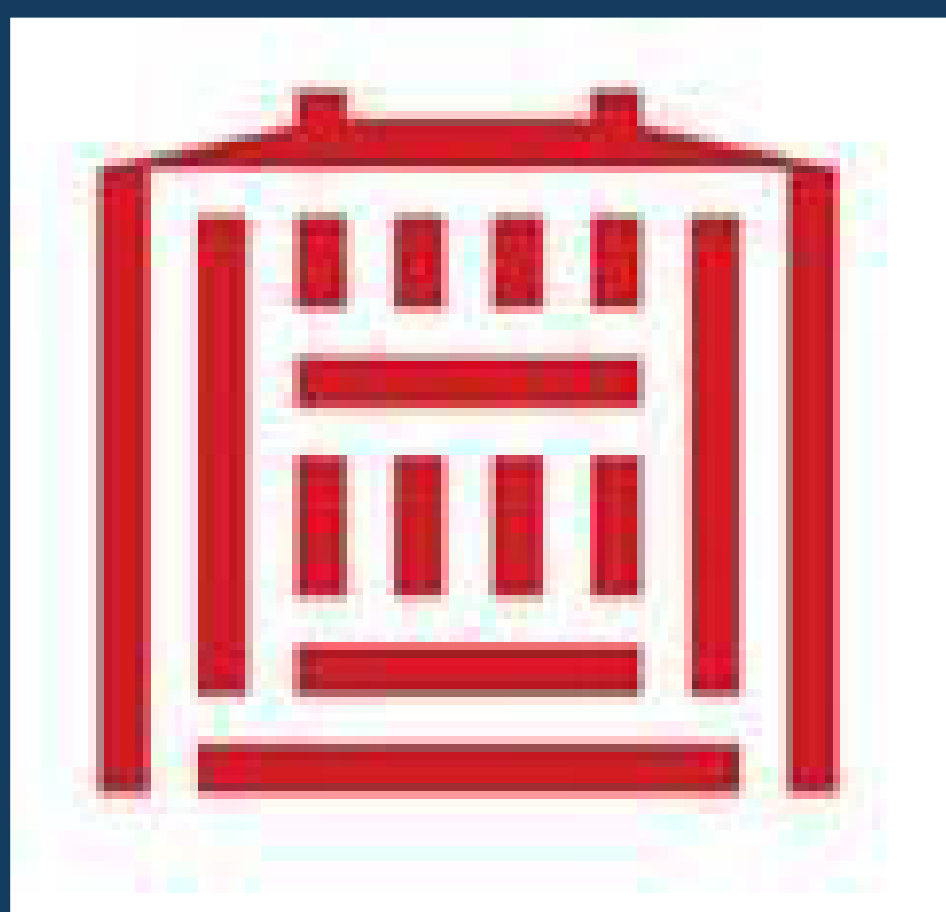


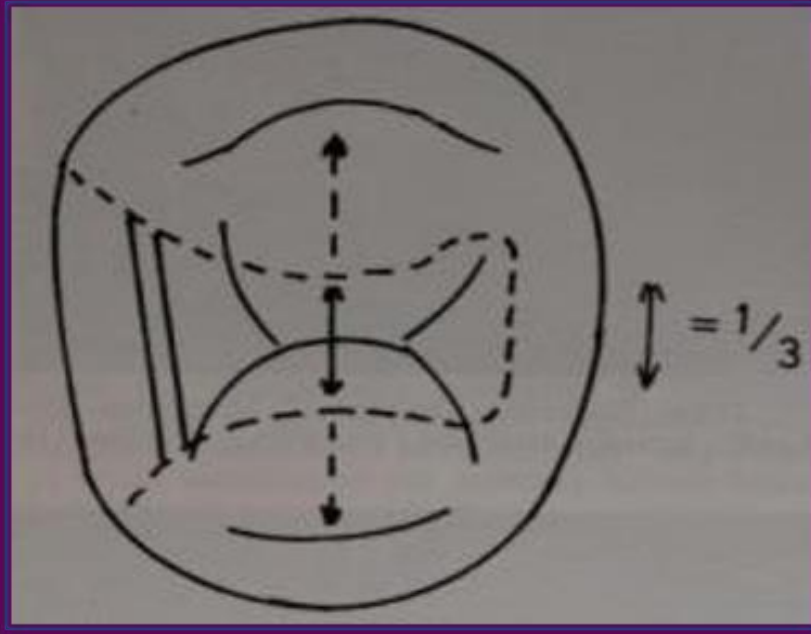
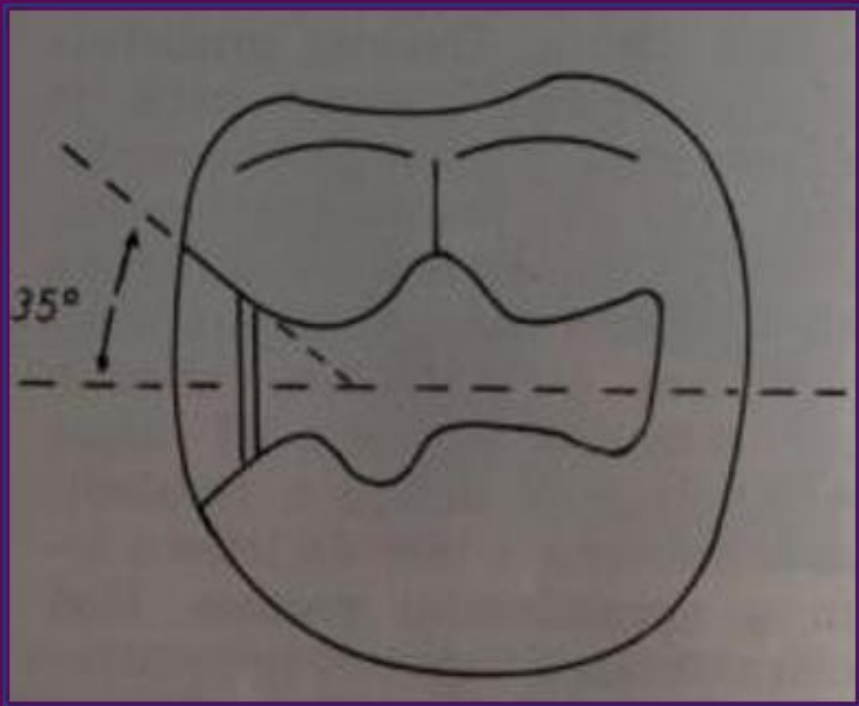
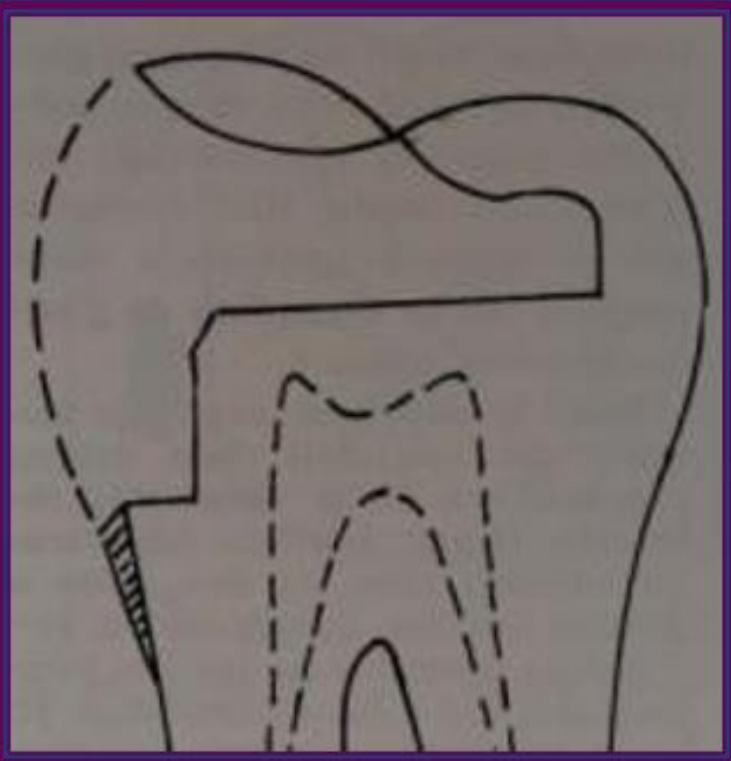
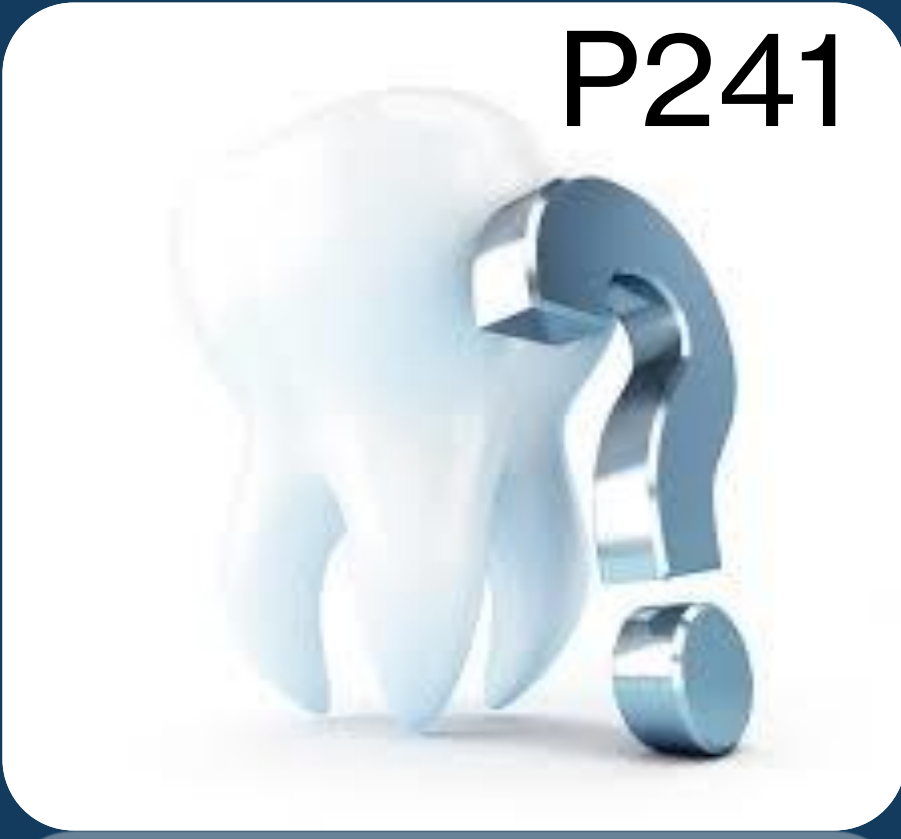


Microscopic evaluation of marginal adaptation in class II composites



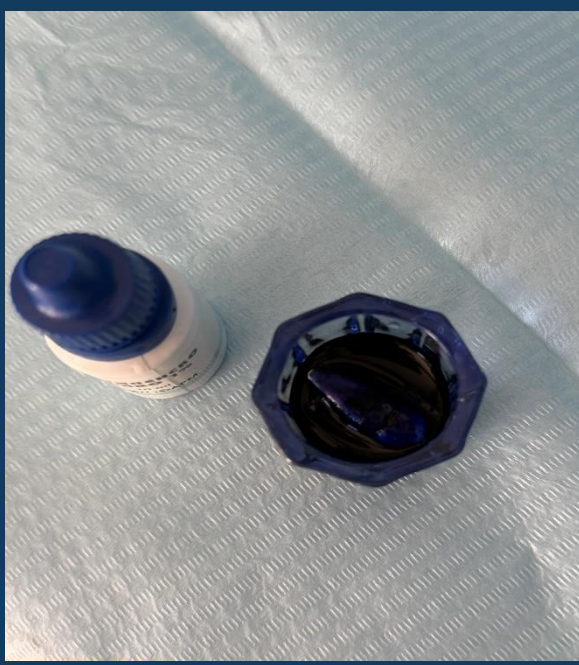
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Marginal adaptation is an important factor influencing the longevity and clinical performance of composite restorations. Inadequate marginal sealing may result in microleakage, postoperative sensitivity, secondary caries, and restoration failure. Differences in filler technology may affect polymerization behavior and adaptation at the tooth-restoration interface.



Aim

The aim of this in vitro study was to compare the marginal adaptation of three composite resins with different filler technologies in standardized Class II restorations using methylene blue dye penetration and microscopic evaluation.



Methods

Sixty extracted intact human teeth were selected and prepared with standardized Class II cavities. The teeth were randomly allocated into three groups (n = 20 per group) according to the restorative material used: Filtek Z350 XT Universal Restorative (3M), a nanofilled composite; Tetric EvoCeram Direct (Ivoclar Vivadent), a nanohybrid composite; and Herculite XRV Ultra (Kerr Corporation), a microhybrid composite. All restorations were performed using Scotchbond Universal Adhesive (3M). The composites were placed incrementally and polymerized using an LED curing light, followed by finishing and polishing.

Marginal microleakage was evaluated using a methylene blue dye penetration method. The specimens were immersed in 0.5% methylene blue solution for 24 hours, and sectioned longitudinally through the center of the restorations. The sections were examined under an endodontic microscope, and dye penetration was scored from 0 to 3.



Results

Of the 60 restorations evaluated, 52 (86.7%) demonstrated no dye penetration (Score 0), while 8 restorations (13.3%) showed limited dye penetration (Score 1). No specimens demonstrated Scores 2 or 3. Limited dye penetration occurred predominantly in the microhybrid group.

Kruskal-Wallis analysis demonstrated a statistically significant difference among the three composite groups (p = 0.03), with the nanofilled composite demonstrating the most favorable marginal adaptation.

Composite material	n	Score 0No penetration	Score 1Limited penetration	Score 2	Score 3
Filtek Z350 XTNanofilled	20	20 (100%)	0 (0%)	0	0
Tetric EvoCeram DirectNanohybrid	20	19 (95%)	1 (5%)	0	0
Herculite XRV UltraMicrohybrid	20	13 (65%)	7 (35%)	0	0
TOTAL	60	52 (86.7%)	8 (13.3%)	0	0

Conclusion

All tested composite resins demonstrated generally good marginal adaptation under the conditions of this in vitro study. The nanofilled composite showed the most favorable marginal adaptation, suggesting that filler technology may influence marginal sealing at the tooth-restoration interface. Further laboratory and clinical studies are needed to confirm these findings and determine their potential clinical relevance.

