

Introduction

Acetal resin is a **monomer free** thermoplastic material used in prosthodontics for removable and **fixed applications**.

Acetal resin is considered a viable alternative in fixed prosthodontic provisionals for patients **with monomer allergies**.

Limited to no information exists on the **bond strength of milled acetal resin relined with chairside materials**.



Figure 1. Full arch milled acetal resin provisional

Objectives

1. Evaluate the shear bond strength of CAD/CAM milled acetal resin to bisacryl following **four different surface treatments**.
2. Evaluate the results of CAD/CAM milled **polymethylmethacrylate (PMMA)** bonded to PMMA treated with the **same protocols**.

Materials and Methods

A rectangular block with a base of 10mmX10mmX22mm was designed using CAD software and 80 blocks total were milled in Acetal Resin (n=40) and Polymethyl Methacrylate (n=40).

Four experimental groups were created based on the applied surface treatment for Acetal Resin and PMMA:

1. No Surface Treatment (n=10 Acetal Resin, n=10 PMMA)
2. Air Particle Abrasion (n=10 Acetal Resin, n=10 PMMA)
3. Monomer (for PMMA, n=10) and Universal Bond (Acetal Resin, n=10)
4. Air Particle Abrasion + Monomer (PMMA, n=10) or Air Abrasion + Universal Bond (Acetal resin, n=10)

A standardized bonding procedure was applied using a 3D-printed jig, and a bisacryl reline material was applied for acetal samples (based on manufactures recommendations), and PMMA reline material was used for PMMA samples. Shear bond strength was tested using an Instron universal testing machine at a crosshead speed of 1 mm/min until failure.

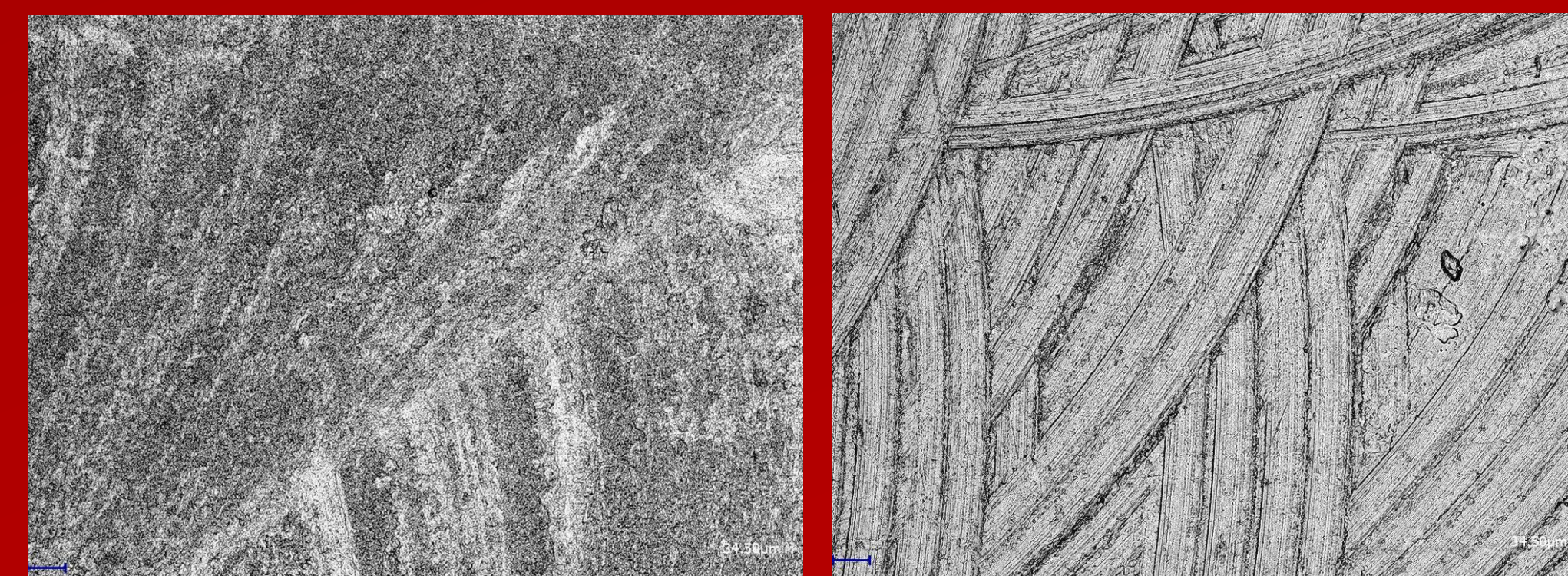
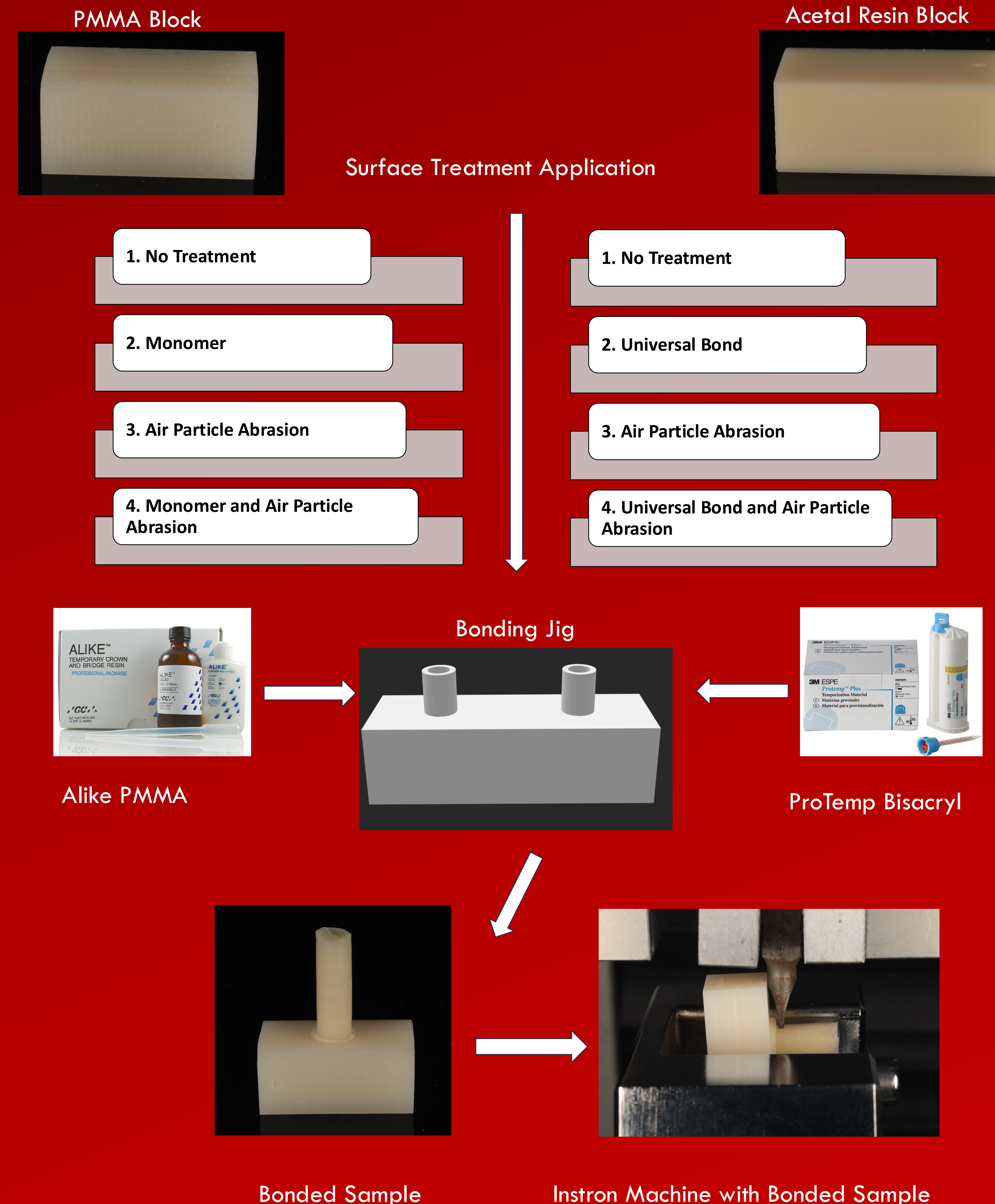


Figure 2. Scanning electron microscope of experimental surfaces (Magnification at 20x) PMMA (left), Acetal Resin (right)

Experimental Protocol



Results

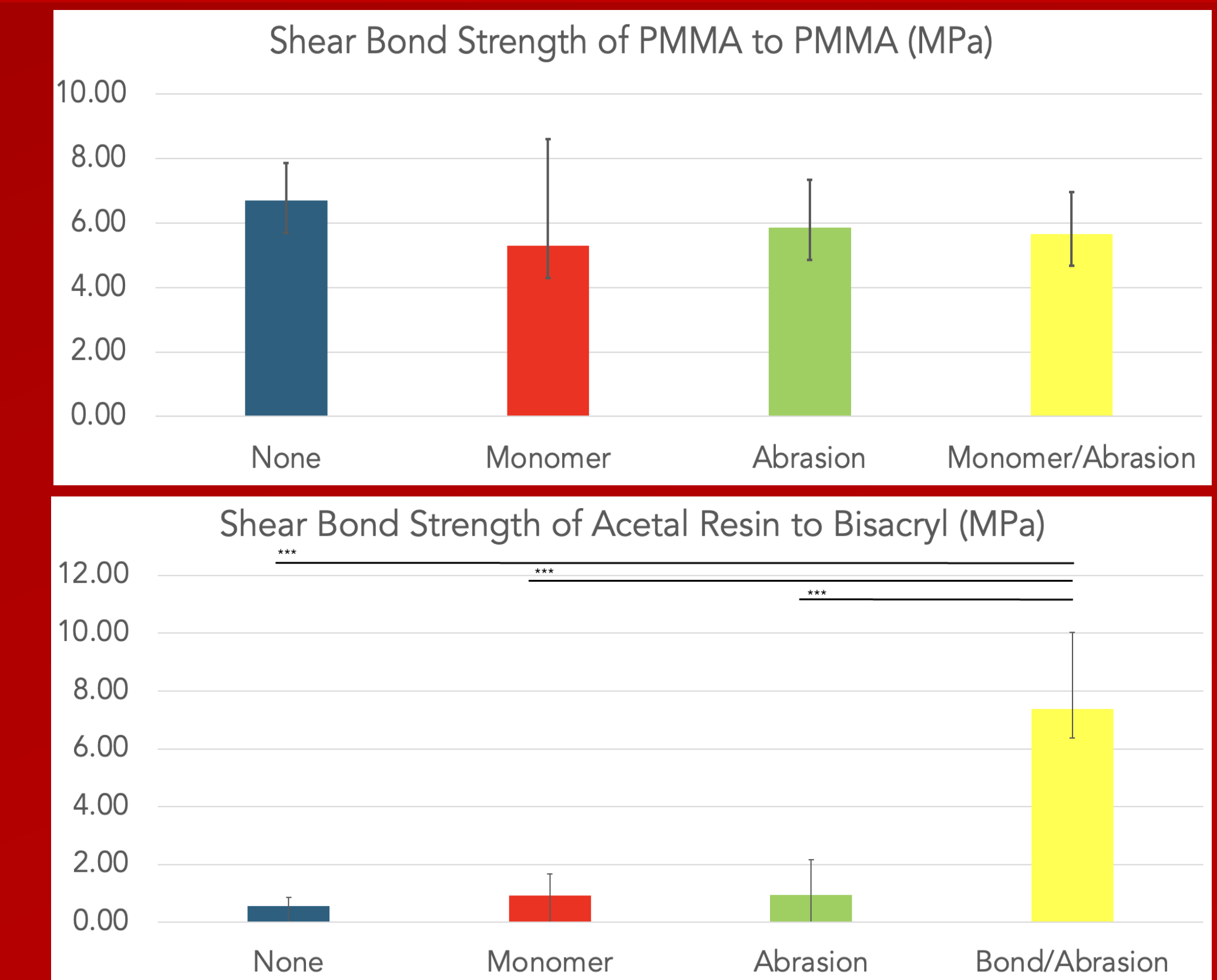


Figure 3. Shear Strength (MPa) of PMMA to PMMA and Acetal Resin to Bisacryl with 4 different surface treatments. (***) = <0.001

ANOVA results demonstrated:

- No significant differences among PMMA surface treatments ($p=.471$)
- Significant differences among the Acetal Resin ($p=<0.001$) groups

CAD/CAM-milled acetal resin bonded to bisacryl exhibits negligible bond strength without surface treatments whereas PMMA demonstrates clinically acceptable shear strength across all 4 treatments.

Conclusions

Preliminary results indicate the reline of milled acetal resin provisionals with bisacryl has low shear bond strength and additional methods, such as mechanical retention, may be indicated to improve bond strength.

