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Do zirconia translucency, thickness and curing time affect bond strength of resin - based cements?

Ambrogio Sara*, Manzon Elena*, Comba Allegra, Pasqualini Damiano*, Berutti Elio*, Scotti Nicola***

*Dental School, University of Turin ~ Turin ~ Italy
**DIBINEN, University of Bologna ~ Bologna ~ Italy

Aim: To evaluate if yttria-stabilized tetragonal zirconia polycrystals (Y-TZP) of different translucency and thickness affect the bond strength of a resin-based dual cured cement irradiated with different curing protocols. The null hypothesis was that the bond strength to if yttria - stabilized tetragonal zirconia policristals was not influenced by translucency, thickness and curing time.
Methods: Four yttria - stabilized tetragonal zirconia polycrystals of different translucencies were selected (Noritake Katana UTML, Noritake Katana STML, Noritake Katana ML, Amann Ghirrbach Ceramill Zi White), in order to obtain 1 mm and 2 mm disks, and sintered. The disks were then air - abraded with 46 µ Al2O3 and, according to the manufacturer instructions, the dual -cure resin cement (Panavia SA, Kuararay) was employed to lute 2 mm diameter composite cylinders to Y-TZP surface. Resin - based dual - cure cement was then light-cured with a LED unit with different curing time protocols: no light, 10 seconds and 60 seconds by placing the light-curing tip in contact to the opposite surface of each disk with respect to the position of composite cylinders. After 24 hours the bond strength was tested with shear - bond strength test. The translucency parameter (TP) of each zirconia was calculated from the color difference of the material on a black versus a white background. Results were statistically analyzed with ANOVA test and post - hock Tukey test ($p < 0.05$).
Results: The statistical analysis (ANOVA test) showed that the bond strength was not influenced by the translucency of the Y - TZP, but was significantly affected by its thickness ($p < 0.01$) and by the curing procedure ($p < 0.001$). Longer curing time significantly increase the cement's bond strength in all groups.
Conclusion: The null hypothesis was partially accepted, since the bond strength to zirconia mainly depended on the ceramic thickness and the curing procedure. Further investigations are needed to confirm these results.

3-years clinical evaluation of additive composite restorations on anterior teeth

Bertozzi Giulia, Debernardi Luca, Ambrogio Sara, Comba Allegra, Michelotto Tempesta Riccardo, Breschi Lorenzo, Berutti Elio, Scotti Nicola

Dental School, Department of Surgical Science - University of Turin, Turin, Italy
DIBINEM, Alma Mater Studiorum – University of Bologna, Bologna, Italy

Aim: To evaluate the clinical performance of additive direct restorations on anterior healthy teeth, performed with 2 different nano-filled composite materials.
Methods: All patients who presented diastema on anterior teeth, to be restored on healthy enamel, were selected in this prospective randomized study. After radiographic evaluation, patients were randomly divided in two groups according to the type of composite material: first group (G1), Clearfil ES2, Kuraray; second group (G2), Asteria, Tokuyama. All restorations were performed by the same operator, following a standardized procedure: rubber dam placement; teeth surface cleaning using pumice; enamel surface sandblasting with alumina oxide particles of 50 µm in diameter and generous water

rinsing; 30 seconds enamel etching with phosphoric acid and generous water rinsing; bonding resin application (Optibond FL, Kerr) on demineralized enamel and 40 seconds light-curing; composite layering with the use of silicon index obtained by a wax-up made on the patient's dental impression. After finishing and polishing procedures, patients were dismissed and scheduled for recall visits after 7 days, 6, 12, 24 and 36 months. During recalls, the restorations were examined and evaluated by two calibrated operators, blinded to the initial material group, in accordance with FDI and USPHS criteria.
Results: A total of 32 selected patients (G1: n = 19; G2: n = 13) received 97 restorations, 57 with Clearfil ES2, 40 with Asteria. The 3-year survival rate was 100% for both composites. The statistical analysis did not detect any statistically significant differences between the two composites employed. However, initial degradation of margin quality between the tooth and the restoration (G1: 10.1%; G2: 12.7%), marginal ditching (G1: 4.7%; G2: 7.7%) and initial surface texture deterioration (G1: 15.7% ; G2: 18.5%) were observed.
Conclusions: The 3-year survival rates showed that nano-filled composites have had good performances in diastema closure treatment with direct techniques. All restorations exhibited excellent results, and the observed initial degradation of margins and surface texture could be easily solved. These results suggest that the direct approach is an excellent and minimally invasive technique. Of course, further controls are necessary to evaluate the clinical performances in the long period.

A multidisciplinary approach to an orthodontic treatment relapse in adult patient: a case- report

Caci F.C., Toderini dei Gagliardis Dalla Volta M.L., Caburlotto A., Drago G., Bressan E., Stellini E.

Department of Neuroscience, University of Padova, Padova, Italy

Aim: The purpose of this treatment plan was to improve smile aesthethics with an interdisciplinary management including orthodontics, cosmetic and restorative dentistry. The patient presented diastemas between the anterior incisors and buccal inclination of the anterior maxillary teeth as a relapse of a previous orthodontic treatment; the goal of the orthodontic treatment was to re-align the teeth considering as fundamental factors the smile arc and reproportioning simmetry and harmony between teeth and soft tissues, with a focus on the gingival margin of tooth 22 which was not symmetric to that of 12. To achieve this goals, esthetics was analyzed according to patient's opinion in order to predict the final ourcomes and avoid misunderstandings.
Methods: In order to re-align anterior teeth and close diastemas 8 sequential aligners were used, programmed with a digital setup software obtained from 0,8mm thick thermoformable discs by Leone. Thanks to this digital setup it was possible to see clearly the final dental position and to "digitally" analyze the case diagnosis, and treatment plan in 3D. After the orthodontic treatment, a home-applied vital tooth bleaching technique was planned to achieve an improvement of teeth color before starting the anterior direct composite restorations. The restorative aspect of this case included a lenghtening of tooth 22 with a direct adhesive restoration with composite resin. In the planning of the treaments the principles of esthetic dentistry were considered such as the divine proportion in considering face and tooth proportionality, the shape of smile arc, and gingival-tooth relation. After treatment was completed a splint was made from 13 to 23.
Results: The patient obtained a real smile makeover thanks to teeth re-alignment and the cosmetic and restorative treatments, achieving an improvement of the aestetic smile design evaluated from gingival, dental and facial perspectives. in the current case were evaluated the changes in the perception of smile after approximating some components of smile to the divine proportion.
Conclusions: The present case report shows interrelationship between various branches of dentistry and orthodontics and how a multidisciplinary approach can be used to achieve ideal dental esthetics and satisfaction for the patient. As beauty is a subjective matter it is essential for the operator to listen attentively to patient's concerns. A meticulous patient examination is a critical factor in the attempt to attain a successful outcome.

Evaluation of the surface roughness of a nano-composite using different polishing techniques

Catellani Alberto, Monterubbianesi Riccardo, Fabrizi Chiara, Sparabombe Scilla, Sampalmieri Francesco, Procaccini Maurizio, Orsini Giovanna, Putignano Angelo

Department of Clinical Science and Stomatology, Polytechnic University of Marche, Ancona, Italy

Aim: The purpose of this study was to compare different polishing techniques of a dental nano-composite by means of roughness measurements and SEM evaluations.
Methods: Twelve samples (12 mm in diameter and 3 mm of thickness) of the resin-composite Filtek Supreme XTE (3M, ESPE, Seefeld) were prepared using the Smile Line sampler (Style Italiano) and Mylar

strips. The specimens were polymerized using a light curing unit (EliparTrilight, 3M-ESPE, Seefeld, Germany) for 40 seconds and dry stored at 238°C for 24 hours, before the test. The surface of all specimens was finished with sand paper under cooling water, to obtain standardized surfaces. The 12 specimens were divided in 4 homogeneous groups: Group 1 was treated using Sof-Lex discs from coarse to superfine; group 2 was finished using Sof-Lex coarse to prepare the surface, multiblade bur (Komet) and Spiral Wheels (3M); group 3 was finished using Sof-Lex coarse, multiblade bur, spiral wheels and diamond twist (primer Dental); group 4 was finished using Sof-Lex coarse, multiblade bur and occlubrush (Kerr Dental). All samples were immersed in ultrasonic bath to remove polishing residual. All samples were observed after 24 hours. All roughness parameters (Ra, Ry, Rz, Rq) were evaluated, in 4 points for each sample, using Mitutoyo Surftest SJ 201P surface roughness tester. Then, samples were processed for SEM analysis (JSM-6390LV Scanning Ekectron Microscope). Five Images for each analyzed sample were taken, at different magnification (50X, 100X, 250X, 500X, 1000X). Data were analyzed by ANOVA ($p<0,05$).

Results: The means of Ra measurements were the following: 0,19±0,05 µm in group 1; 0,22±0,10 µm in group 2; 0,15±0,12 µm in group 3; and 0,28±0,30 µm in group 4. The other roughness parameters evaluated (Ry, Rz, Rq) showed the same trend of results. The values obtained by the surface roughness tester were confirmed by SEM evaluation. The lowest roughness values were recorded for group 3, followed by group 1, group 2 and finally group 4.

Conclusion: The success and durability of a resin-composite restoration depend on the quality of the surface. The presence of irregularities could increase plaque retention, gingival inflammation, may promote secondary caries, surface solubility or alterations in color and aesthetics. Furthermore, a not smooth surface could reduce mechanical properties such as hardness or strength and increase the wear of the composite.The present study highlights that the surface of a nano-composite can reach a high level of polishability, thus potentially improving its durability and esthetic outcomes. Based on the presented data, the technique with the best results seems to be the one using Sof-Lex disc coarse, multiblade bur, spiral wheels and diamond twist. However, given the paucity of the samples and the limited period of observation, further studies are required.

Aesthetic improvement of six upper anterior teeth through a conservative approach in a patient with compromised periodontal status

Cavallet B., Pastore E., Gervasi M., Drago G., Bressan E., Stellini E.

Department of Neuroscience, University of Padova, Padova, Italy

Aim: The aim of this paper is to present a case report of smile improvement in a patient whose esthetics was severely compromised by chronic periodontal disease, limiting cost and time.

Methods: A 64-year-old female patient came to our attention for an implant rehabilitation: she presented chronic periodontal disease and many missing teeth. The patient complained of esthetic discomfort and was ashamed of smiling. Six anterior teeth were characterized by different incisal margin levels (consequent to extrusion of 2.1 and 2.2), gaps between teeth, shape asymmetry, malposition, discoloration and mobility (especially of 2.1). The patient wanted a rapid and inexpensive solution, so orthodontic and prosthetic treatments were considered inappropriate for time, cost and periodontal status. The patient refused anterior teeth extractions. Nonsurgical periodontal therapy was performed and oral hygiene instructions were given in order to control periodontal disease. A conservative solution with composite restorations was proposed to solve the main patient's complaint and it was well accepted. A diagnostic wax-up was made: a conservative preparation of the teeth was necessary to have a successful result. Putty was used to manufacture a template guide for the restorations. After teeth isolation with rubber dam, preparation of 11, 12, 13, 21 and 22 was performed with diamond bur. All steps of adhesive process were made. The restoration with composite opaque OPA2 and enamel A2 body masses (Tukuyama Estelite Sigma Quick®) was made in a single appointment. The Golden Ratio, which describes the best anatomical proportion of teeth in the aesthetic area, was checked with a dental golden compass. During the second appointment finishing was performed: macro and microtexture on the teeth surface was obtained through diamond bur on a contrangle handpiece. The final step of polishing was carried out with discs, rubbers and spiral wheels.

Results: With this treatment the patient's aesthetic improvement was obtained despite the severe initial situation. This approach permitted to avoid laboratory costs, to perform the extensive restoration in only two appointments and to preserve largely dental tissue.

Conclusions: In this case minimally invasive preparation associated with composite restoration proved to be an efficient aesthetic solution even if patient presented periodontal disease, especially in this case in which patient refused orthodontic and prosthetic treatments. Furthermore the golden ratio was respected in dental shape and smile harmony was obtained also respecting cost-benefit ratio. To maintain long term results, patient's compliance with oral hygiene is necessary and has been partially obtained. The patient was satisfied with her teeth and now she can smile without hiding her mouth.

Effects of fiber-glass-reinforced composite restorations on fracture resistance, failure mode and marginal integrity of endodontically treated premolars

Coda Emanuele, Michelotto Tempesta Riccardo*, Comba Allegra, Pasqualini Damiano*, Berutti Elio*, Scotti Nicola***

*Department of Surgical Sciences, Dental School Lingotto, University of Turin, Turin, Italy
** DIBINEM Alma Mater Studiorum, University of Bologna, Bologna, Italy

Aim: To evaluate marginal integrity, fracture resistance and fracture pattern of endodontically treated upper premolars, restored with different glass-fiber reinforced materials.
Methods: Thirty-six extracted intact premolars were endodontically treated; MOD cavity was prepared 1 mm coronal from the CEJ, 5 mm deep and 4 mm width. All specimens were then divided in six groups according to the filling technique employed: sound teeth (G1); no restoration (G2); direct composite restoration with fiber reinforced composite (Ever-x Posterior, GC) (G3), direct ormocer restoration (Admira Fusion, Voco) (G4); G3 reinforced with buccal-oral glass-fibers (G5); G4 reinforced with buccal-oral glass-fibers (G6). Specimens were scanned with micro-CT (SkyScan 1172: Bruker- microCT, Kontich, Belgium). After scanning, samples were incorporated in cilynders with methacrylate resin. Then, they were submitted to a fatigue treatment with 20 Zirconia balls for 10 minutes (Ball Mill Machine) the equivalent of 18 years of physiological aging in the oral cavity. After this treatment, to evaluate marginal integrity, the specimens were submerged in a radiopaque silver nitrate solution (AgNO3, 50% w/w) overnight. The pH of the AgNO3 solution was measured as ~3.3. Afterwards specimens were scanned with micro-CT with the same parameters as baseline and then 3D recostructions were done using Data Viewer software. Specimens were then loaded until fracture using a universal testing machine (Instron, Canton, MA, USA). The maximum breaking loads were recorded in Newton (N) and data were analysed with one-way ANOVA and post-hoc Bonferroni test ($p<0,05$). Fractured specimens were also analysed with SEM and fractography analysis was performed.
Results: ANOVA test showed that horizontal glass-fiber insertion did not significantly improve marginal integrity of restorations. However, fracture resistance of G5 and G6 was significantly higher than G3 and G4 ($p=0.001$). All specimens fractured in a catastrophic way. In G5 and G6 glass-fibers induced partial deflection of the fracture, even if they were not able to stop the crack propagation.
Conclusions: For the direct restoration of endodontically treated premolars, the reinforcement of composite resins with glass-fibers or fiber-post could enhance the fracture resistance. The SEM analysis showed a low ability of glass-fibers in deviating the fracture, but this effect was not sufficient to lead more favorable fracture patterns, over the CEJ.

Deep cavity margins elevation: *in vivo* evaluation of different composite materials

Comba G.*, Ghiberto C.*, Comba A., Breschi L.**, Berutti E.*, Scotti N.***

*University of Turin, Department of Surgical Sciences, Dental School, Italy;
**DIBINEM, Alma Mater Studiorum, University of Bologna, Italy

Aim: Deep cavity margins are always difficult to seal and restore. In literature, there are few indications about the proper protocol to follow in these cases, but there is little clinical evidence. Thus, the aim of this *in vivo* study was to evaluate the efficacy of different composite materials on deep cavity margins elevation.
Methods: Forty patients with premolar and molar deep carious lesions, that did not invade the biological width, were selected. Patients with systemic diseases, mobile and fixed orthodontic devices and fixed and mobile prostheses were excluded from the study. Selected patients were submitted to professional oral hygiene treatment in order to obtained a full mouth plaque score less than 20%. Then, they were randomly divided into two groups according to the material employed for the deep cervical margin relocation procedure: G1 Flowable deep cavity margin elevation; G2 Non-flowable deep cavity margin elevation. After a pre-operative Rx with custom centering, the cavity was cleaned. In some cases, for a correct isolation with a rubber dam, marginal surgical exposure was needed. Operative field was then isolated with rubber dam and a direct or indirect restoration was performed. Randomly, the cervical cavity margin relocation was performed with a 1 mm layer of flowable or non-flowable composite. Adhesive system, composite and curing protocol was the same for all restorations, which were performed by the same operator. Follow-up clinical visit were performed by two different blind calibrated operators at 1, 3, 6 and 12 months and radiological follow-up was performed at 12 months. The USPHS modified criteria were employed to evaluate the restorations. Data were statistically analyzed with chi-square test.
Results: Clinical and radiographic evaluation after 12 months showed the integrity of the restoration and the absence of infiltration of the cavity margins in both groups. Anova test did not show a significant difference between the two groups according to the

USPHS criteria.
Conclusion: The results obtained indicate that the efficacy of deep cavity margins elevation is not initially influenced by the restorative material used. Further controls (planned up to 10 years) are necessary to confirm the results obtained.

Color specification of two new resin composites and influence of stratification on their chromatic perception

La Rosa G.R.M.*, Pedullà E.*, Gueli A.M., Pasquale S.**,Rapisarda E.***

*Department of General Surgery and Surgical – Medical Specialties, University of Catania, Catania, Italy
**PH3DRA (PHysics for Diagnostics Dosimetry Dating Research and Application) laboratories, Department of Physics and Astronomy, University of Catania, Catania, Italy

Aim: In recent years, there is an increased attention to the color characteristics of the composites that are used for the reproduction of the structure of the teeth in conservative dentistry. The aim of this study was to compare the color differences between two new resin composites and the corresponding VITA classical tabs. In addition, the influence of the order of composite layer's stratification on resin composites color was evaluated.
Methods: 96 discs samples made of two new different composite materials (Brilliant EverGlow and Estelite Asteria) of Dentin shade (A2B2 and A2 Body, for Brilliant EG and Estelite Asteria respectively) and of Enamel (Trans and Natural Enamel, for Brilliant EG and Estelite Asteria respectively), each with a 1mm thickness, were divided into 12 configurations. In addition, to evaluate color correspondence to VITA shade guide, 12 dentin samples for each composite were made. These samples were realized in various thicknesses (1.00 ± 0.05 mm, 2.00± 0.05 mm, 3.00± 0.05 mm and 4.00± 0.05 mm) to evaluate the influence of thickness on color perception. A2 and B2 VITA shades were considered as target. The color specification was conducted using a Konica Minolta spectrophotometer, model CM-2600d. The results were elaborated with the attention to the values of the color coordinates of CIELab color space. Using this color space, the color difference between two colors was calculated by the ΔE_{ab}^* quantity according to the following formula: $\Delta E_{ab}^* = [(L^{*1} - L^{*2})^2 + (a^{*1} - a^{*2})^2 + (b^{*1} - b^{*2})^2]$. Concerning physiological perceptibility of differences in ΔE_{ab}^*, values ranging from 0.0 to 1.1 were considered as not perceptible, between 1.1 and 3.3 as visually perceptible but clinically acceptable while all ΔE_{ab}^* higher than 3.3 were considered as clearly visible and clinically disturbing.
Results: Overall, the L*a*b values of the dentin composites shade were highly different from the corresponding VITA tabs, both for A2 and B2 VITA shades, in all thicknesses ($\Delta E > 3.3$). Regarding the stratifications, six configurations (DDDD, DDDE, DDEE, DEEE, DEDE, DEED) showed $\Delta E > 3.3$ compared to gold standard EDDE for Brilliant EG, while two configurations for Estelite Asteria (DDDD, EEEE). The best configurations were EDED and EDDD for Brilliant EG and Estelite Asteria, respectively.
Conclusion: The color characteristics of Brilliant EverGlow and Estelite Asteria were found to be different from the ones of VITA shades. Relevant differences were also found in the stratification of dentin and enamel discs with regard to gold standard configurations except for EDED and EDDD.

Ultra-thin CAD-CAM composite overlays: role of different thickness on mechanical behavior

Merli Marco*, Brenna Adriana, Turco Gianluca***, Frassetto Andrea***, Cadenaro Milena***, Gherlone Enrico****, Paolone Gaetano****, Breschi Lorenzo********

*Università di Bologna, Bologna, Italy
**Università Vita-Salute San Raffaele, Milano, Italy
***Department of Medical Sciences, University of Trieste, Trieste, Italy
****Department of Dentistry, University "Vita Salute San Raffaele" of Milan, Milan, Italy
*****Restorative Dentistry, Università Vita-Salute San Raffaele, Milano, Italy
******Department of Biomedical and Neuromotor Sciences, DIBINEM, University of Bologna, Italy

Aim: The aim of the study was to evaluate mechanical behavior and wear of ultra-thin (< 1 mm) CAD-CAM produced composite overlays with two different thickness luted on extracted human molars after thermo-mechanical challenge. The tested hypothesis was that overlay thickness influences the mechanical and marginal stability of resin composite overlays.
Methods: Extracted human molars were collected (N=8), cleaned, embedded in a silicon index, covered with powder (Optispray Cerec, Dentsply-Sirona), then molars were scanned (Cerec Bluecam, Dentsply Sirona). The occlusal surface of each specimen was removed maintaining a cuspal inclination and part of marginal enamel using diamond burs (014-881, 014 8390, Komet) mounted on a high-speed hand-piece. Immediate dentin sealing (IMS) protocol was applied by selective enamel etching with 37% phosphoric acid (Ultra-Ethc, Ultradent) followed by One Coat 7 Universal (Coltene) application in accordance with manufacturer's instructions of self-etch mode. After application of powder (Optispray Cerec, Dentsply-

Sirona), specimens were re-scanned using Cerec Bluecam (Dentsply-Sirona). Overlays were designed with Cerec Software 4.4.2, realizing two different minimal thickness (0,5 or 0,8 mm) measured in the central fossa. Brilliant Crios resin composite blocks were milled using Cerec Sirona MC-XL (Dentsply-Sirona). After sandblasting, the overlays were luted with One Coat 7 Universal and TetricEvoFlow (Ivoclar-Vivadent). Photo-polymerization was performed with a LED lamp (Valo, Ultradent) for 60 s on each surface. Both digital and silicon (to produce replicas for SEM analysis) impressions of the restored teeth were taken, then specimens were submitted to thermo-mechanical loading (50 N at a frequency of 5 Hz for 1.200.000) using a Chewing Simulator (Mechatronic). After loading, additional digital and silicon impressions were taken. Epoxy resin replicas obtained by silicon impression before and after thermo-mechanical loading were analyzed under SEM to investigate marginal stability and surface characteristics.
Results: After loading on Chewing Simulator no specimens (n=0) showed fractures. Through SEM analysis no differences between the groups regarding the marginal integrity were observed and adhesive interface showed continuous margins. Minor defects were found along the luting interface and at the occlusal contact points.
Conclusions: Since both 0.5 and 0.8mm thick composite overlays maintain good marginal integrity after thermal-cyclic occlusal load, the tested hypothesis was rejected. Indeed, no differences between the groups were found. Additional studies are currently ongoing to test the longevity of composite overlays.

Push-out bond strength of traditional and hollow fiber post cemented with a dual-curing self-adhesive resin

Generali L.*, Sassatelli P., Piergianni V.*, Lusvarghi L.**, Bertoldi C.*, Consolo U.***

*Department of Surgery, Medicine, Dentistry and Morphological Sciences with Transplant Surgery, Oncology and Regenerative Medicine Relevance (CHIMOMO) - School of Dentistry - University of Modena and Reggio Emilia, Modena, Italy
**Department of Engineering "Enzo Ferrari" (DIEF) University of Modena and Reggio Emilia, Modena, Italy

Aim: The purpose of this study was to evaluate the push-out bond strength of traditional glass fiber post and newly marketed glass fiber hollow post, both cemented using a dual-curing self-adhesive resin.
Methods: Seven extracted human premolars with single canals were selected for the study. The crowns were removed using a size 701 high speed fissure bur. The root canals were mechanically prepared using ProTaper Universal until #F4 instrument and they were obturated using Thermafil Obturator #F4. A post space was obtained drilling a 7mm depth hole with a pre-calibrated 1.2mm diameter tip. Prepared teeth were randomly divided in two groups: a full post was luted in Group 1 (n=3), while a hollow post in Group 2 (n=4) by using a dual-curing self-adhesive resin cement. Treated tooth were mounted in resin blocks and sectioned perpendicular to the long axis of the root canal. Six 500 µm thick slices were obtained from each specimen. The push-out test was performed on each slice. Student's t-test was used to compare push-out bond strength values between the two groups. While comparisons of push out bond strength values among root region (cervical, middle and apical part), for each group, were performed with one-way ANOVA test. After the push-out test all specimens were analysed by scanning electron microscope (SEM) to determine the fracture patterns. The cross section of both the full and hollow posts were studied by SEM and EDS analysis to evaluate the amount and distribution of the glass fiber, as well as their chemical composition. The cross sections were prepared by embedding the samples into epoxy resin. The embedded samples were then grounded and polished on a plane orthogonal to the long axes of the sample until complete exposure of the post cross section.
Results: Push-out bond strength of Group 2 was significantly higher than that of Group 1, respectively 6.38 MPa ±1.59 and 2.23 ± 3.64 MPa. No differences were observed between the three root regions (cervical, middle and apical part) in the same group. In both groups the predominant failure mode, observed in 50% of the samples in Group 1 and in 44.4% of the samples in Group 2, was represented by mixed fracture, with resin cement covering 0-50% of the post diameter. In the hollow post, the glass fibers appeared similar to each other and homogeneously arranged within the matrix. Differently, in the full post, fibers with different size with a lower homogenous arrangement where observed. Also, a different chemical composition of the glass fiber in the two posts was observed. The hollow post contain mainly SiO2, Al2O3 e CaO, whereas full post are predominantly composed of silica.
Conclusion: The glass fiber hollow post showed significantly higher bond strength values compared to the glass fiber full post cemented using the same dual-curing self-adhesive resin.

Fracture resistance and marginal integrity of composite veneers on endodontically treated incisors

Comba Galileo, Michelotto Tempesta Riccardo*, Comba Allegra, Baldissara Paolo**,Pasqualini Damiano*, Berutti Elio*, Scotti Nicola***

*Department of Surgical Sciences, Dental School Lingotto, University of Turin, Turin, Italy
**DIBINEM, Alma mater Studiorum, University of Bologna

Aim: To evaluate marginal integrity, fracture resistance and fracture pattern of endodontically treated incisors, restored with composite veneers supported or not supported by fiber post.
Methods: 32 extracted intact incisors were endodontically treated and obturated. Samples were divided in 4 groups (n=8) according to the restorative technique: composite veneer with vestibular preparation supported by fiber post (G1); composite veneer with vestibular preparation not supported by fiber post (G2); composite veneer with overlap preparation supported by fiber post (G3), composite veneer with overlap preparation not supported by fiber post (G4). Samples were then scanned with micro-CT (SkyScan 1172: Bruker- microCT, Kontich, Belgium), before and after fatigue artificial treatment with Ball Mill Machine, to evaluate marginal integrity manatinance. Specimens were then loaded until fracture using a universal testing machine (Instron, Canton, MA, USA). The maximum breaking loads were recorded in Newton (N) and data were analysed with one-way ANOVA and post-hoc Bonferroni test ($p<0,05$). Fractured specimens were also analysed with SEM and fractography analysis was performed.
Results: ANOVA test showed that fiber post insertion did not significantly improved marginal integrity of composite veneers ($p>0.05$) but it affected fracture resistance ($p<0.001$). After fatigue treatment, all groups showed a significant marginal integrity loss.
Conclusions: Composite veneers, reinforced or not with a fiber post, showed a poor protective effect towards the endodontically treated incisors. Further studies are necessary to validate these findings.

Functional halloysite-nanotubes fillers doped with triclosan: innovative resin composites

Salvati Giovanni*, Paolone Gaetano*, Tsai Shang-Lun, Lee Jiun-Hang**, Degrazia Felipe***, Cantatore Giuseppe*, Gherlone Enrico*, Saboia Vicente Paulo****, Collares Fabrício Mezzomo***, Sauro Salvatore****

*Dental Clinic, Università Vita-Salute San Raffaele, Milan, Italy
**Biomaterials and Minimally Invasive Dentistry, Departamento de Odontologia, Facultad de Ciencias de la Salud, Universidad CEU-Cardenal Herrera, Valencia, Spain
***Laboratório de Materiais Dentários, Faculdade de Odontologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
****Restorative Dentistry Department, Federal University of Ceará, Fortaleza, Brazil

Aim: Antimicrobial agents like Triclosan (TCN) are easy to process and incorporate into aluminosilicate-(halloysite) nanotubes (HNTs). This procedure provides therapeutic activities such as antibacterial and remineralization. The aim of this study was to evaluate the physico-chemical properties of three different experimental resin composites containing an aluminosilicate-(halloysite) filler doped with triclosan (HNT/TCN) and compare to those of commercial resin composites.
Methods: Three experimental resin composites were prepared using bis-GMA, bis-EMA, TEGDMA, Camphorquinone and ethyl 4-dimethylaminobenzoate containing different amounts of a micro-hybrid filler (68.5wt% EXP-SS2; 72.3 wt% EXP-SS3; and 79.6 wt% EXP SS5) made of a constant amount of silica/barium glass (80wt%) and HNT/TCN filler (20wt%). Three commercial composite were used: a micro-filled (ENAM: Enamel AURA, SDI Australia), nano-hybrid (DENT: Dentine AURA, SDI Australia), and nano-cluster composite (SUPREME: Filtek Supreme XTE, 3M ESPE, USA). Ten disc specimens for each composite were submitted to Knoop micro-hardness assessment (50g/15s) before and after chemical degradation in alcohol for 24h (softening ratio). Further five disc specimens per group were submitted to water sorption/solubility assessment. Further five cubic-shape specimens per group were sectioned in sticks (1.5 mm) and tested for ultimate tensile strength (0.5 mm/min).
Results: The experimental composites SS5 revealed no significant difference in microhardness and ultimate tensile strength compared to the nanocluster SUPREME composite. All the experimental groups had comparable water sorption property to DENT-SDI and SUPREME. However, there were significant differences between the commercial composites and the experimental ones for water solubility, as all the experimental nano-tubular composites showed an important increase of their mass due to transformation of halloysite-nanotubes into calcium phosphates.
Conclusions: All the experimental composites filled with aluminosilicate-(halloysite) filler doped with triclosan (HNT/TCN) have comparable properties to those of commercial nano-hybrid and nano-cluster composites. Thus, EXP-SS2 may be potentially suitable for clinical application as enamel composite, while EXP-SS5 as composite for posterior restorations.

Universal adhesives containing advanced high-performance functional monomers: bond-durability and chemical interactions

Uccioli Riccardo*, Paolone Gaetano*, Feitosa Victor P., Ogliari Fabrício A.***, Saboia Vicente Paulo**, Cantatore Giuseppe*, Gherlone Enrico*, Sauro Salvatore******

*Dental Clinic, Università Vita-Salute San Raffaele, Milan, Italy

**Restorative Dentistry Department, Federal University of Ceará, Fortaleza, Brazil
***School of Materials Engineering, Federal University of Pelotas, Pelotas, Brazil
****Biomaterials and Minimally Invasive Dentistry, Departamento de Odontologia, Facultad de Ciencias de la Salud, Universidad CEU-Cardenal Herrera, Valencia, Spain

Aim: Chemical interaction and bonding performance of a recently developed universal adhesive containing poly-GDMAP (glycerol-dimethacrylate-dihydrogen-phosphate) functional monomer was compared to a commercial adhesive containing 10 MDP.
Methods: Twenty extracted human molars were prepared and divided into 2 groups (n=10). Poly-GDMAP and 10-MDP were first formulated and then submitted to ATR-FTIR to analyze their chemical spectra before and after application (30s) onto middle-dentine specimens (2x2x2mm) and also after washing the dentine with absolute ethanol (30s) followed by distilled water (30s). Specimens were bonded using two universal-adhesives and light-cured for 20s: Adhesive containing poly-GDMAP (NEB: DEI New Extra Bond One, DEI Italia, Varese, Italy) or containing 10-MDP (CUB: Clearfil Universal Bond, Kuraray, Japan). A build-up of 6 mm using universal nanohybrid composite (Amira Fusion, Voco, Germany) were performed. Specimens were then cut into beams (0.9 mm), immersed in distilled water for 24 hours or 1 year at 37°C and submitted to MTBS; results were analysed by ANOVA and Tukey test ($p < 0.05$). Fractured specimens were analyzed with a stereomicroscope and SEM.
Results: poly-GDMAP performed alike the "gold-standard" 10-MDP at FTIR analysis. Indeed, both monomers were still attached to the dentine surface after water/ethanol washing. Bonded specimens showed that the two adhesives presented no significant differences both at 24h and after one year of storage and no statistically significant drop in MTBS after 1 year of water storage. Both groups quite often showed factures of cohesive type at 24h and mixed/cohesive after a year in water.
Conclusions: A stable and a durable bond strength can be obtained with the new NEB adhesive with poly-GDMAP as well as that formulated with 10-MDP. In clinical practice, the use of self-etching adhesives containing high performance acidic functional monomers can improve the durability of composite restorations.

Surface roughness of different esthetic restorative materials after three finishing and polishing protocols: a profilometric study

Vialba Lodovico, Riva Paolo, Trovati Federico, Colombo Marco, Lasagna Alessandro

Department of Clinical-Surgical, Diagnostic and Pediatric Sciences Section of Dentistry, University of Pavia, Pavia, Italy

Aim: The purpose of this *in vitro* study was to evaluate the surface roughness of five different esthetic restorative materials after three different finishing and polishing techniques.
Methods: Five different restorative materials (Gradia Direct, G-aenial, Essentia, Admira Fusion, Estelite Asteria) were polymerized for 40 seconds into silicone rubber rings (2 mm x 6 mm x 8 mm) to obtain 20 specimens identical in size for each material. Polymerization was performed using a Mylar strip, placed between two glass slides, to minimize the formation of an oxygen-inhibited layer. The specimens were divided into four groups. Group 1: the specimens were finished with three polishers interspersed with diamond grit (Komet REF 4312A); group 2: the specimen were polished with two polisher interspersed with diamond grit (Komet REF 4652); group 3: the specimen were finished using one tungsten carbide bur followed by one polisher interspersed with diamond grit (Komet REF 4556); control group: finishing and polishing procedures were not performed, the disks in this group were only polymerized using Mylar strips. Finishing and polishing were performed All specimen preparation/finishing/polishing procedures were performed by the same investigator, in order to reduce variability, following the manufacturer's instructions. After all specimens were finished and polished, they were thoroughly rinsed with water and allowed to dry for 24h before the average surface roughness (Ra) was measured. A profilometer (Alicona Infinite Focus, Alicona Imaging GmbH, Raaba/Graz, Austria) was used to measure the surface roughness of specimens. The mean Ra value was determined for each specimen and an overall Ra was determined for the total sample group.
Results: One-way ANOVA and post-hoc Scheffè tests were applied to estimate significant differences between the surface roughnesses of the esthetic materials. The results of present investigation showed significant differences in roughness values among the different methods. Between the polishing and finishing systems, REF 4312A has provided significantly better values, REF 4652 the worst data. Among the esthetic restorative materials, Essentia provided the surface roughness values (Ra) significantly lower.
Conclusion: This study demonstrated that the finishing technique with three-step polisher produced an excellent surface smoothness. Even tungsten carbide burs gave good results, Two-step polisher interspersed with diamond grit obtained the worst results; they gave high roughness values, probably due to high tendency to wear and rigidity. Parallel to the finishing

and polishing system used, the composition of the esthetic restorative materials, and in particular the characteristics of the filler particles, plays a key role in the final results.

Roughness and gloss evaluation of bulk-fill resin composites after different finishing and polishing procedures

Moratti Eugenio*, Gimenez Sancho Alberto, Scolavino Salvatore***, Sauro Salvatore****, Cantatore Giuseppe*, Paolone Gaetano*, Gherlone Enrico***

*Dental Clinic, Università Vita-Salute San Raffaele, Milan, Italy
*Department of Ingeniería de la Edificación y Producción Industrial - ESET, Universidad CEU-Cardenal Herrera, Valencia, Spain
***Private practice, Nola, Italy
****Restorative Dentistry Department, Federal University of Ceará, Valencia, Spain

Aim: The purpose of this *in vitro* study was to evaluate the effect of four different polishing systems on four current bulk fill composites through profilometry assessment and gloss analysis.
Methods: One hundred sixty disc-shaped specimens were prepared using four resin-based bulk fill composites and divedded in four main groups: Filtek Bulk-Fill (3M), Tetric Evoceram Bulk-Fill (Ivoclar), Fill-Up! (Coltene) and Sonicfill2 (Kerr). Specimens were polished 400-grit silicon carbide papers to have a baseline standard roughness for all composites. These were then divided into four sub-groups and polished following the manufacturers' instructions by a single operator using different polishing systems: 2-step Sof-Lex Spiral Wheels (3M), Opti-1-Step Polisher (Kerr), 3-step Astropol (Ivoclar) and Hiluster 2-Steps Polishing System (Kerr). . The average roughness was measured in triplicate on each single specimen with a contact profilometer Mitutoyo SJ-201 Rougness Tester (Mitutoyo). Gloss measurement was also performed for small areas (2mmx2mm) using a Glossmeter (MG6-SA, KSJ). Data were analysed using a two-way analysis of variance (ANOVA) to analyse whether the following factors affect the values of roughness and gloss: (i) material; (ii) polishing/finishing. Tukey HSD test was also conducted to evaluate any statistically significant differences between the material/procedure combinations (α=0.05).
Results: Opti-1-Step Polisher (Kerr) polishing system produced the highest Ra and the lowest GU mean in all the tested composite ($p<0.05$); the other three polishing systems showed no significant differences ($p<0.05$) between them. The Spiral Wheels (3M) and Ivoclar Astropol (Ivoclar) created the smoothest surface ($p<0.05$)compared to the other two systems. The lowest significant gloss values were obtained with Fill-Up! (Coltene). Sof-Lex Spiral Wheels (3M) obtained the highest gloss values.
Conclusion: Either the tested materials or the finishing/polishing procedure affect the resulting surface quality and the gloss. Lower Ra values were obtained with Filtek Bulk-Fill (3M) and Tetric Evoceram Bulk-Fill (Ivoclar) and when using the finishing/polishing method Spiral Wheels (3M) or Ivoclar Astropol (Ivoclar).