Materials and methods: he experimental specimens were grouped as follows: SD, CAD, and ITCM-pretreated CAD (CAD-ITCM). Dentin slices were obtained for Attenuated Total Reflectance-Fourier Transform Infrared (ATR-FTIR) analysis. The bonded samples were subjected to microtensile bond strength analysis after 24 h of water storage or aging by thermocycling, and the bonding interface quality was evaluated by nanoleakage assessment, interfacial nanoindentation testing, and in situ zymography. Cytotoxicity experiments with ITCM were performed.

Results: FTIR showed that the isocyanate groups in ITCM can covalently bind and form hydrogen bonds with the collagen in CAD to mediate chemical bonding. ITCM pretreatment significantly improved the bond strength of CAD, reduced interfacial nanoleakage, improved the sealing of the bonding interface, enhanced the homogeneity of the hybrid layer, and inhibited matrix metalloproteinase activity. In addition, ITCM presented acceptable biocompatibility for dental restorative application.

Conclusions: This study reported the application of ITCM to induce collagen based chemical bonding in the CAD bonding system, which fills the gap in strategies to improve the bonding performance of CAD immediately and after aging and has important clinical application prospects.

Key Words: Caries-affected dentin, Dental adhesives, Dental diseases, Dental restoration, Collagen, Cross-Linking Reagents, Matrix metalloproteinases, Dental Leakage.

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CA2223

Untargeted Salivary Metabolomics In Early Childhood Caries

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Aim or purpose: This study employs comparative salivary metabolomics in Han and Uyghur children with caries to identify ethnicity-specific metabolic pathways (e.g., oxidative phosphorylation) and biomarkers, advancing personalized prevention strategies.

Materials and methods: Saliva from 20 caries-active children underwent untargeted metabolomic profiling. Differential metabolites were selected via PLS-DA (VIP >1, P <0.05), with functional pathway enrichment analyzed using KEGG. Caries severity was stratified (mild/moderate/severe) for subgroup analyses.

Results: Untargeted metabolomics identified 787 metabolites, with ethnic comparisons revealing 103 differentially expressed metabolites (91 upregulated in Han children). Key enriched pathways included linoleic acid metabolism (P = 0.002), citric acid cycle (P = 0.008), and unsaturated fatty acid biosynthesis (P = 0.015). Stratification by severity revealed distinct signatures: mild caries involved 159 metabolites linked to platelet activation (P = 0.004) and coenzyme A biosynthesis (P = 0.011), while severe caries featured 30 metabolites associated with oxidative phosphorylation (P = 0.006) and cortisol synthesis (P = 0.019). Han children exhibited heightened activity in lipid/energy metabolism pathways compared to Uyghur counterparts.

Conclusions: This study reveals Han children's caries susceptibility linked to disrupted amino acid catabolism (P<0.01) and mitochondrial oxidative phosphorylation. Moderate caries lacked metabolite shifts, indicating stage-specific biomarker potential. Ethnic metabolic divergence supports saliva's diagnostic utility and ethnically tailored prevention. Dysregulated pathways in lipid homeostasis (e.g., citrate cycle, P=0.008) and bioenergetics highlight targeted interventions.

Key Words: early childhood caries, metabolomics, different ethnic groups, saliva.

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3. Dental Treatment & Restorative Dentistry - 3.1 Caries
Case Report – free communications

CA6613

Qraypen In Residual Caries Detection And Cavity Disinfection

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Introduction: Residual bacterial activity after selective caries removal may compromise restoration longevity. QrayPen, a fluorescence-based device, enables real-time detection of red fluorescence (ΔR) and maximum red fluorescence (ΔRmax)—markers of bacterial activity. This case series explores QrayPen's utility in identifying residual caries and evaluating the antibacterial effect of 2% chlorhexidine digluconate applied as a cavity disinfectant.

Case description: Five adult patients with active dentinal caries underwent selective caries removal. QrayPen was used to measure ΔR and ΔRmax before and after chlorhexidine application. Measurements were standardized in a dark environment with consistent drying and probe positioning. Lesions were also evaluated using ICDAS II, Nyvad criteria, and ICCMS radiographic scores. All five cases showed detectable fluorescence post-caries removal; post-disinfection readings indicated reduced bacterial activity.

Discussion: The findings suggest QrayPen can identify residual bacterial presence undetectable by conventional visual-tactile methods. The observed decrease in ΔR and ΔRmax values after chlorhexidine application supports its effectiveness as an adjunctive diagnostic tool. This dual use may enhance decision-making in minimally invasive restorative protocols by confirming both cleanliness of the cavity and efficacy of disinfection.

Conclusion/clinical significance: QrayPen may aid clinicians in verifying caries removal and evaluating cavity disinfection in real time. Its integration into routine practice could support more conservative and evidence-based restorative treatments, improving long-term outcomes.

Key Words: QrayPen Fluorescence imaging Residual dentin caries Chlorhexidine digluconate Red fluorescence (ΔR) Cavity disinfection.

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CA6395

Combined Periodontal-Restorative Therapy For Mandibular Second Molar Distocervical Caries

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Introduction: Distocervical caries in mandibular second molars induced by impacted third molars present significant therapeutic challenges due to limited access. This report introduces a novel 5-year follow-up of combined therapy for such case, establishing its clinical validity.

Case description: A 37-year-old female presented with persistent sensitivity in tooth 37 following composite resin filling after the extraction of the impacted left mandibular third molar. Clinical/radiographic evaluations revealed subgingival defective filling, extensive caries, and marginal gap. Treatment included: 1. Full-thickness flap elevation for lesion exposure 2. Dental operative microscope-assisted removal of defective filling and caries excavation 3. Composite resin restoration using adhesive technique 4. Flap repositioning and suturing Five-year follow-up confirmed intact restoration, normal periodontal status, and no radiographic recurrence.

Discussion: Key advantages of this approach: 1. Surgical exposure improved visualization and precision for subgingival caries management 2. Preservation of distal marginal ridge maintained tooth structural integrity 3. Adhesive restoration combined with periodontal care ensured long-term success.

Conclusion/clinical significance: Combined periodontal-restorative therapy offers an alternative to extraction for mandibular second molar distocervical caries induced by impacted mandibular third molars. The technique preserves tooth function while minimizing invasive procedures, making it particularly suitable for younger patients.

Key Words: distal cervical caries, mandibular second molar, combined therapy, tooth impaction, mandibular third molar.

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CA5397

Innovative Restorative Protocol For Irreversible Pulpitis: A 3-Year Study

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Introduction: This study presents the "Pulpitis Restorative Protocol" (PRP), a novel approach for managing deep caries with reversible pulpitis (RP) and symptomatic irreversible pulpitis (IP) using standard restorative materials. PRP offers a high success rate and minimal post-operative pain, providing a more conservative and simpler IP treatment alternative to endodontic treatment.

Case description: This prospective case series treated 25 patients with PRP (15 IP, 10 RP), with follow-up from 3 to 36 months (5 cases 3-11 months, 12 cases 12-23 months and 8 cases 24-36 months). Clinical success was achieved in 13 of 15 IP cases and 9 of 10 RP cases. At 24 hours post-treatment, all patients—and 92% on the same night—reported little or no pain without analgesics

Discussion: PRP employs a combination of glutaraldehyde and resin-modified glass ionomer (RMGI) in an alkaline environment which may activates glutaraldehyde's protein cross-link activity to sterilize dental cavity, denature the bacterial toxin and inflammatory factors, exert its apoptosis effect on necrotic pulp tissue adjacent to caries to eliminate pulp inflammation and accomplish pain relief.

Conclusion/clinical significance: PRP is a simple, affordable alternative for managing symptomatic IP, especially in emergency or rural settings with limited endodontic access. Applicable to both RP and IP, it offers rapid pain relief, reducing the need for analgesics and the risk of narcotic misuse. PRP may also prevent post-restorative pain in deep caries or serve as a temporary measure. Its effectiveness and broad potential warrant further validation through randomized clinical trials

Key Words: Irreversible pulpitis, restorative protocol, pain control, reversible pulpitis.

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CA5036

Silver Diamine Fluoride: Caries Arrest And Aesthetic Smile Rehabilitation

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Introduction: Silver diamine fluoride (SDF), a minimally invasive topical agent, has gained recognition for its capacity to arrest dental caries. Emerging evidence supports SDF's role in bridging preventive and restorative dentistry, aligning with the global shift toward minimally invasive, patient-centered care.

Case description: A 34-year-old male with a high caries risk index—exacerbated by chronic tobacco use and drug addiction—presented with multiple active cavitated lesions across anterior and posterior teeth, seeking a comprehensive smile rehabilitation to regain employability and psychosocial confidence. Given his complex medical history and limited initial capacity for extensive restorative care, silver diamine fluoride (SDF) was prioritized as a first-line therapy to arrest caries progression. Over three monthly applications, SDF's antimicrobial and remineralizing properties stabilized lesions. Interim glass ionomer restorations were placed in esthetically sensitive zones to restore function while managing aesthetic compromises. Following six months of caries arrest, smoking cessation support, and improved oral hygiene compliance,