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What's new for the clinician – summaries of recently published papers (May 2026)

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1. SCOTCHBOND UNIVERSAL ADHESIVE (SBU) VS SCOTCHBOND UNIVERSAL ADHESIVE PLUS (SBU+) FOR CLINICAL APPLICATION IN POSTERIOR COMPOSITE RESTORATIONS: A RANDOMIZED CLINICAL TRIAL

Universal dental adhesives, introduced in 2011, represent a significant evolution in adhesive dentistry by offering clinicians the flexibility to function as etch-and-rinse (ER), self-etch (SE), or selective enamel etching (SEE) systems. The central mechanism underlying their performance is ionic adhesion to tooth structure, primarily mediated by acidic functional monomers—most notably 10-methacryloyloxydecyl dihydrogen phosphate (MDP)—which form nano-layered MDP-calcium salts within the adhesive interface.

Scotchbond Universal Adhesive (SBU) has established a robust clinical track record, while Scotchbond Universal Plus (SBU+) offers several technical refinements: dual/self-cure compatibility without a separate activator, a Bis-GMA-free radiopaque crosslinking monomer, and an extended silane chain eliminating the need for a separate ceramic primer. Despite promising laboratory data, peer-reviewed clinical trials of SBU+ in posterior restorations remain scarce.
This equivalence trial addresses this evidence gap by comparing SBU+ against SBU (control) in Class I and II restorations using the SE technique. The investigators hypothesized no difference in 2-year clinical outcomes assessed by FDI criteria. The study is particularly relevant given ongoing debate about SE versus ER/SEE strategies, with prior NCCL studies suggesting ER/SEE superiority for retention, while Class I/II data indicate SE technique equivalence.

METHODOLOGY

Study Design

Prospective, double-blind, randomized, paired-comparison clinical trial with 2-year follow-up, conducted at the University of Minnesota Oral Health Clinical Research Center (June 2022–March 2025). The paired design (each subject receiving both adhesives) controls inter-subject variability.

Participants

51 healthy adults (55% female, median age 30 years, range 18–68) from university dental clinics. Four screening failures occurred. Each subject received two posterior restorations (102 total).

Randomization & Blinding:

Teeth randomized 1:1 via centralized electronic system (Zelta) after preparation but before adhesive application. Evaluators and subjects were blinded; operators were not (due to distinguishable adhesive colors).

Interventions: Class I/II preparations restored with Filtek Universal Restorative composite following manufacturer instructions. Both adhesives applied in SE mode. Isolation with Isovac; V3-ring sectional matrices for Class II. Deep dentin cases received calcium hydroxide liner plus Vitrebond Plus RMGIC base. Adhesives and composite cured with Elipar DeepCure-S LED (1470 mW/cm^2).

Outcomes: FDI World Dental Federation criteria assessing esthetic, functional, and biological properties. Primary endpoints: fracture/retention, marginal adaptation, marginal staining, surface luster, postoperative sensitivity, color match, translucency. Secondary endpoints: proximal anatomical form, surface staining, caries recurrence.

Calibration: Two independent evaluators trained using 13 photographs; calibrated with 25 photographs. Inter-rater Cohen's Kappa: 0.63–0.87 (except color match/translucency: 0.55). Recalibration occurred after 6 months when a new evaluator joined.

Statistics: Wilcoxon signed-rank test for continuous/ordinal data; McNemar/Cochran-Mantel-Haenszel for categorical data. Two-tailed $\alpha = 0.05$. SAS v9.4. Analysis with and without imputation for primary endpoints; per-protocol for secondary endpoints.

Sample Size Justification: 50 subjects (100 restorations) with 20% anticipated attrition to yield 40 completers. Based on 1.0–3.5% annual failure rates, expected 3.3% annual failure with upper 95% CI limit of 7.7% using Wilson score method.

RESULTS

Follow-up: 13 subjects withdrew by 2 years (25.4% attrition vs. predicted 20%), yielding 38 subjects with primary 2-year data. One additional tooth withdrawn for non-compliance.

Primary Endpoints:

Table: Summary of Primary Endpoints

Criterion	Key Finding at 2 Years
Retention	100% for both SBU+ (37/37) and SBU (38/38)
Fracture/Retention	SBU+: 97% "Excellent/Very Good," 3% "Satisfactory"; SBU: 100% "Excellent/Very Good" ($p > 0.05$)
Marginal Adaptation	All clinically acceptable; no significant difference
Marginal Staining	All acceptable; no significant difference
Surface Luster	All acceptable; no significant difference
Postoperative Sensitivity	100% absence in both groups
Color Match/Translucency	Significant difference at 6 months (SBU lower, $p = 0.016$); no difference at 1 or 2 years

Secondary Endpoints:

- **Proximal Anatomical Form (Class II only):** SBU slightly better but not statistically significant
- **Surface Staining:** 95% SBU+ vs. 97% SBU "Excellent/Very Good" ($p > 0.05$)
- **Recurrent Caries:** None observed at 2 years in either group

Notable Observations:

- At 6 months, both groups showed some reduction in marginal adaptation, marginal staining, and surface luster compared to baseline, though all remained clinically acceptable
- No restorations scored "Clinically Insufficient/Unsatisfactory" or "Clinically Poor" for any criterion at any timepoint
- The transient color match/translucency difference at 6 months resolved by 1 year

Key Conclusions at 2 year follow-up:

- No restoration failures or recurrent caries in either group
- All FDI criteria clinically acceptable for both adhesives
- The SE technique with MDP-containing universal adhesives produces durable outcomes in Class I/II restorations
- Ionic bonding mechanisms (MDP-Ca salts and polyalkenoic acid copolymer-calcium interactions) likely explain the clinical resilience despite mild self-etching on enamel

Implications for Practice

- **Clinical Equivalence:** SBU+ can be substituted for SBU in posterior composite restorations without compromising 2-year clinical outcomes. The additional features of SBU+ (dual/self-cure compatibility, Bis-GMA-free formulation, integrated silane) offer practical advantages without performance penalty.

- **Self-Etch Viability:** This trial adds to accumulating evidence that the SE technique with MDP-containing universal adhesives is clinically viable for posterior restorations, challenging the dogma that ER or SEE is mandatory for enamel bonding. The ionic bonding mechanism appears to compensate for limited enamel demineralization.

- **Material Selection:** The importance of MDP and polyalkenoic acid copolymers in adhesive composition is reinforced. Clinicians should prioritize adhesives with demonstrated ionic bonding capability, particularly when using SE protocols.

- **Patient-Centered Outcomes:** The complete absence of postoperative sensitivity and recurrent caries supports patient comfort and safety. The transient color match difference at 6 months (favoring SBU+) is of limited clinical significance given resolution by 1 year.

- **Limitations in Translation:** The 25% attrition rate and academic center setting suggest cautious generalization to private practice. The paired design, while statistically efficient, may not capture population-level variability as effectively as parallel-group designs.

- **Long-term Monitoring:** While 2-year data are encouraging, longer follow-up (3–5 years) remains necessary to confirm durability, particularly for marginal adaptation and color stability where subtle degradation may progress over time.

REFERENCE

1. Perdigão, J., Trauger, K.A., Campbell, C.I. *et al.* Prospective, randomized, paired-comparison clinical trial of a new universal adhesive in posterior composite restorations: A 2-year evaluation. *Clin Oral Invest 30*, 113 (2026). https://0-doi-org.innopac.wits.ac.za/10.1007/s00784-026-06799-7

2. TIMING AND EXTENT OF PERI-IMPLANT BONE LOSS FOR DENTAL IMPLANT REMOVAL

Dental implant therapy has revolutionized oral rehabilitation, with survival rates exceeding 90% over two decades – a testament to advances in osseointegration science and peri-implant tissue management. However, as implant utilization has expanded globally, implant failure has emerged as a significant clinical concern requiring systematic investigation. Implant loss is broadly categorized into early failure (during osseointegration, prior to prosthetic loading) and late failure (following functional loading), with distinct etiological profiles. Early failure, affecting approximately 1.5% of placed implants, is attributed to infection, inflammatory processes, and potentially foreign body reactions characterized by soft tissue encapsulation. Late failure is predominantly driven by biological and biomechanical factors, with peri-implantitis – an inflammatory disease characterized by progressive crestal bone loss – serving as the leading cause.

Despite extensive research on peri-implant disease prevalence and risk factors, a critical knowledge gap persists regarding the temporal dynamics and morphological characteristics of bone loss at the point of implant removal. Existing literature has focused primarily on disease prevalence and therapeutic interventions, while the terminal stage of implant failure – specifically when and how clinicians decide to remove implants – has not been systematically characterized. Understanding these patterns is essential for refining diagnostic thresholds, optimizing intervention timing, and developing evidence-based guidelines to prevent progression to irreversible failure.

This retrospective cross-sectional study by Halstenbach and colleagues (2026)[1] addresses this gap by analyzing 738 removed dental implants across a 10-year period (2014–2024) at the University of Freiburg. The investigation is particularly timely given the increasing recognition that peri-implantitis progresses in a non-linear fashion, with accelerated bone loss in advanced stages. The study aims to correlate implant loss timing with radiographic bone loss levels and defect morphology, offering clinicians practical benchmarks for decision-making.

METHODOLOGY

This retrospective, cross-sectional, monocentric study was conducted at the Department of Oral and Maxillofacial Surgery, University Medical Center Freiburg, Germany and included all available patients referred for implant removal between 2014 and 2024.

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- **Inclusion and Exclusion Criteria:** Participants were adults (≥18 years) with at least one dental implant scheduled for removal and radiographs of adequate quality (panoramic or intraoral) taken within six months prior to removal. Cases were excluded if radiographs were of inferior quality (mispositioning, low resolution, motion artifacts) or if the implant was incompletely depicted.

- **Study Design Considerations:** The investigators appropriately acknowledge a fundamental limitation: the cohort comprises only implants referred for removal, characterizing terminal conditions without comparison to surviving implants. The selective nature of the sample – reflecting referral patterns to a tertiary academic center – introduces inherent bias that the authors transparently discuss.

- **Data Acquisition:** Comprehensive demographic and clinical data were collected, including patient gender, age at placement and removal, implant position, reason for removal, anamnestic factors (head/neck radiation, antiresorptive medication), implant manufacturer, and timing variables. Notably, insufficient clinical data on probing depth and bleeding on probing necessitated use of "peri-implant inflammation" as an umbrella term encompassing peri-implantitis, suppuration, abscess formation, pain, and implant loosening.

- **Radiological Assessment:** Bone loss was quantified as relative radiological bone loss (%BL), calculated as the ratio between bone defect (BD) and implant length (IL), measured from the most coronal point of the intraosseous implant portion. This approach mitigates distortion effects inherent in panoramic radiography. Measurements were performed using DeepUnity Diagnost software.

- **Defect Classification:** Peri-implant bone defects were classified according to Monje et al.'s system: Class I (intraosseous), Class II (supracrestal/horizontal), and Class III (combined), with severity graded as Slight (<25%), Moderate (25–50%), and Advanced (>50%) bone loss. The authors appropriately note that two-dimensional radiography cannot reliably distinguish subtypes within Classes I and III (buccal dehiscence, 2–3 wall defects, circumferential defects), limiting three-dimensional morphological assessment.

- **Methodological Strengths:** The large sample size (738 implants from 462 patients) represents one of the most extensive retrospective cohorts of removed implants in the literature. The use of relative bone loss (rather than absolute measurements) standardizes comparisons across implant lengths and radiographic modalities. The explicit acknowledgment of limitations demonstrates methodological rigor.

- **Methodological Limitations:** The absence of Cone Beam Computed Tomography (CBCT) is a significant constraint, as buccal and lingual defect components cannot be assessed with two-dimensional imaging, potentially leading to misclassification of combined defects. The retrospective design precludes standardized clinical data collection, resulting in missing information on critical confounders including smoking history, periodontal status, and detailed clinical inflammatory parameters. The monocentric design limits generalizability to other clinical settings with different referral patterns and maintenance protocols.

RESULTS

- **Cohort Characteristics:** The study included 738 implants from 462 patients (56% male, mean age at removal 66 ± 13 years). Maxillary implants accounted for 55% of cases, with mandibular implants representing 45%. The first molar was the most frequently removed position in the mandible, while premolars and first molars predominated in the maxilla.

- **Timing of Implant Loss:** Early implant loss (prior to prosthetic loading) occurred in 107 cases (14.5%). Late implant loss accounted for 85.5%, with peri-implant inflammation as the dominant cause (71% of late losses). Other reasons—mechanical failure, osteonecrosis, aesthetic/prosthetic concerns, and displacement – were comparatively rare. The reason for removal was unclear in 8% of cases.

For the 183 late-loss implants with known placement dates, the mean functional duration was 7.4 ± 4.9 years (median 6 years). A notable peak in removals occurred at three years post-placement, with subsequent progressive decline. Mann-Kendall trend testing confirmed significant temporal association ($\tau = -0.645$, $p < 0.001$), while Pearson correlation indicated moderate strength ($r = 0.54$).

Radiological Bone Loss: Among inflammatory cases (n = 524, excluding osteoradionecrosis and MRONJ), mean bone loss at removal was 51% ± 28% (median 49%, IQR 32.43–67.05%). Mandibular implants demonstrated significantly greater bone loss (59% ± 31%) than maxillary implants (45% ± 23%) ($p < 0.001$). No significant differences in bone loss were observed across implant positions within either jaw.
Temporal analysis revealed that implants removed within 1–3 years exhibited mean bone loss of 36% ± 21%, while those removed at 8–10 years showed 60% ± 30% ($p = 0.002$). Complete loss of osseointegration (100% bone loss) increased from 18% in years 1–3 to 28% in years 8–10.

Defect Morphology: Class I (intraosseous) defects predominated (45.1%), followed by Class III (combined, 25%) and Class II (horizontal, 21.6%). No radiological bone loss was observed in 8.3% of cases. Class I and III defects were predominantly graded Advanced (>50% bone loss; 55% of these classes), while Class II defects were mainly Moderate (25–50%; 51% of Class II). Class II defects demonstrated significantly lower bone loss (47% ± 22%) compared to Class I (57% ± 28%, $p = 0.0007$) and Class III (55% ± 22%, $p = 0.0044$). The proportion of defect classes remained stable over time ($p = 0.7342$).

CONCLUSIONS

The authors present several key conclusions supported by their data. First, peri-implant inflammation is the dominant cause of late implant failure, accounting for 83% of cases. Second, implant removal most commonly occurs at approximately 50% radiological bone loss, with a peak in the early post-loading period (three years). Third, bone loss severity increases with implant functional duration, with advanced osseous destruction more prevalent in older implants. Fourth, intraosseous defects (Class I) are the most common morphology, though horizontal defects (Class II) appear more frequently in terminal cases than previously reported. Fifth, mandibular implants are removed at more advanced bone loss stages than maxillary implants, likely

reflecting anatomical and physiological differences in bone density and symptom presentation.

The authors appropriately acknowledge that implant removal decisions are multifactorial, incorporating patient factors, anatomical conditions, clinician experience, and socioeconomic considerations beyond radiographic thresholds alone.

IMPLICATIONS FOR PRACTICE

Diagnostic Thresholds: The finding that implants are typically removed at ~50% bone loss provides a practical benchmark for clinicians. Current reviews have identified this as an appropriate cutoff for considering explantation, beyond which regenerative prognosis becomes increasingly unfavorable. However, this should not be applied rigidly—individual patient factors and defect morphology must inform decisions.

Maintenance Protocol Intensification: The peak in implant removals at three years post-placement aligns with the established timeline for peri-implantitis onset. This underscores the critical importance of intensive maintenance during the first three years, with frequent professional cleaning and monitoring. Declining adherence to maintenance over time likely contributes to delayed diagnosis and more severe defects.

Defect-Morphology-Guided Treatment Planning: The high prevalence of Class I defects supports regenerative approaches in appropriately selected cases, while the significant proportion of Class II defects (21%) highlights the need for resective treatment expertise. Class II defects, associated with lower bone loss at removal, may represent cases where earlier intervention could have preserved the implant.

Jaw-Specific Considerations: The greater bone loss at mandibular implant removal suggests that clinicians may tolerate more advanced disease in the mandible before intervention, possibly due to delayed symptom presentation in denser bone. This warrants heightened vigilance for mandibular implants, where clinical signs may underestimate disease severity.

Imaging Limitations: The reliance on two-dimensional radiography in routine practice may underestimate defect complexity. While CBCT is not universally indicated, clinicians should consider three-dimensional imaging when defect morphology influences treatment planning, particularly for regenerative procedures.

Early Intervention: The progressive increase in bone loss with implant age, coupled with the poor prognosis of advanced defects, supports early, aggressive intervention when peri-implantitis is diagnosed. The temporal data suggest that implants surviving beyond the initial high-risk period may still develop severe disease if maintenance is neglected.

REFERENCE

1. Halstenbach, T., Semper-Hogg, W., Cieplik, F. et al. Timing and extent of Peri-Implant bone loss for dental implant removal: A retrospective Cross-Sectional analysis. Clin Oral Invest 30, 111 (2026).

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