

DIRECT COMPOSITE RESTORATION FOLLOWING DENTAL TRAUMA: A CASE REPORT WITH 2-MONTH FOLLOW-UP

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Objectives: dental trauma is a common emergency in dentistry, with a particularly high incidence in the upper anterior region among young patients. This report describes the clinical management of a post-traumatic coronal fracture of tooth 11 in a 20-year-old patient, in whom the young age guided the therapeutic choice toward a minimally invasive approach, aimed at preserving the remaining tissues and future treatment options.

Materials and methods: on physical examination, an uncomplicated coronal fracture of tooth 11 (IADT) and an incisal abrasion of tooth 21 were noted. Following isolation with a rubber dam and a three-step etch-and-rinse bonding procedure, the restoration was carried out using an intraoperative silicone template. The biomimetic layering faithfully repro-

duced the natural anatomy: a palatal wall of enamel, cusps modelled on the contralateral tooth, an opaque incisal layer, dentine with decreasing chroma, and an enamel covering. Finishing was performed using abrasive discs and polishing with rubber cups of decreasing grit.

Results: the restoration achieved full aesthetic and functional integration. At the 2-month follow-up, intact margins, absence of leakage, normal periodontal response and patient satisfaction were observed.

Conclusions: this case confirms that direct composite restoration, performed using a biomimetic layering technique, represents an effective choice that respects the remaining tissues in young patients, ensuring aesthetically pleasing and clinically stable results.

THE USE OF FLUORESCENCE WITH DEDICATED SYSTEMS FOR THE DIAGNOSIS AND REMOVAL OF CARIES IN DAILY PRACTICE

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Aim: the purpose of this study is to evaluate the diagnostic effectiveness of a fluorescence-based system (VistaProof, Dürer Dental) in detecting carious lesions and comparing it with traditional methods such as clinical examination (ICDAS criteria) and bitewing radiography.

Methods: an *in vivo* clinical study was conducted on 49 sites (29 teeth). Protocol: professional cleaning, ICDAS visual inspection, bitewing X-ray, and VistaProof fluorescence analysis. Caries removal served as the gold standard to verify tissue elimination. Data were analyzed using DBSWIN software and logistic regression models.

Results: ICDAS revealed 11 sound sites (22.5%), 15 enamel lesions (30.6%), and 23 dentinal lesions (46.9%). For early le-

sions (D0-D1), VistaProof showed high diagnostic accuracy (AUC 0.90; sensitivity 0.86; specificity 0.81), outperforming bitewing ($r = 0.24$). For dentinal lesions (D1-D3), VistaProof sensitivity decreased to 0.52 (specificity 1), compared to 0.65 for bitewing. After logistic regression, sensitivity reached 0.87 for VistaProof and 0.83 for bitewing. Overall, the diagnostic error was 45% for bitewing and 31% for VistaProof; combined use reduced the error to 16% (84% correct diagnoses).

Conclusions: VistaProof excels in detecting early enamel lesions, where bitewing is limited by the demineralization threshold. Integrating both methods optimizes diagnostic accuracy (16% error rate), confirming VistaProof as a valuable tool for follow-up, residual caries management, and patient communication.

COMPARATIVE EVALUATION OF DIFFERENT POLISHING PROTOCOLS ON A NEXT-GENERATION NANOCOMPOSITE WITH GLOSSMETER AND SCANNING ELECTRON MICROSCOPE

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Aim: this study aims to evaluate the effect of different finishing and polishing (F/P) protocols on the surface gloss and morphology of a next-generation universal nanocomposite.

Methods: twenty samples (discs 2 mm thick and 12 mm in diameter) of Easy Match Universal Restorative (3M Filtek) were prepared. For each sample, side A was subjected to the polishing protocol, while side B, polymerized using a Mylar strip, was used as the control surface. The samples were divided into four groups (n = 5) and polished using different instruments: Group TA+TB (Twist A + Twist B Diacomp-Eve); Group TA+TB+L (TwistA, TwistB, Lucida Diashine); Group TA+L (Twist A, Lucida); Group SW+L (Spiral Wheel brown 3M, Lucida).

Gloss was measured using a NOVO-CURVE™ glossmeter (Rhopoint Instruments), calibrated at 95 GU, while morpho-

logical analysis was performed using a Carl Zeiss SUPRA™ 40 SEM.

Results: gloss values, in increasing order, were: Group TA+TB (50.40 ± 13.20 GU), Group SW+L (85.05 ± 3.69 GU), Group TA+L (90.65 ± 1.46 GU), Group TA+TB+L (91.20 ± 2.50 GU).

SEM analysis, compared with the control (which showed a smooth surface with minor irregularities), revealed that Group TA+TB exhibited a more irregular surface with superficial scratches, Group SW+L showed the presence of surface voids, while Groups TA+TB+L and TA+L displayed more uniform surfaces.

Conclusions: it is recommended to use F/P protocols involving at least two instruments: the first being a rotary rubber polisher impregnated with abrasive particles (diamond), and the second a felt wheel used to apply a diamond polishing paste.

VARIATION OF THE COLOR MATCH BETWEEN TOOTH AND RESTORATION AFTER DIFFERENT BLEACHING TREATMENTS

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Aim: the aim of this *in vitro* study is to evaluate the effect of bleaching procedures on the color match between tooth and different composite restorations.

Methods: the color of 60 extracted teeth was recorded using a spectrophotometer to include only teeth matching A2, A3, B3, C2-C4, D3, D4 VITA values. A standardized Class V cavity (2 x 4 x 4 mm) was prepared on the buccal surface of each tooth, 1 mm above the CEJ. Teeth were randomized into 3 groups (n = 20) based on the composite used for the restorations: VB, VD and VP. Color differences (ΔE_{00}) between tooth and restoration were calculated to exclude samples that did not meet the perceptibility criteria ($\Delta E_{00} \leq 1.8$) and to ensure a homogeneous initial sample. Half of the teeth (n = 10) were treated with a 25% H₂O₂ professional use gel, and the other

half with a 6% H₂O₂ gel at-home use. CIELAB coordinates (L*, a*, b*), C* and h° were recorded using a spectrophotometer. The ΔE_{00} between tooth and restoration was calculated 24 h after restoration (T₀) and 24 h after bleaching (T₁).

Results: instrumental analysis showed statistically significant differences in ΔE_{00} values between T₀ and T₁ within each group ($0.00142 \leq p \leq 0.00834$), while no significant differences were observed between the different groups when compared at each time point.

Conclusions: ΔE_{00} values increase after bleaching could indicate a worst color match between tooth and the 3 tested resins, that becomes perceptible after the treatment. However, it would be clinically more relevant to perform a visual analysis of the color match between tooth and restoration after bleaching.

EFFECT OF DIFFERENT FINISHING/POLISHING SYSTEMS ON SURFACE GLOSS AND ROUGHNESS OF COMPOSITES WITH DIFFERENT POLYMERIZATION TIME

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Aim: the objective of this *in vitro* study was to evaluate the effectiveness of different finishing and polishing (F/P) systems by the analysis of surface gloss and roughness of single- and multi-shade composites, polymerized for either 40 or 80 seconds.

Methods: a total of 240 composite blocks (14 x 5 x 4 mm) were produced and divided into 3 groups (n = 80): one multi-shade (Harmonize, Kerr) and two single-shade composites (Vitre APS Unique, FGM and Omnicroma, Tokuyama). Each group was further divided into 4 subgroups (n = 20) finished and polished using OptiDisc (Kerr), Enhance PoGo (Dentsply), or Twist Dia (Kuraray), plus an untreated control group. A further subdivision (n = 10) was based on polymerization time (40" or 80") of the blocks. Surface gloss was measured using

a tailored 60° incidence angle glossmeter, while roughness was evaluated using a rugosimeter.

Results: all F/P systems increased gloss and reduced roughness compared to the untreated control group. Twist Dia produced the smoothest and glossiest surfaces (p <0.001). Gloss and roughness values appeared to be more effective in the single-shade groups when polymerized for 40 seconds (p <0.001), whereas in the 80 seconds subgroups the effect of F/P systems appeared variable and dependent on the specific combination of materials and protocols.

Conclusions: data showed that the choice of the F/P system and the composite material is fundamental to optimizing the esthetic and surface characteristics of direct restorations.

INFLUENCE OF SURFACE TREATMENTS OF ZIRCONIA AND LITHIUM DISILICATE ON THE WEAR AND INTEGRITY OF ADHESIVE CEMENT: AN *IN VITRO* STUDY

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Aim: the aim of this study is to evaluate the effect of surface treatments on Zirconia and Lithium Disilicate regarding material wear and the integrity of ZirCAD® adhesive cement under simulated *in vitro* conditions.

Methods: four groups, each consisting of eight samples of Zirconia and Lithium Disilicate, were analyzed, with two groups glazed and two polished as different surface treatments. The samples were subjected to 10,000 cycles in a chewing simulator designed to reproduce oral wear conditions over time. Surface and adhesive interface changes

were evaluated using Profilometry and Optical Coherence Tomography (OCT).

Results: comparing pre- and post-chewing data, the expected results show significant differences between glazed and polished groups, indicating that the type of surface finish affects material wear and the integrity of ZirCAD® adhesive cement.

Conclusions: surface finishing could significantly influence the medium - to long - term durability of the restoration, representing a key factor for the longevity of Indirect Restorations.

FINITE ELEMENT ANALYSIS IN POLYMER-BASED ADHESIVE DENTAL RESTORATIONS: A NARRATIVE REVIEW

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Aim: to evaluate the application of finite element analysis (FEA) in polymer-based adhesive dental restorations, focusing on methodological validity and clinical relevance.

Methods: a narrative review was conducted using PubMed, Scopus, and Web of Science, including English-language studies published between 2000 and 2025. Finite element investigations on direct and indirect adhesive resin-based restorations in anterior and posterior teeth were included, while studies on crowns, posts, implants, and non-adhesive procedures were excluded. Studies were qualitatively appraised considering modeling assumptions, material properties, adhesive interface representation, loading conditions, and clinical interpretation.

Results: across class I to class V cavities and indirect restorations

(inlays, onlays, overlays, tabletops), FEA showed that cavity configuration, residual tooth structure, material stiffness, and adhesive behavior influence stress distribution and cuspal deflection. Extensive MOD cavities exhibited increased tensile stress and deformation, whereas cuspal coverage improved stress redistribution. In anterior and cervical restorations, stress patterns were affected by marginal design and non-axial loading. Simplified material models and static loading limit long-term prediction.

Conclusions: FEA provides relevant biomechanical insight into adhesive restorative dentistry and supports minimally invasive principles. When interpreted within its limits and integrated with experimental and clinical evidence, it remains a valuable adjunct for restorative decision-making.

NON-INVASIVE TREATMENT FOR ENAMEL DEMINERALIZATION: A SYSTEMATIC REVIEW AND META-ANALYSES

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Aim: this systematic review compares non-invasive techniques for treating enamel demineralization.

Methods: a comprehensive literature search across MEDLINE, Embase, and Cochrane databases identified papers evaluating non-invasive remineralization protocols. Interventions compared were resin infiltration, fluoride-based therapies, casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), nano-hydroxyapatite and bioactive glass. Primary outcomes included changes in mineral content, surface microhardness, reduction in lesion area and efficacy of aesthetic outcome.

Results: resin infiltration demonstrated superior aesthetics, with a 46.6% lesion reduction compared to 26.6-29.8% for fluoride varnish and CPP-ACP at 12 months.

Meta-analyses found greater resolution with resin infiltration compared to controls (SMD 1.24, 95% CI 0.59-1.88). Long-term studies demonstrated that only 9-14% of infiltrated lesions progressed compared to 45-48% of controls over 3-7 years. CPP-ACP demonstrated remineralization comparable to fluoride varnish. Network meta-analyses identified high-concentration fluoride (5000 ppm) and fluoride varnish sealants as the most effective for non-cavitated lesions when aesthetics are secondary.

Conclusions: resin infiltration is the best non-invasive approach for the aesthetic improvement of WSLs, with optimal long-term stability and superior lesion arrest. Fluoride-based treatments represent the best approach for biological remineralization.

PROGNOSTIC EVALUATION AND RESTORATIVE PLANNING OF DECALCIFIED PERMANENT TEETH THROUGH THE USE OF AN ARTIFICIAL INTELLIGENCE MODEL

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Aim: demineralization of permanent teeth represents a significant clinical problem due to its negative impact on aesthetics and dental integrity. Careful prognostic assessment of demineralized lesions and proper restorative planning are essential for conservative treatment. Artificial intelligence has demonstrated significant potential in supporting diagnostic and treatment planning processes in dentistry.

Methods: the protocol is based on a structured database of clinical photographs from scientific literature, each associated with a diagnosis of enamel decalcification and related treatment protocols. The images are classified based on lesion severity, reversibility, and therapeutic approach. The study allows for the development of an artificial intelligence-based application where a new uploaded clinical pho-

tograph is automatically compared with reference images. Through this process, the system provides a probable diagnosis and suggests a treatment plan consistent with the clinical protocols described in the literature.

Results: the AI model demonstrated high accuracy in recognizing and classifying decalcified lesions. Diagnostic results showed strong concordance with literature-based classification. The system generated treatment plan recommendations consistent with reference protocols.

Conclusions: integration of a literature-based image database with an AI model represents a promising approach to improve prognostic evaluation and restorative planning of decalcified permanent teeth, supporting consistent, conservative, evidence-based clinical decisions.

A GUIDED DIGITAL WORKFLOW FOR ANTERIOR DIRECT COMPOSITE RESTORATIONS: RESMILE TEMPLATE MODE

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Aim: to describe an innovative digital workflow protocol that combines CAD planning with sequential thermoformed template guides to overcome limitations of traditional freehand techniques in anterior composite restorations, increasing both predictability and accessibility for operators of varying experience levels.

Methods: the protocol integrates Digital Smile Design (DSD), intraoral scanning and CAD software planning to create two stereolithographic models: an alternate-tooth model and a final arch on both of which 0.5 mm thermoformed templates are fabricated. Templates are then pre-loaded with highly filled composite and stamped on the correspondent 3D model with the interposition of an acetate sheet; excesses are eliminated before the intraoral stamping which occurs in two

phases: first using the alternate-tooth template, then the complete arch template. Adjacent teeth are isolated with Teflon tape for contact points control in each phase.

Results: the DSD provides precise aesthetic visualization, defines the final morphology and guides clinical execution. Pre-loading templates and preventive surplus removal allows control over excess management, reducing chairside finishing procedures. The two-phase stamping approach ensures precise contact points and morphological reproduction with minimal intraoral adjustments.

Conclusions: Resmile Template Mode represents a standardized digitally guided approach that reduces operator dependency and clinical time, obtaining biomimetic results and a highly accessible protocol.

DIGITAL WORKFLOWS IN DIRECT COMPOSITE RESTORATIONS: A SYSTEMATIC REVIEW

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Aim: digital workflows are increasingly integrated into direct composite restorations. Innovative approaches include the injection technique using flowable composites and direct composite printing through prefabricated transparent matrices derived from Digital Smile Design (DSD) and CAD/CAM models. These methods aim to enhance aesthetic predictability, reduce chair time, and standardize clinical outcomes.

Methods: a systematic search was conducted in PubMed, Scopus, and Web of Science to identify studies on digitally assisted injection techniques with using prefabricated matrices from DSD and CAD/CAM planning. Both *in vitro* and clinical studies were included. Data on accuracy, aesthetic outcomes, marginal adaptation, treatment time and reproducibility were extracted. Methodological quality and risk of bias were assessed.

Results: digitally guided injection techniques enable highly predictable reproduction of tooth morphology with improved operator consistency. Flowable composite injection through digitally fabricated transparent matrices demonstrates good marginal adaptation and high aesthetic accuracy. DSD combined with CAD/CAM models allows precise matrix fabrication facilitating minimally invasive treatments and reducing procedural variability.

Conclusions: modern injection techniques represent promising advancements in direct restorative dentistry, improving aesthetic predictability, efficiency and reproducibility. Further long-term clinical trials with standardized protocols are needed to confirm their effectiveness and stability in routine practice.

AI-GUIDED DIGITAL WORKFLOW FOR PRE-ORTHODONTIC MANAGEMENT OF DENTAL MORPHOLOGICAL ANOMALIES WITH INJECTION MOLDING TECHNIQUE

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Aim: to propose an AI-supported digital workflow for planning and executing restorative modifications on teeth with morphological anomalies prior to orthodontic treatment, improving the predictability of esthetic and functional outcomes through the injection molding technique.

Methods: analog and digital workflows were compared to highlight clinical and operational differences.

In the analog workflow, dental proportions are evaluated using calipers and Chu's Aesthetic Gauges, supported by dental indices and esthetic ratios. This approach includes conventional impressions, stone models, manual diagnostic wax-up, and subsequent fabrication of a silicone index for injection molding based on the wax-up.

The digital workflow includes intraoral scans, panoramic radiographs, lateral cephalograms and photographs. Dental morphology is designed with AI-supported software, allowing virtual modification according to esthetic and functional

parameters. A 3D-printed model is used to produce the silicone index, and orthodontic treatment is planned, often with clear aligners.

Results: both workflows allow early definition of dental morphology and support treatment planning. The analog workflow is cost-effective and does not require advanced technology but is more operator-dependent, less reproducible, more prone to errors, and time-consuming. The AI-guided workflow offers greater precision, reproducibility, and anatomical customization, improving interdisciplinary and patient communication, although it requires digital equipment, technical skills, and higher costs.

Conclusions: the AI-guided protocol offers greater predictability, reproducibility, and personalization of esthetic and functional outcomes in orthodontic-restorative treatment, while the analog workflow remains a valid and cost-effective alternative.

ARTIFICIAL INTELLIGENCE AND DENTISTRY: NEW FRONTIERS IN RADIOGRAPHIC SEGMENTATION AND SMILE DESIGN

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Aim: to clinically validate two AI-powered features of the Neowise software (Cefla): AI ORTHO SEG, for automatic segmentation of endoral radiographs, and AI SMILE DESIGN, for keypoint detection and aesthetic smile planning, evaluating their potential to support diagnostic accuracy and personalized treatment planning.

Methods: patient images were acquired with informed GDPR compliant consent across a broad population sample. Manual annotations were performed using CVAT software by experienced clinicians, following a cross validated annotator/reviewer protocol. Demographic variables (age, sex, ethnicity) were systematically recorded. AI outputs are being benchmarked against manual annotations using standardized performance metrics provided by the manufacturer.

Results: the annotation workflow proved feasible across a broad patient population. AI ORTHO SEG reliably identified anatomical structures, pathological findings and prosthetic elements. AI SMILE DESIGN accurately detected facial keypoints and tooth contours, effectively supporting symmetry evaluation and aesthetic rehabilitation planning.

Conclusions: although conclusive evidence is still being gathered, early results are promising and support the potential clinical value of AI-assisted dental diagnostics. This ongoing validation represents a critical step toward responsible integration of AI into dental practice, with significant implications for future personalized and data-driven treatment strategies.

RADIOMICS-BASED CLASSIFICATION OF CARIES EXTENT AND DEPTH FROM INTRAORAL PHOTOGRAPHS

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Aim: this study aimed to evaluate the potential of a radiomics-based approach combined with machine learning to classify caries extent and depth from intraoral photographs, reducing reliance on radiographic imaging.

Methods: standardized intraoral images were acquired, segmented, and labeled according to ICDAS and E-D scales. Radiomic features were extracted from RGB color channels. Feature selection methods and multiple classifiers (LDA, k-NN, SVM, and neural networks) were applied using cross-validation to assess performance in terms of accuracy, sensitivity, and specificity.

Results: the models achieved high performance, with accu-

racy up to 94% and sensitivity and specificity comparable to radiographic methods. Texture-related features, especially from red and green channels, were the most predictive. The integration of RGB channels improved classification accuracy, while explainable AI techniques confirmed the relevance of key radiomic features in model decisions.

Conclusions: radiomics applied to intraoral photography represents a reliable, non-invasive, and cost-effective alternative for caries classification. This approach may enhance diagnostic workflows, reduce exposure to ionizing radiation, and improve accessibility, supporting the adoption of AI-driven methods in clinical dental practice.