AESTHETIC-CONSERVATIVE TREATMENT OF A PATIENT WITH ECTODERMAL DYSPLASIA: A CASE REPORT

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Aim: to describe the conservative and aesthetic rehabilitative treatment of a patient with multiple syndromic tooth agenesis, microdontia and deep bite.

Methods: after the orthodontic evaluation and the patient's decision not to immediately undergo orthodontic treatment, the increase in the vertical dimension of occlusion and the anterior aesthetic rehabilitations were carried out. In the posterior area, table-top overlays were cemented with flowable composite resin, which allowed an anterior bite opening. Subsequently, the anterior reconstructions were performed: the upper ones using a direct layering technique, and the lower ones using the injection technique.

Results: thanks to the posterior overlays, an anterior bite opening was achieved, which allowed an adequate space to perform the anterior reconstructions. The anterior teeth were modified in shape and size, resulting in an aesthetically pleasing and satisfactory outcome for the patient.

Conclusions: through a simple and extremely conservative approach, a satisfactory aesthetic and functional result was achieved. At the end of the conservative treatment, the patient will undergo orthodontic treatment with aligners with the aim of achieving complete closure of the interdental spaces in the upper arch and improving the position of element 34, to facilitate the subsequent implant rehabilitation of the edentulous area.

FLOW INJECTION TECHNIQUE FOR CONSERVATIVE ESTHETIC REHABILITATION IN A YOUNG ECTODERMAL DYSPLASIA PATIENT

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Aim: the Flow Injection Technique (FIT) is a minimally invasive approach for esthetic dental rehabilitation. While not suitable for all cases, it can be highly effective in selected conditions. This case presents a conservative smile restoration in a 17yo male with ectodermal dysplasia, highlighting FIT's potential in managing microdontia and hypodontia. The patient sought a provisional esthetic solution to close diastemas involving conoid and retained deciduous teeth.

Methods: the patient attended the Dental Clinic of the University of Bologna with smile defects due to ectodermal dysplasia. The patient complains about the esthetic of the smile but also economic difficulties. Clinically, the agenesis of the upper right lateral incisor was observed, along with diastema between central incisors, conoid teeth and presence of mobile deciduous teeth (62, 63, 52). Following clinical and radiographic evaluation, digital scans (TRIOS 5) and diagnostic wax-up were performed. After mock-up approval, a transparent silicone mould (Zhermack SpA) was fabricated. Each tooth was isolated, sandblasted (50 µm alumina), etched (37% H_3PO_4), and treated with a 3-step adhesive. Using the mould, highly filled flowable composite (CLEARFIL MAJESTY™ ES Flow–Low, shade A1) was injected per tooth, followed by light-curing. Finishing (Twist Dia, Kuraray) was done, with final polishing after one week.

Results: the patient expressed high satisfaction with the esthetic outcome. No postoperative issues were reported. At the 3-month follow-up, restorations showed no wear, fractures, or periodontal concerns.

Conclusions: the FIT allowed for a predictable and efficient esthetic rehabilitation of altered smile in a single appointment. A thorough understanding of the materials and their clinical handling is essential to maximize the potential of this technique.

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REVIVING SMILES: THE POWER OF CERAMIC VENEERS IN MODERN AESTHETIC DENTISTRY

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Aim: to show how ceramic veneers offer a minimally invasive solution to improve smile aesthetics and function, correcting discoloration, shape anomalies, wear, and slight misalignments while preserving tooth structure.

Methods: the clinical protocol includes patient selection, color matching with a spectrophotometer, wax-up, minimal tooth preparation, and adhesive cementation. Literature and case review support key factors such as enamel bonding and proper follow-up.

Results: veneers improved smile aesthetics and maintained masticatory function. High-quality ceramics and expert lab support enhanced durability and resistance to fracture or marginal discoloration.

Conclusions: ceramic veneers are a reliable option for anterior aesthetic rehabilitation.

Long-term success depends on planning, minimal preparation, and precise cementation.

THE INJECTABLE RESIN COMPOSITE TECHNIQUE: POST-ORTHODONTIC RESTORATIVE TREATMENT OF ANTERIOR TEETH WITH A DIGITAL WORKFLOW A CLINICAL STUDY

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Aim: the Injectable Resin-Composite technique (IRC) is a minimally invasive and recently introduced procedure used for the direct restoration of anterior teeth. It is a predictable method that uses a transparent silicone index and flowable resin composite to reproduce the anatomy of the tooth through a purely additive approach.

The purpose of this prospective clinical study is to evaluate how the IRC can improve esthetics and function in post-orthodontic patients in which diastema, residual conoid teeth or irregular dental anatomy persists.

Methods: this study involves 15 patients and a total of 48 anterior restorations. The technique is carried out by a digital workflow that begins with the scanning of the dental arches, followed by STL file processing, 3D-printing of the model and fabrication of a silicone index covered by a transparent resin shell. The clinical performance of the restorations was evaluated with the USPHS guidelines at 6 months. Data were statistically analyzed using Kaplan-Majer test.

Results: after an observation time of 6 months, survival rate was 100%. At follow-up repairable restorations were observed in five patients (score 4), whereas ten restorations were classified as clinically acceptable (scores 1-3) according to the FDI criteria.

Conclusions: after 6 months the IRC showed a favorable clinical performance over an short observation period, however, clinical long-term data have to be awaited.

EVALUATION AND COMPARISON OF THERACAL LC AND THERACAL PT IN VITAL PULP THERAPY: *IN VIVO* STUDY

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Aim: Vital Pulp Therapy (VPT) techniques, including Direct Pulp Capping (DPC), are conservative treatments aimed to preserve compromised pulp tissue.
This *in vivo* study aims to evaluate the effectiveness of DPC with TheraCal LC and TheraCal PT in permanent adult teeth with primary and secondary caries. The null hypothesis is there are no differences in the outcome.
Methods: inclusion criteria: permanent posterior teeth with deep caries showing normal pulp vitality. Patients aged 18 to 65 (30±12) and signed the informed consent.
Exclusion criteria: non-vital or non-restorable teeth, periapical radiolucency, treatment disagreement, or inability to complete follow-ups.
Patients are divided into two groups: Group 1: TheraCal LC, Group 2: TheraCal PT.
Follow-up visits are scheduled at 1 week, 1 month, 3 months, with assessments including pulp vitality, percussion tests, and clinical evaluation for swelling or fistulas. Pulp response type indicates treatment success or failure.
Results: clinical data collected up to 3 months showed a success rate of 94.4% for TheraCal LC (n = 18) with one failure (5.6%) and 33.3% for TheraCal PT (n = 3), with two failures in the PT group (66.7%). Between the failures, 4 were primary caries and 1 secondary. Failure rates were 23.53% for primary caries and 25% for secondary.
Conclusions: this study suggests the potential efficacy of both materials, but a larger sample size is required to draw definitive conclusions and evaluate long-term effects. Due to the small sample size, the confidence interval is wide, with lack of statistical significance.

ENVIRONMENTAL SCANNING ELECTRON MICROSCOPE (ESEM) ANALYSIS OF MORPHOLOGY AND ROUGHNESS OF THE BUILD-UP SURFACE AFTER TREATMENT WITH SANDBLASTER OR ERBIUM (ER:YAG) LASER

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Aim: the aim of this preliminary study is to evaluate the efficacy of Er:YAG laser used in QSP (Quantum Square Pulse) modality to treat the surface of the build-up before adhesive cementation sequence, instead of traditional sandblaster.
Methods: the *ex vivo* study was conducted on 12 intact, not decayed and kept hydrated in NaCl 0.9% solution extracted teeth. A cavity was created in the center and reconstructed with composite resin. Then, samples were prepared with burs as for overlay build-ups and divided into 3 groups: control group G1 prepared only with burs; group G2 in which surfaces were treated with sandblaster (Al2O3, 2.5 bar, 10 mm from composite surface, 10 sec); group G3 treated using Er:YAG laser (QSP mode,1 W, 10 Hz, 100 mJ).
Surface roughness of the build-up was measured with laser profilometer, and surface morphology was studied using ESEM.
Results: mean surface roughness in enamel resulted not statistically different between control and sandblaster, but significantly greater with laser. A similar trend was observed in dentin and resin.
ESEM analysis of surfaces treated with sandblaster and laser are rougher than the control ones. Laser samples have no smear layer, tubules are visible, and enamel shows organized prisms (like an etching action).
Conclusions: Er:YAG laser in QSP mode used on build-up surface for indirect adhesive restorations is innovative and should be investigated with further studies. It seems extremely effective in increasing roughness, erasing smear layer and creating characteristics favorable for a good adhesion in all substrates (enamel, dentin, resin).

RESIDUALS OF BRISTLES OF ADHESIVE SYSTEM APPLICATOR: A MICROSCOPIC ANALYSIS OF THREE DIFFERENT SYSTEMS

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Aim: this *ex vivo* study aimed to investigate the presence of remnants from three different types of applicators on the prepared surface of extracted teeth.

Methods: forty-five extracted teeth were prepared as Class II cavities according to Black's classification and divided into three groups. For each group, a different applicator was used: Microbrush (M), Zeroflox (Z), or Nylon disposable brush tips (N). All cavities were treated with a two-step self-etching system and polymerized. The samples were then examined using Scanning Electron Microscopy (SEM) after being mounted on aluminum stubs and coated with gold.

Results: bristle remnants were observed in 80% (12/15) of samples in group M, whereas no remnants were detected in groups Z and N.

Conclusions: the microscopic analysis revealed significant differences in bristle presence among the three applicator groups. Further studies are required to determine whether these remnants may affect the adhesion parameters. Clinicians should therefore consider the possibility of remnants being left on the adhesive surfaces during restorative procedures, especially when using microbrush applicators.

HIGH-VISCOSITY GLASS-IONOMER RESTORATIONS EFFECT AGAINST SECONDARY CARIES: AN *EX VIVO* CHARACTERIZATION

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Aim: this study aimed to characterize the biointeractions between Glass-Ionomer (GIC) biointeractive restorations and hard tissues affected by Secondary Caries (SC) in extracted teeth.

Methods: four molars, extracted for clinical reasons years after the placement of high-viscosity GIC restorations, were included in the study. All teeth showed clinical evidence of deep SC. They were scanned using micro-CT, embedded in epoxy resin, and then sectioned. The sections were analyzed using optical microscopy, scanning electron microscopy, and Energy-Dispersive X-ray Spectroscopy (EDS).

Results: micro-CT imaging showed the high-viscosity GIC material placed in medium-to-deep cavities. Mineral density increased in dentin adjacent to the restoration but decreased within the restoration near dental tissues, suggesting ion migration toward these tissues over time. EDS confirmed the presence of aluminum, silicon, fluoride, and strontium. SC developed predominantly at the restoration-tooth interface, particularly at the cervical margin. A demineralized dentin layer was seen beneath the ion migration zone only in teeth with SC. It is unclear if this layer results from incomplete remineralization by the restorative material or from calcium and phosphate ion migration from sound tissues, potentially influenced by fluoride's high electronegativity.

Conclusions: the remineralization provided by high-viscosity GIC restorations did not prevent the development of SC over time. Understanding the biointeractions between these materials and hard dental tissues is essential for addressing the SC occurrence.

EXPRESSION OF MATRIX METALLOPROTEINASES (MMPS) IN DECIDUOUS TEETH: A DESCRIPTIVE *IN VITRO* STUDY

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Aim: main: to evaluate MMPs' expression in sound and decayed primary teeth. Secondary: to investigate any changes in MMPs' expression after ozone and chlorhexidine application.
Methods: sound primary teeth, naturally exfoliated or extracted for orthodontic reasons, and decayed primary teeth (primary caries, ICDAS codes 3–6), naturally exfoliated or extracted were included. Teeth were divided into 4 groups and treated with ozone (OzoneDTA®, program n°6) (G1 = 3 sound teeth, G2 = 7 decayed teeth) and 0.2% chlorhexidine (G3 = 4 sound teeth, G4 = 5 decayed teeth) for 1min. Decayed teeth were treated after caries removal using rotary instruments. Both treated and untreated sound (n = 4) and decayed teeth (n = 6) were sectioned using a microtome, mounted on glass slides, and reduced in size by polishing with wet abrasive papers (50 µm thickness). Samples were covered with a mixture of gelatin conjugated with fluorescein and observed using a confocal microscope. The Kruskal-Wallis test was performed to evaluate any differences in the mean fluorescence pixel values among groups ($p < 0.05$).
Results: MMPs' expression was clearly visible in untreated decayed teeth and almost absent in untreated sound teeth. Chlorhexidine reduced MMPs' expression in both sound and decayed treated teeth, while ozone seemed to enhance their activity ($p < 0.001$).
Conclusions: ozone and chlorhexidine are pain-free treatments useful in children. Applying chlorhexidine after caries removal reduces MMPs' expression, thereby prolonging the restoration longevity. The activating effect of ozone on MMPs warrants further investigation.

BIODENTINE XP IN BULK-FILL MODE FOR DIRECT RESTORATIONS: A M-CT AND SEM EVALUATION

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Aim: this study evaluates the marginal integrity of Biodentine XP, applied in bulk-fill mode in Class I composite restoration. The µ-CT and SEM were used to analyze voids and marginal gaps at different interfaces.
Methods: ten Class I cavities were prepared in extracted molars (6 mm depth, 4 mm mesiodistal, 4 mm buccolingual). Biodentine XP was applied in a 4 mm layer and left to set for 15 min. After that, adhesive procedures were performed, and 2 mm of bulk-fill composite were applied and polymerized for 40 sec. µ-CT analyzed voids at the Tooth-Biodentine XP (TB) and Biodentine XP-Restoration (BR) interfaces. Then, sagittal sections were examined by SEM to assess marginal adaptation.
Results: several voids were found within materials than at the different interfaces.
Marginal voids were more frequent in TB (0.11 ± 0.22 mm^3) than in BR interface (0.06 ± 0.04 mm^3). SEM showed no macroscopic gaps but revealed small internal voids, confirming µ-CT findings.
Conclusions: Biodentine XP in bulk-fill mode showed good adaptation to the restoration, although the tooth interface had more voids.
Proper adaptation and handling are crucial to minimize gaps. Future studies should improve Biodentine XP adaptation to enhance restoration quality and durability.

EVALUATION OF THICKNESS AND VOID FORMATION OF DIFFERENT CEMENTATION TECHNIQUES FOR INDIRECT RESTORATIONS

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Aim: thickness and voids within the cementation layer can affect the stability and longevity of indirect restorations. This study aims to evaluate thickness and voids formation of the cement applying different cementation techniques.
Methods: to standardize the evaluations, the models and the indirect restorations (SprintRay Crown A3 Dentin) were printed (SprintRay Pro95S) from the same STL. Cementation was performed under rubber dam isolation using three materials: a dual-cure resin cement (3M Relyx Universal), a packable bulk-fill composite (3M Filtek One Bulk Restorative), and a flowable bulk-fill composite (3M ESPE Filtek Bulk-Fill Flowable). The five methods were: RLX (dual-cure resin cement), PCK+RLX (packable bulk-fill composite+resin cement), PCK+FLW (packable+flowable bulk-fill composite), FLW (flowable bulk-fill composite), and PCK (packable bulk-fill composite). The adhesive (3M Universal Plus) was applied to both the preparation and indirect restoration. Samples were analyzed by μ-CT to measure voids and cementation layer thickness.
Results: all groups exhibited voids within the cementation layer, in increasing order: PCK+FLW, FLW, PCK+RLX, PCK, RLX. The largest void was found in PCK, the smallest in PCK+RLX. Regarding the average thickness of the cementation layer, the order from lowest to highest was: PCK+FLW, FLW, PCK, PCK+RLX, RLX.
Conclusions: the use of light-curable composites resulted in fewer voids and a more uniform cementation layer. For less experienced operators using a technique with light-curable cements may be more reliable.

THE USE OF MACHINE LEARNING TO DETECT AND CLASSIFY DENTAL CARIES

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Aim: this study proposes a radiomics-based Machine Learning (ML) approach to classify caries extent from intraoral photographs.
Methods: standardized images were taken, resized, segmented, labled and classified using ICDAS scales. Data augmentation increased sample size. Radiomic features were extracted from each color channel using Pyradiomics, and feature selection (AUC-ROC, ReliefF, LASSO, backward selection) was applied within 5-fold cross-validation. ML classifiers (LDA, k-NN, SVM, NNET) were evaluated for accuracy, sensitivity, and specificity. Model explainability was assessed via partial dependence plots and residual analysis.
Results: NNET with backward selection achieved the highest accuracy (87.6-95.4%), with sensitivity from 61.5-93% and specificity from 73-90%. The green and red channels significantly influenced predictions, particularly texture features. The red channel, mimicking near-infrared transillumination, enhanced the contrast between healthy and decayed tissue. The blue channel had a lesser impact, but combining RGB channels yielded the best accuracy.
Conclusions: radiomics enables caries depth classification from intraoral photographs, offering a non-invasive, cost-effective alternative to radiographs.

ENHANCING CBCT IMAGE QUALITY: METAL ARTIFACT REDUCTION IN TEETH WITH CERAMIC BRACKETS AND COATED ARCHWIRES - AN *IN VITRO* STUDY

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Aim: this study aimed to evaluate the effectiveness of a Metal Artifact Reduction (MAR) algorithm in Cone-Beam Computed Tomography (CBCT) scans of teeth with ceramic brackets, with or without coated archwires.

Methods: an *in vitro* setup was used, where 10 ceramic brackets were bonded to the maxillary anterior teeth (from second premolar to second premolar) of a dry human skull. CBCT scans (85 kVp, 8 mA, 14.5 s) were performed twice, once with and once without coated nickel-titanium (Ni-Ti) archwires. The skull was placed in a water container to simulate soft tissue. Images were reconstructed with and without the MAR algorithm and analyzed using ImageJ software to determine the Contrast-to-Noise Ratio (CNR) at 15-, 20-, and 25-mm distances from the tooth center. Data were statistically analyzed using independent t-tests, ANOVA, and the Bonferroni test ($\alpha = 0.05$).

Results: the MAR algorithm did not significantly affect CNR, regardless of the presence of archwires ($p > 0.05$). However, CNR varied significantly depending on the tooth type and increased with greater distance from the tooth center ($p < 0.05$).

Conclusions: within the limitations of this *in vitro* study, the MAR algorithm did not significantly improve CBCT image quality for teeth with ceramic brackets, whether or not coated archwires were present.

LATEST INNOVATIONS IN THE PREVENTION AND MANAGEMENT OF DENTAL EROSION

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Aim: dental erosion is a progressive loss of dental hard tissues due to chemical processes involving acids. Its primary causes include dietary habits and medical conditions. While preventive measures primarily focus on fluoride-based remineralization and dietary modifications, emerging biomimetic technologies like nanomaterials and bioactive polymers are gaining attention. Restorative approaches remain necessary for advanced cases, despite the lack of standardized clinical protocols.

Methods: the inclusion criteria encompassed randomized controlled trials and retrospective analyses focusing on human subjects. Studies not written in English, in vitro experiments, and animal-based research were excluded.

Results: a total of 391 articles were retrieved, of which 34 met the inclusion criteria. These studies explored the effectiveness of fluoride-based treatments, novel protective varnishes, and minimally invasive restorative techniques such as CAD-CAM restorations and injection molding. Findings indicate that fluoride-enriched products, particularly those combined with calcium phosphate technologies, improve enamel resistance against acid challenges. Recent advancements in composite materials and digital workflows have enhanced the durability of restorative treatments.

Conclusions: fluoride continues to be a cornerstone in prevention, though innovative remineralizing agents and protective formulations are expanding treatment options. In cases of advanced erosion, conservative restorative techniques such as adhesive veneers and CAD-CAM restorations show promise.

INSTRUMENTAL AND VISUAL COLOR MATCH ASSESSMENT OF SINGLE AND MULTI-SHADE RESIN COMPOSITES USED FOR DIRECT CLASS V RESTORATIONS: A RANDOMIZED CLINICAL TRIAL

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Aim: this randomized clinical study aims to compare the chromatic correspondence between tooth and single- or multi-shade composites in class V restorations.

Methods: forty-five teeth with carious and non-carious cervical lesions were randomized obtaining 15 cavities restored with Essentia Universal (EU), 15 with Vittra Unique (VU) and 15 with Harmonize (HZ). Following selective enamel etching, adhesive procedures were performed with, respectively G-Premio Bond, Ambar Universal and Optibond Universal. Then, all composites were layered in 2 mm increments and light-cured for 20". Restorations were finished and polished through disks and rubbers. A color match between tooth and restoration was detected using a spectrophotometer (Rayplicker Cobra) after 7 days, 6 and 12 months, and through a visual evaluation performed by 6 expert observers after 7 days on a scale from 0 to 4 (where 0 means excellent match and 4 stands for absent match).

Results: instrumental analysis allowed to detect L*, a*, b*, C* and h° color coordinates, used to calculate ΔE_{00}, i.e. the color variation between the restorative material and the dental tissue. At 7 days the average ΔE00 was 1.44±0.45 (EU), 1.9±0.65 (VU) and 1.5±0.46 (HZ). Visual analysis revealed that all materials were able to provide a good color correspondence, reporting values between 0 and 1.

Conclusions: single-shade composites seem to be able to achieve a color match between tooth and restoration as accurate as group-shade composites. Moreover, the existing slight differences seem to go undetected by a visual observation.

CARIES DEPTH CLASSIFICATION USING RADIOMICS: A NON-INVASIVE ALTERNATIVE TO RADIOGRAPHS

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Aim: conventional methods for detecting dental caries rely on visual inspection and radiographs, mainly to evaluate lesion depth. While Deep Learning has been used to assess the extent of caries, no study has applied radiomic features from intraoral photos to determine how deep the lesion extends. This study explores a radiomics-based Machine Learning (ML) approach for estimating caries extent and depth using photographic images, traditionally assessed with radiographs.

Methods: standard intraoral photos were taken with a Nikon D7500 and an MF-R76 macro flash, including only healthy and carious teeth. The images, once resized and segmented with Labelme, were classified using ICDAS and E-D scales. Data augmentation increased the dataset. Radiomic features were extracted from each color channel using Pyradiomics. Feature selection (AUC-ROC, ReliefF, LASSO, backward selection) was applied within 5-fold cross-validation to prevent bias. ML classifiers (LDA, k-NN, SVM, NNET) were used to evaluate accuracy, sensitivity, and specificity. Model interpretability was explored using partial dependence plots, residuals, and breakdown profiles.

Results: the NNET model with backward selection showed high performance, with accuracy between 87.6 and 95.4%. Sensitivity ranged from 61.5 to 93%, and specificity varied between 73 and 90%. The red channel's greater impact reflects its ability to mimic near-infrared light transillumination, enhancing contrast between healthy and decayed tissue. The blue channel had a lesser impact, but combined RGB channels yielded the best accuracy.

Conclusions: this ML-radiomics method offers a reliable, non-invasive way to classify caries depth using intraoral images as a cost-saving alternative to radiographs.

EVALUATING THE IMPACT OF AUGMENTED REALITY ON THE RESTORATION OF CLASS I CAVITIES IN MOLARS: A COMPARATIVE ANALYSIS OF CONVENTIONAL AND ADVANCED TECHNIQUES

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Aim: this study aims to evaluate the effectiveness of Augmented Reality (AR) in reconstructing Class I cavities on an upper first molar model by comparing three surgical techniques: direct vision, 2D AR headset and 3D AR headset. Precision, depth perception, hand-eye coordination and overall user experience were evaluated.

Methods: the study involved 23 participants, each of whom reconstructed three Class I cavities using the three different techniques. At the end of the procedures, a structured questionnaire was administered to collect data on perceived effectiveness, ease of use, speed of execution and visual comfort. The data were statistically analysed to identify significant correlations between the variables reported and the techniques used.

Results: the use of AR showed a significant improvement in hand-eye coordination and depth perception compared to direct vision. The 3D AR headset was preferred by most participants for modelling the occlusal surface. However, some participants reported visual discomfort with prolonged use of the headset.

Conclusions: the use of augmented reality, particularly through the 3D headset, improved the quality of the restoration process and the overall user experience compared to traditional techniques. However, some issues related to visual comfort during prolonged use still need to be addressed. These findings suggest that with further technological improvements, augmented reality could become a valuable tool in both clinical practice and university education.