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Durability of Bonds between Luting Cements and High-Gold-Content Alloy

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Poster Award
Best Poster of Conference

Introduction

Luting cements must withstand the forces of mastication and parafunction in the warm and moist oral environment for many years and maintain their integrity while transferring stress from crowns or FPDs to tooth structures.

Objectives

Purpose

- Determine long-term bond strength of various luting cements to high-gold-content alloy
- Determine influence of artificial aging
- Examine the mode of failure

Material and Methods

Preparation of specimens

- High-gold-content alloy (Portadur P4; Wieland, Germany) specimens (Ø = 10 mm, h = 1 mm)
- Plastic ring, embedded with slow-polymerizing epoxy (Palapress Vario; Heraeus Kulzer, Germany)
- Wet grinding to 600 grit using SiC sandpaper (Buehler, USA)
- Ultrasonic cleaning in 96% isopropanol for 3 min

Surface Treatment

- Airborne-particle abrasion with 100 µm aluminium oxide at 2.8 bar and a distance of 10 mm for 10 seconds
- Application of alloy primer according to the manufacturer\'s instructions (Panavia F/Alloy primer; Nexus 2/Optibond solo plus; Calibra/Prime&Bond NT and Selfcureactivator)

Material	Manufacturer	Type
PermaCem	DMG Hamburg, Germany	dual-polymerzing compomer cement
RelyX ARC	3M ESPE Seefeld Germany	dual-polymerzing resin cement
Panavia F	Kuraray Osaka Japan	dual-polymerzing resin cement

Nexus 2	Kerr Orange USA	dual-polymerzing resin cement
Calibra	Dentsply DeTray Konstanz Germany	dual-polymerzing resin cement
RelyX Unicem	3M ESPE Seefeld Germany	dual-polymerzing self-adhesive universal resin cement

Tab. 1: Luting cements

Bonding Procedure

- Specimens randomly assigned to 12 groups (n = 8 each)
- Materials handled according to the manufacturer\'s instructions (Table 1)
- Gelatin capsules (Ø = 5.5 mm; Torpac Inc., Fairfield, USA) filled with composite to within 2 mm below the rim
- Capsules bonded perpendicular to the pre-treated high-gold-content alloy surface, applying a weight of 200 g for 10 min using a custom-made device

Specimen Treatment

- Group A = aged and tested after 150 day / 37° water storage
- Group B = aged and tested after 150 day / 37° water storage, subsequently thermally cycled 37,500 times (Willytec Typ V2.8; Willytec, Germany) between 5 °C and 55 °C

Bond Strength Testing

- Applying shear force using a universal testing machine (Zwicki 1120; Zwick, Germany) at constant crosshead speed of 0.5 mm/min (Figure 1)

Mode of failure

- Examination under a light microscope (Stemi 2000-C; Zeiss, Germany), magnification 30x
- Cohesive failure within the bonding substrate, adhesive failure between the cement-bonding substrate interface, or mixed failure

Statistical Analysis

- Two-way ANOVA model with all main effects (cementing agent (6 levels) and time of measurement (2 levels))
- Multiple pairwise comparisons (Tukey)
- Significance level (α=0.05)

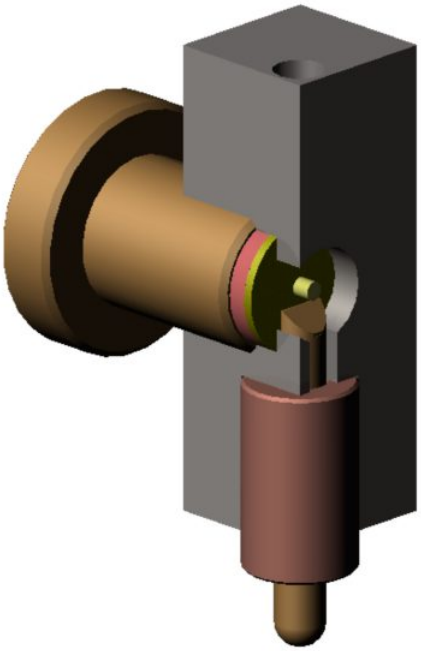

Fig 1: Mounting jig

Results

- Two-way ANOVA model analyzed significant differences between all main effects (all p<0.0001) and all corresponding interactions (p=0.0376)
- Significant differences (p<0.0001) existed between the six luting cements, and the two times of measurement
- Panavia F reached the highest bond strength values (10.8 ± 2.0 MPa), followed by RelyX Unicem (9.4 ± 0.8 MPa)
- Significant differences (all p<0.02) were seen between Panavia F and all other materials (PermaCem, RelyX ARC, Nexus 2, Calibra, and RelyX Unicem)
- After 150 days of storage in water and subsequent thermal cycling (37,500X), bond strength was significant lower (6.1 ± 2.7 MPa) than after 150 days of storage in water alone (7.5 ± 2.3 MPa) (p<0.0001)
- Failure modes were completely adhesive between the cement-bonding substrate interface

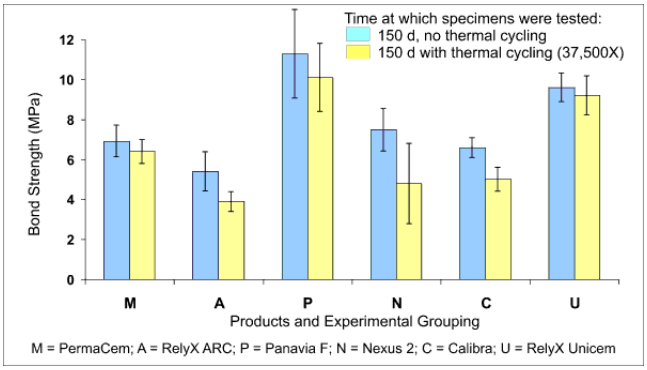

Fig 2: Mean bond strengths of luting cements to high-gold-content alloy (Portadur P4), pre-treated with 100 µm Al2O3

Conclusion

- The resin cement Panavia F and the self-adhesive universal resin cement RelyX Unicem yielded the highest bond values to high-gold-content alloy over time and after artificial aging
- These cements may be more suitable for the application examined in this in-vitro study

Bibliography

1. Cobb DS, Vargas MA, Fridrich TA, Bouschlicher MR. Metal surface treatment: characterization and effect on composite-to-metal bond strength. Oper Dent 2000;25:427-33.
2. Mojon P, Hawbolt EB, MacEntee MI, Ma PH. Early bond strength of cementing agents to a precious alloy. J Dent Res 1992;71:1633-9.

This Poster was submitted by Dr. med. dent. Andree Piwowarczyk.

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Poster Faksimile:

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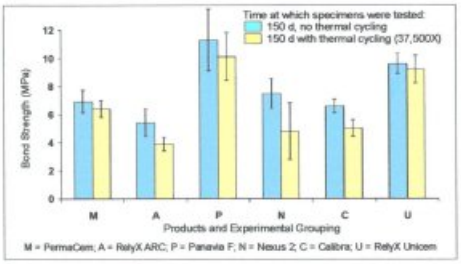

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