARGIN ELEVATION: A MICRO-CT STUDY

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Aim: the aim of the present study was to evaluate interfacial 3D adaptation and internal voids of different flowable materials before and after cyclic fatigue in a simulated deep-margin elevation scenario. The null hypothesis tested was that marginal sealing of enamel and dentine cervical margins is not influenced by flowable composites with different viscosities.

Methods: extracted premolars were selected and a class II MOD cavity was prepared with the mesial box with cervical margin 1mm above CEJ and distal box with cervical margin 1mm below CEJ. After performing adhesive procedures, specimens were divided in 4 groups according to the employed materials for horizontal deep-margin relocation: nanohybrid composite; medium viscosity flowable composite; low viscosity flowable composite; conventional viscosity flowable composite. To reveal interfacial gap progression specimens were scanned with a micro-CT, before and after 500000 cycles of thermomechanical chewing simulation (50N, 1Hz). Interfacial gap and internal voids, expressed in mm^3, were collected and statistically analyzed with ANOVA test.

Results: the mean external gap augmentation was tridimensionally measured as volume. Flowable composites showed significantly showed less gaps than nanohybrid composites ($p = 0.0023$). Any differences were found between different tested flowables.

Conclusions: the initial null hypothesis is accepted since flowable resin composites with different viscosities were equally able to seal enamel and dentin cervical margins in deep-margin elevation technique.

A MULTIDISCIPLINARY APPROACH FOR THE EVALUATION OF BULK-FILL COMPOSITE RESTORATIONS

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Aim*:* this study aimed to investigate the behavior of three different bulk-filling techniques, analyzing in terms of internal and external adaptation of class II resin-composite restorations, by evaluating the gap formation using microcomputed tomography (µ-CT) and scanning electronic microscopy (SEM) coupled with energy-dispersive X-ray spectroscopy (EDS).

Methods: two standardized class II mesio/disto-occlusal slot cavities (4 mm long, 4 mm wide and 3 mm deep) were prepared in fifteen extracted sound molar (n = 30 cavity preparations). The cavities were randomly assigned into three groups (n = 10 per group) according to three bulk filling techniques: Bulk Traditional (BT), Bulk&Go (BG) and Bulk&Flow (BF). Therefore, after universal bonding application, followed by the light curing, the same bulk-fill composite was used for restorations. Thereafter, samples were scanned with µ-CT to evaluate 3D interfacial gaps. Acquired µ-CT data were analyzed to quantify the gap formation. Complementary information to the µCT, the teeth were analyzed by SEM to investigate the external marginal seal and the chemical composition of tooth-restoration interface was analyzed by EDS.

Results*:* the internal marginal adaptation by means of µCT examination revealed gaps formation at the tooth-restoration interface only for BT group, while an intimate contact free of gaps were found in the other two groups. Moreover, in BT and BF groups voids were present within the restoration. SEM investigation showed a right external marginal seal for all groups examined as confirmed by the EDS analysis, highlighting the presence of adhesive layer at the tooth-restoration interface.

Conclusions: BG and BF techniques can be considered as reliable alternatives to BT technique, as they simplify the class II restoration without transforming it into class I, thus ensuring a successful result.

ADHESION FORCE OF UNIVERSAL ADHESIVES TO DENTINE: A SYSTEMATIC REVIEW

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Aim: determine whether the etch-and-rinse or self-etching technique is the best protocol for dentin adhesion by universal adhesives.

Methods: a systematic literature review was performed in accordance with PRISMA guidelines. The reviewer performed a literature search in three international databases: MEDLINE, Scopus, The Cochrane Library.

Inclusion criteria: only studies evaluating the bond strength of universal adhesives to dentin by the etch-and-rinse and self-etch strategies by *in vitro* evaluation of μTBS and μSBS, published from 01/01/2012 to 1/06/2021, were included.

Results: 9445 potentially relevant articles were identified on databases (identification), 8407 articles selected, eliminating duplicates, for evaluation by title and abstract reading (screening), 64 articles selected for full-text reading (eligibility), 26 articles included in the review that meet the inclusion criteria (inclusion).

These 26 articles evaluate the bond strength (μTBS and μSBS) of 17 different universal adhesives.

Conclusions: the performance of the multimodal adhesives evaluated in the articles included shows that all the new adhesive systems tested are highly versatile. The values of the adhesion force are statistically equivalent in the different techniques etch-and-rinse (μ = 36.7 MPa) and self-etch (μ = 36.2 MPa).

INTEGRATIVE TEACHING METHOD FOR CLINICAL PRACTICE IN RESTORATIVE DENTISTRY: INSTRUCTIONS!

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Aim: a survey carried out on Italian dentistry students and currently in review by the *European Journal of Dental Education* showed a decreasing of self-confidence of students in the practical approach because of the interruption of clinical activities due to the COVID-19 outbreak. The study aimed to assess the effectiveness of an integrative didactics solution proposed to improve the practical teaching of restorative dentistry.

Methods: the students of the fourth year of undergraduate program of University of Verona were randomly divided into two groups and two ways of teaching restorative dentistry were assessed. The first group (9 students) underwent traditional lessons by slides, the second one (10) received both slides and video-tutorials of clinical restorative procedures (preparation and filling of caries). A questionnaire about the followed teaching method satisfaction was administered to the students and a final assessment (scoring) of clinical ability of students was carried out by teacher of the course. Statistical analyses were performed.

Results: the comparison between the scoring of clinical procedures carried out by the two groups showed a better clinical ability of students of the second group (Mann-Whitney U test). The possibility to have available a video-tutorial was largely appreciated by the students.

Conclusions: the interruption of the clinical practice training significantly affected the self-confidence of students. An integrative teaching method involving the use of video-tutorials as support in teaching clinical procedures deserves to be considered.

3D INTERFACIAL GAP FORMATION WITH BULK MATERIALS: A MICRO-CT STUDY

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Aim: to evaluate the effect of light curing on the contraction shrinkage and consequently on the internal gap formation in high c-factor dental cavities restored with five different composites.

Methods: 40 extracted molars were collected and two first-class cavities, 2 mm and 4 mm deep, were prepared on the occlusal surface. After performing standardized adhesive procedures, specimens were randomly divided in five groups, according to the composite employed: Venus One (Kulzer), Tetric Powerfill (Ivoclar), Tetric Power Flow (Ivoclar), Filtek Posterior (3M), Filtek BulkFill (3M). The composites were placed in the cavity in a unique horizontal layer. A micro-CT scan of each specimen was performed before and after composite light curing (20s) to tridimensionally evaluate interfacial gaps and internal voids after curing process. Specimens were then submitted to thermocycling (10000 cycles between 5°C and 55°C) and a micro-CT scan was repeated. Volumetric gaps and voids related to curing process and thermocycling were calculated and statistically analyzed with ANOVA test.

Results: the bulkfill materials showed lower interfacial gaps than conventional composite, which were mainly located at the cavity floor. Any significant differences were found regarding the internal voids, which were detected in any restoration independently of the tested materials. Thermocycling induced a general increase of the interfacial gaps in all restorations.

Conclusions: based on the study results, the volumetric gap detection seems to be reduced with the use of bulkfill materials.

INFLUENCE OF TWO POLISHING PASTE SYSTEMS ON SURFACE ROUGHNESS OF NANOFILLED COMPOSITES

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Aim: to evaluate surface roughness of packable and flowable nanofilled resin composites after polishing with one-step and two-step diamond-based paste systems.

Methods: silicon molds (2 mm depth, 4 mm diameter) were used as a template to produce 120 specimens with packable (n = 60) and flowable (n = 60) nanofilled resin composite (Filtek Supreme XTE and Filtek supreme XTE Flow, 3M ESPE). The top surfaces of the discs were covered with a Mylar strip and light-cured. Twenty unpolished specimens for each material were used as controls whereas specimens to be polished were finished with P1200 sandpaper and assigned to two polishing protocols: one-step diamond-based paste (Unigloss, Intensive) (n = 40) and two-step diamond-based paste (Diamond Polishing Mint, Ultradent Products) (n = 40). A linear rugosimetric parameter (R_a) was measured three times on randomly selected areas on the top surface of all specimens. Data were subjected to statistical analysis with Kruskal-Wallis and Mann-Whitney tests with Bonferroni correction ($p < 0.05$).

Results: the mean surface roughness values and their standard deviations were: packable/one-step system, 0.057 ± 0.006 µm; packable/two-step system, 0.048 ± 0.005 µm; flowable/one-step system 0.044 ± 0.006 µm; flowable/two-step system 0.049 ± 0.006 µm. The surface of the packable composite polished with the one-step system was significantly rougher than the Mylar control ($p < 0.01$) and the flowable composite polished with the same protocol ($p < 0.05$).

Conclusions: a two-step diamond-based paste polishing system appears preferable for polishing packable nanofilled composite.