



# Macro and Micro Treatment Considerations for Improved Adhesion to 3D Resin Provisionals



# CAD | CAM

computer aided design

computer aided manufacturing



With CAD/CAM, particularly additive manufacturing, or 3D printing, workflows allow for rapid and accurate fabrication of nearly all types of restorations, guides, and tools dentists utilize for successful treatment.

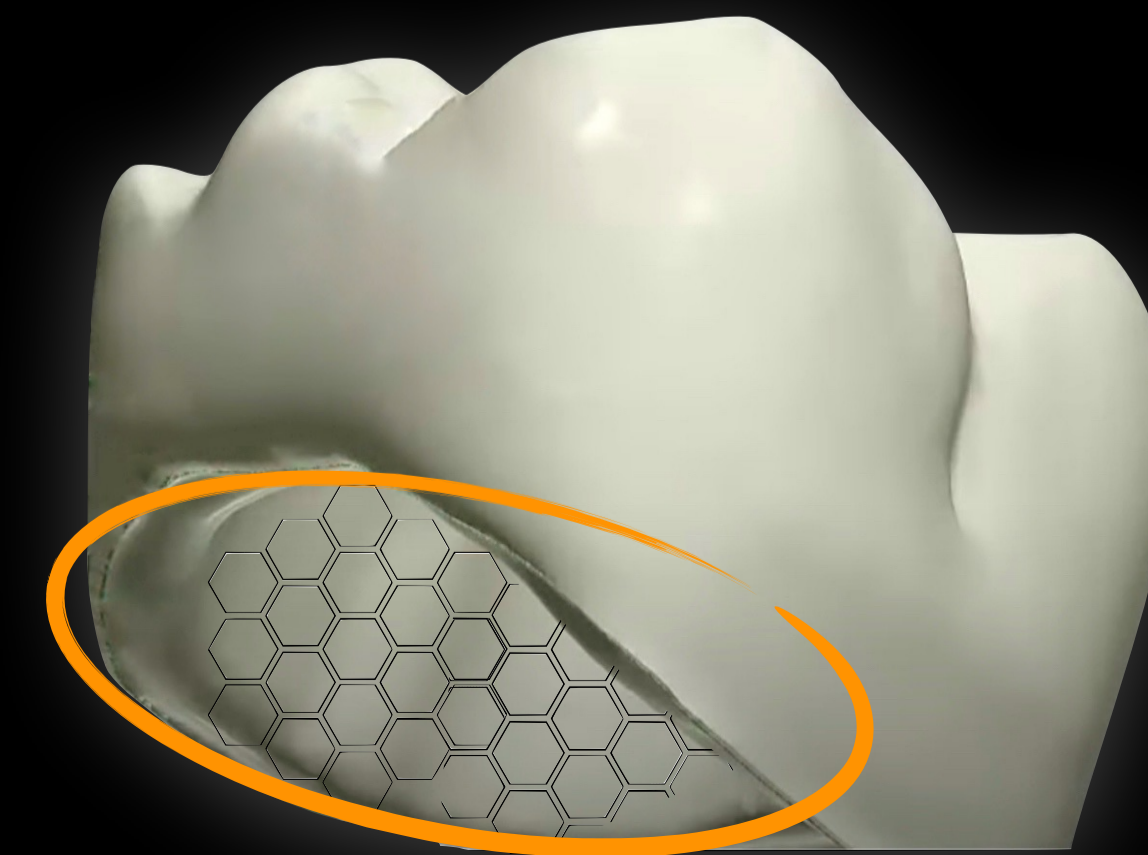
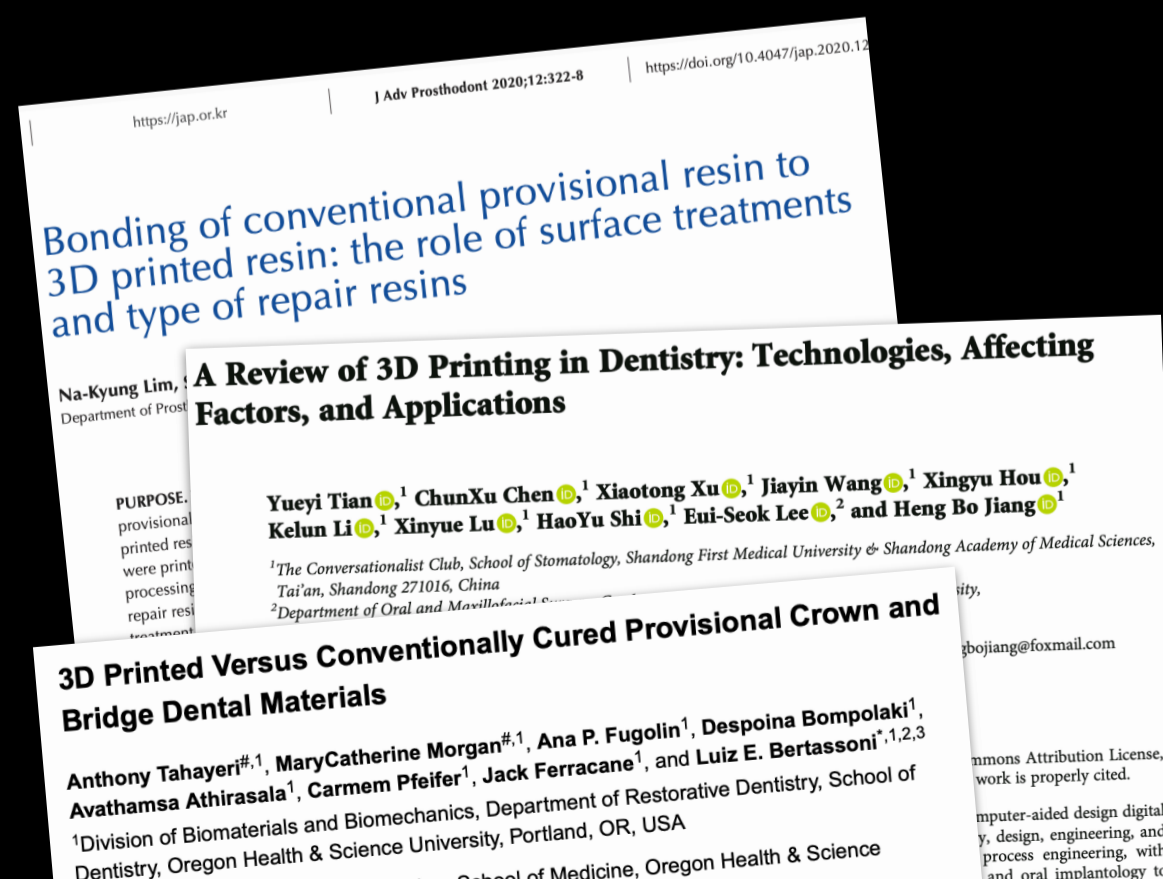
Printed = Conventional

BUT

*Variability*

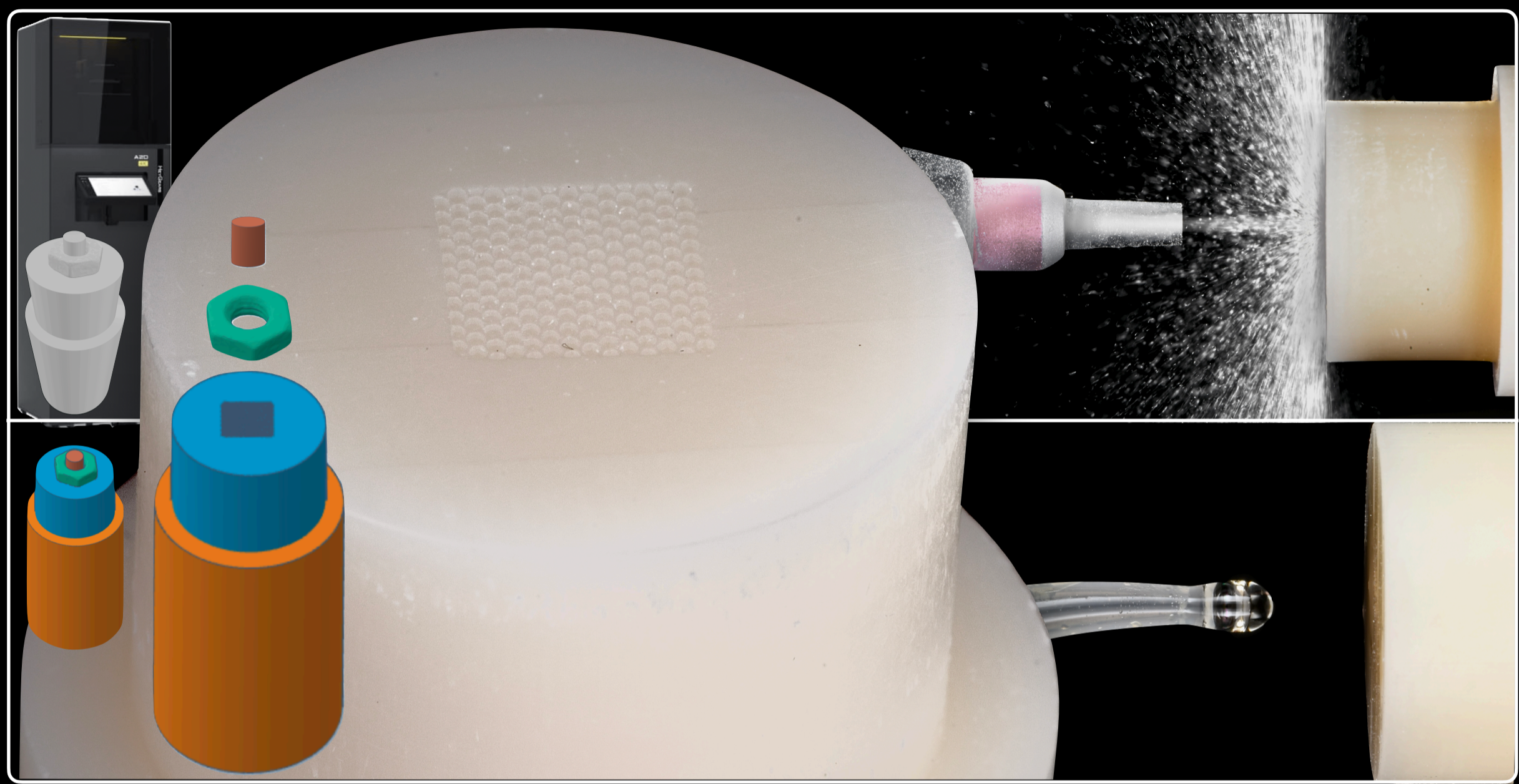
SO

**Leverage CAD/CAM?**

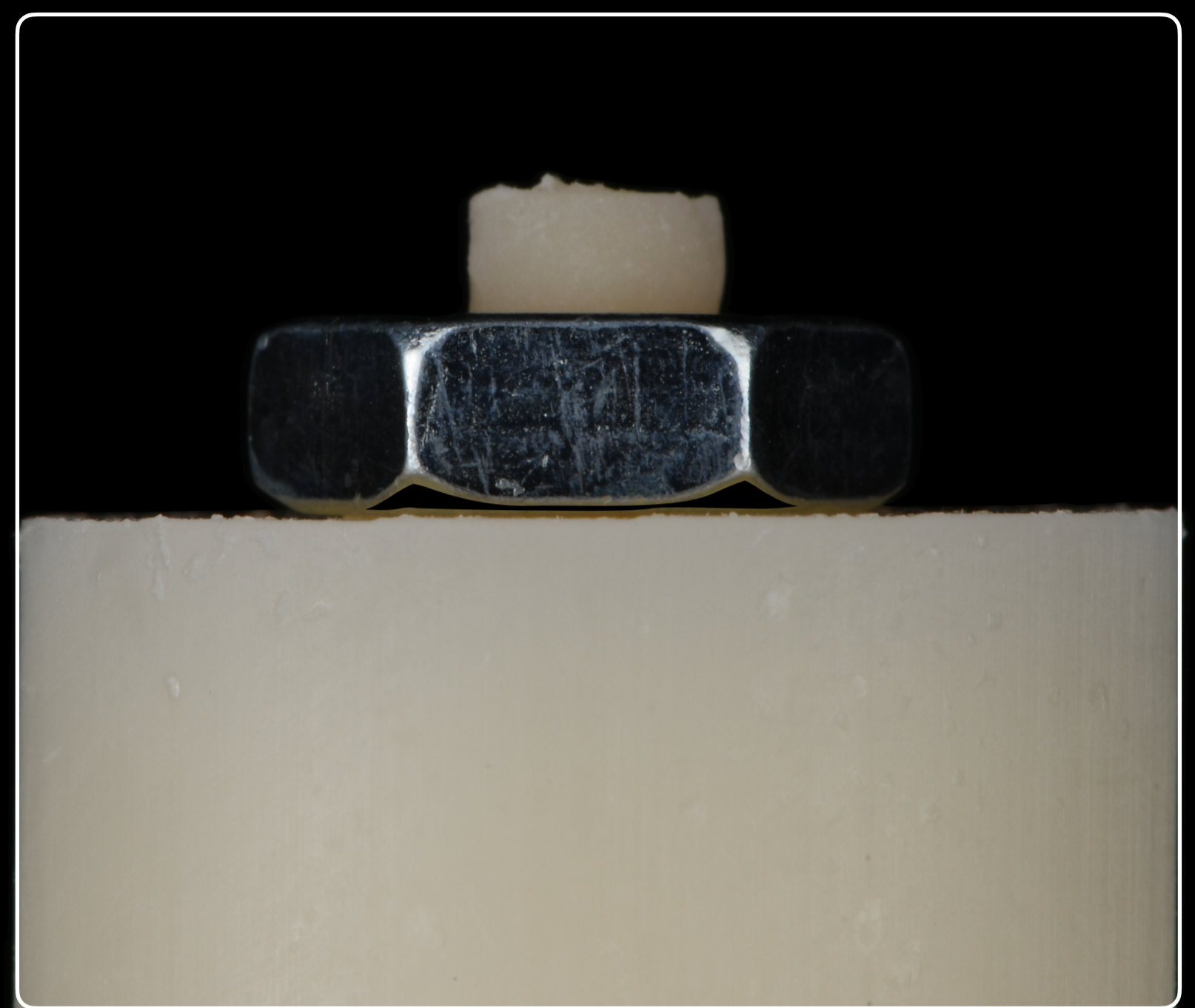


# Surface modification, by way of altering the design of 3D printed crown intaglio surface geometry, will provide greater adhesive strength when relined by conventional materials.

**1** Specimens were designed and assembled digitally, then printed in a DLP printer.

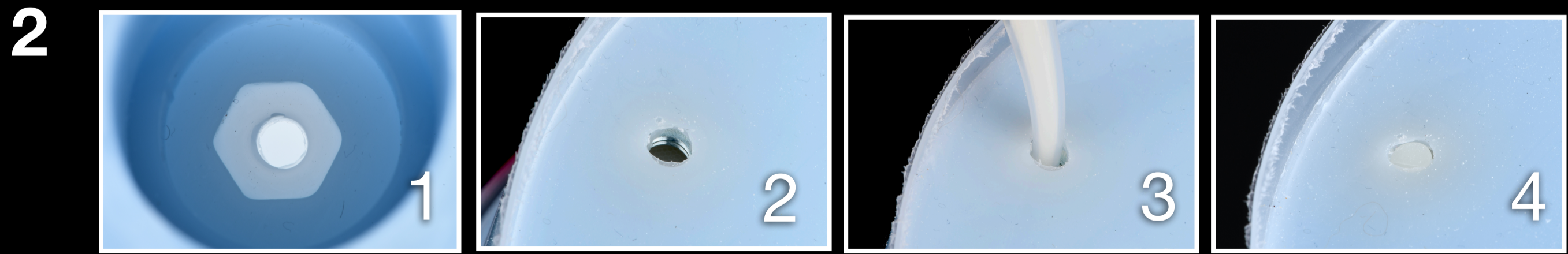


**3**



A total of n=72 were divided into 6 groups: Control (No modification) "C", Sandblast "S", Monomer Soak "M", Texture "T", Sandblast & Monomer Soak "SM", Texture & Sandblast "TS".

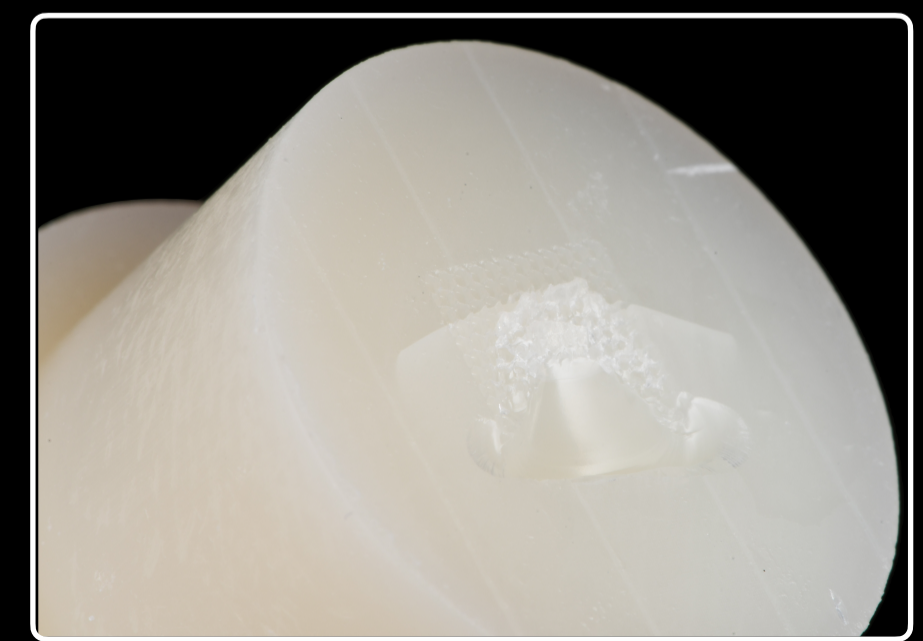
Specimens, now complete, were ready for testing in a UTM. Analysis was completed.



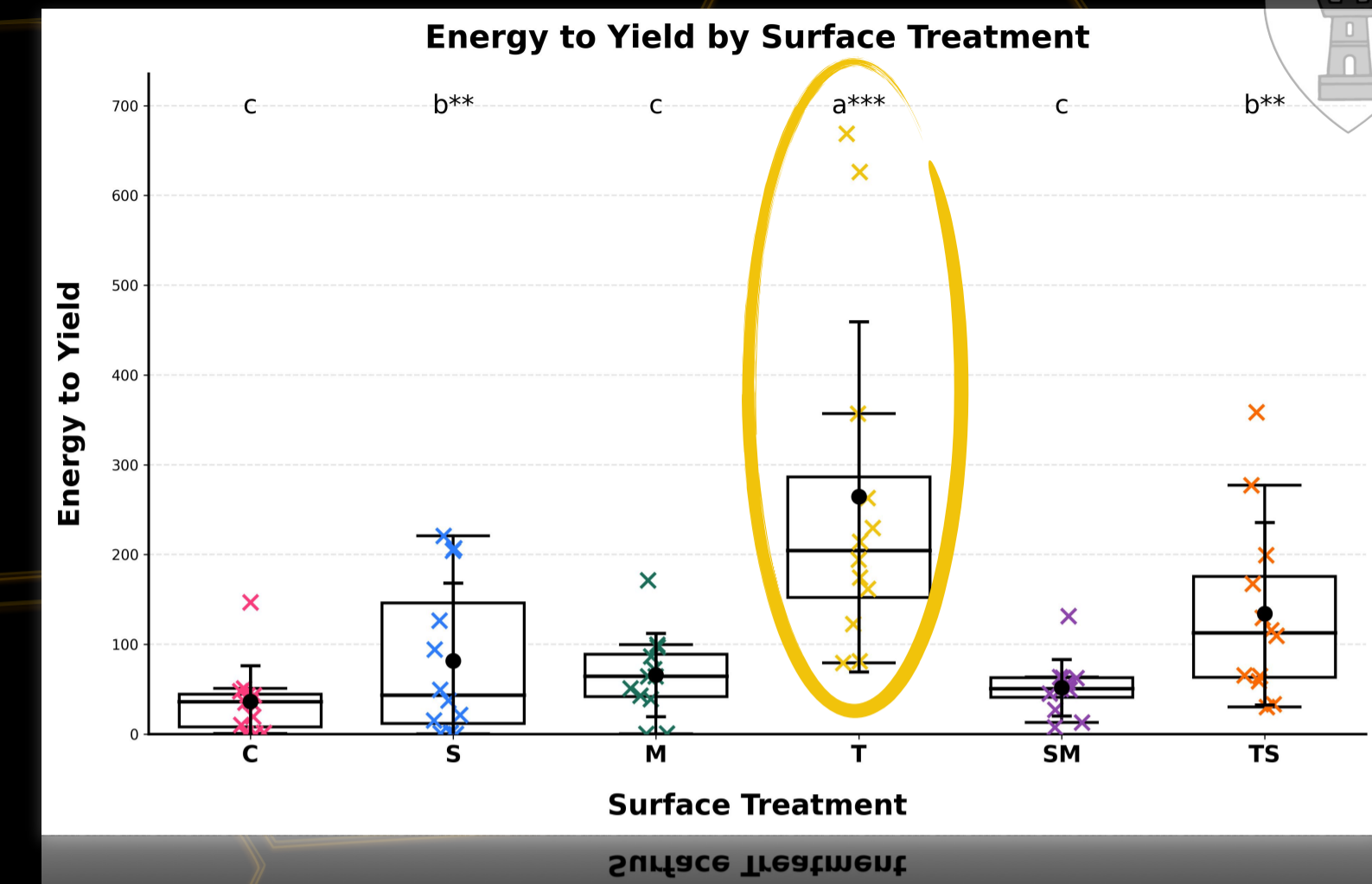
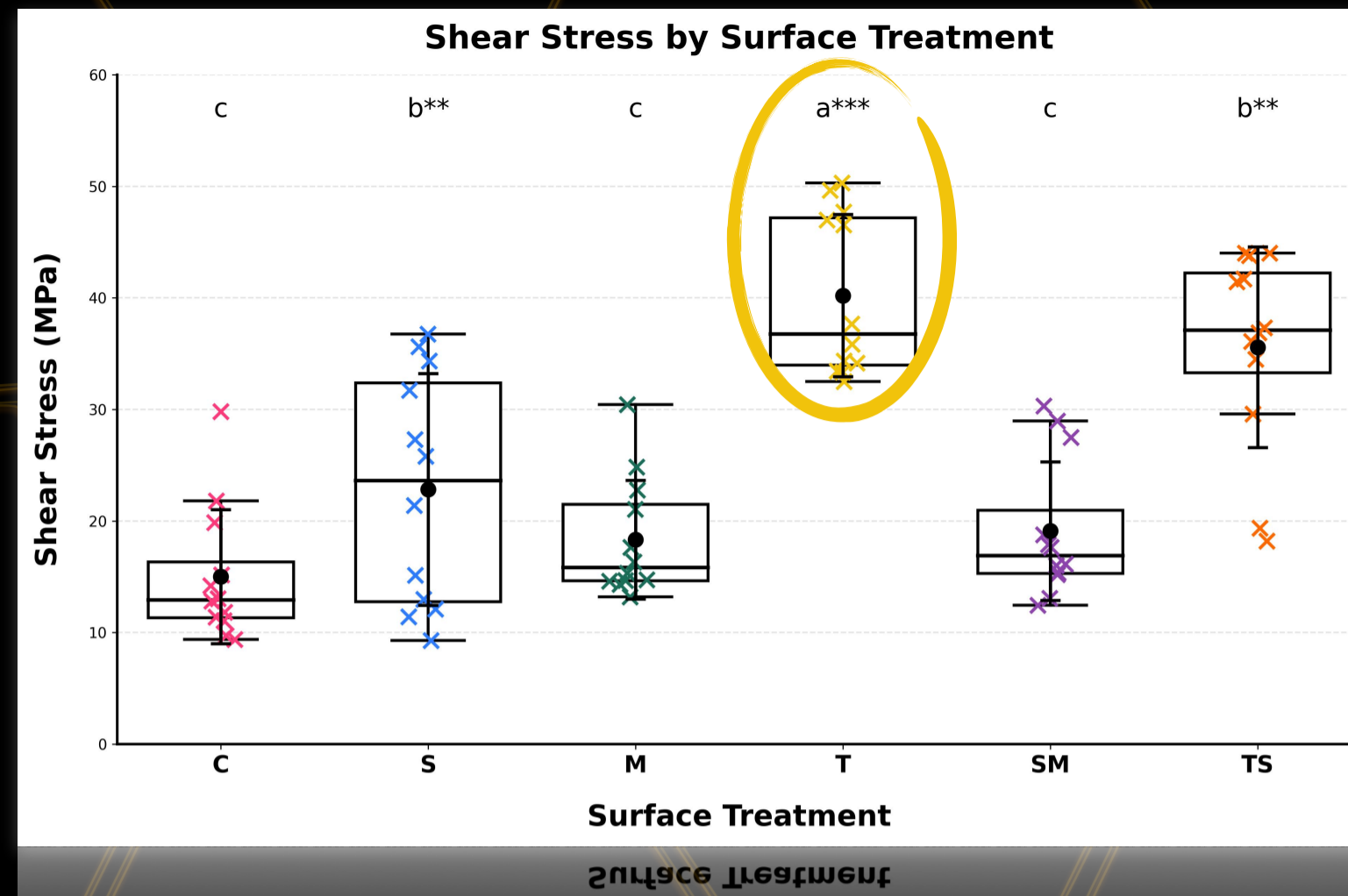
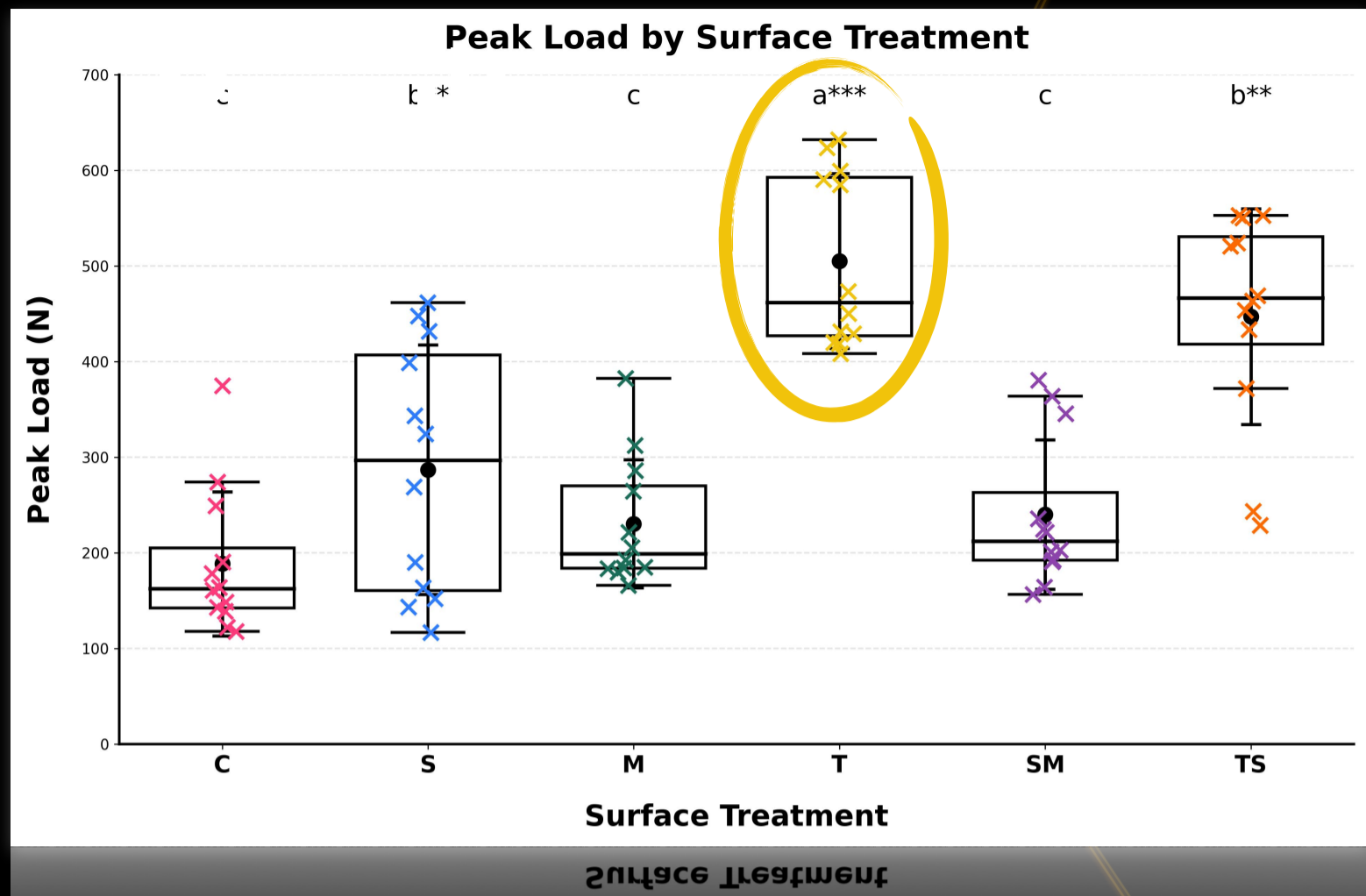
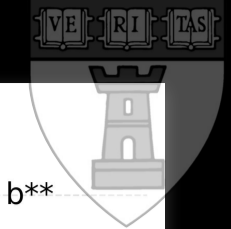
**4**



**5**

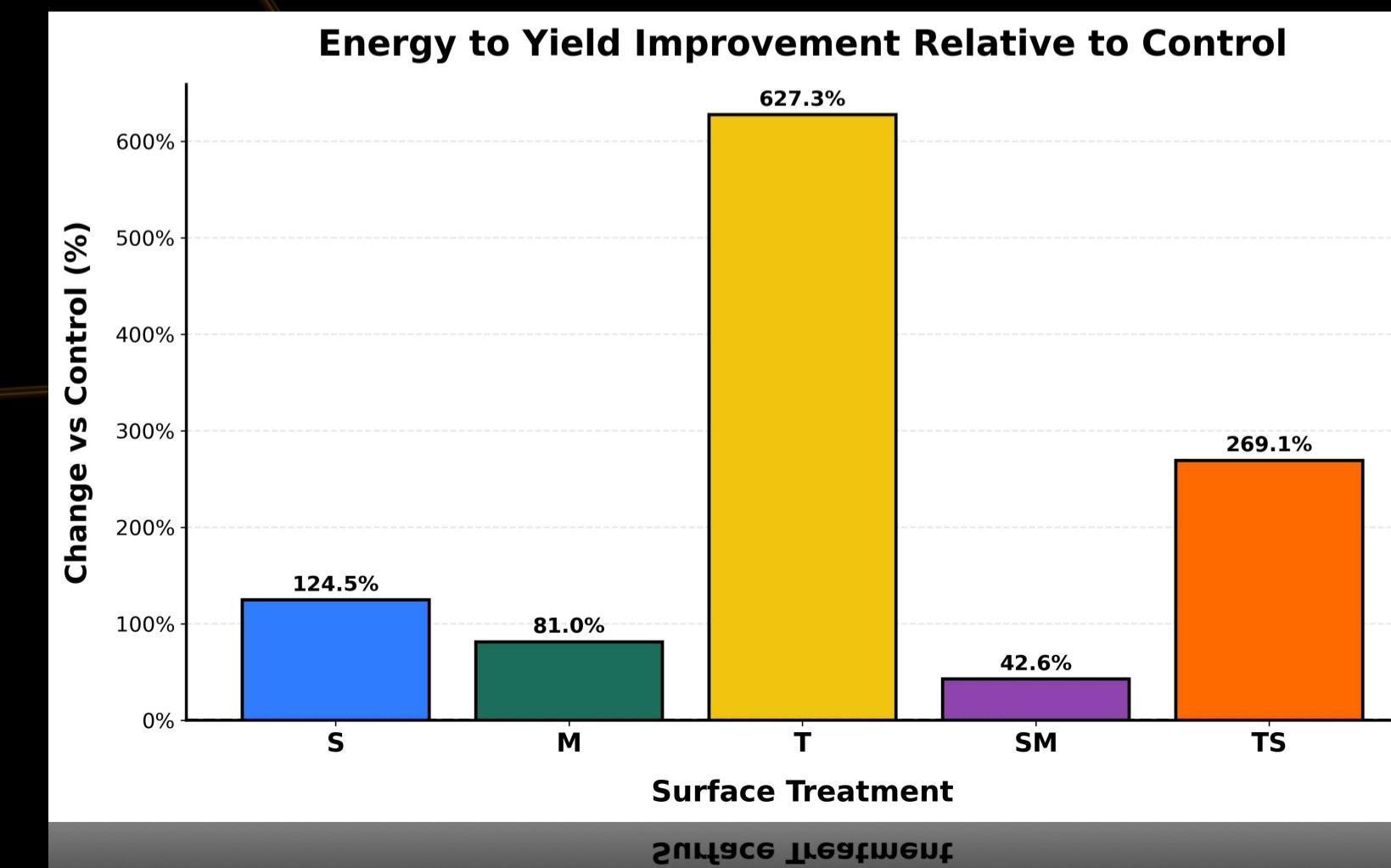
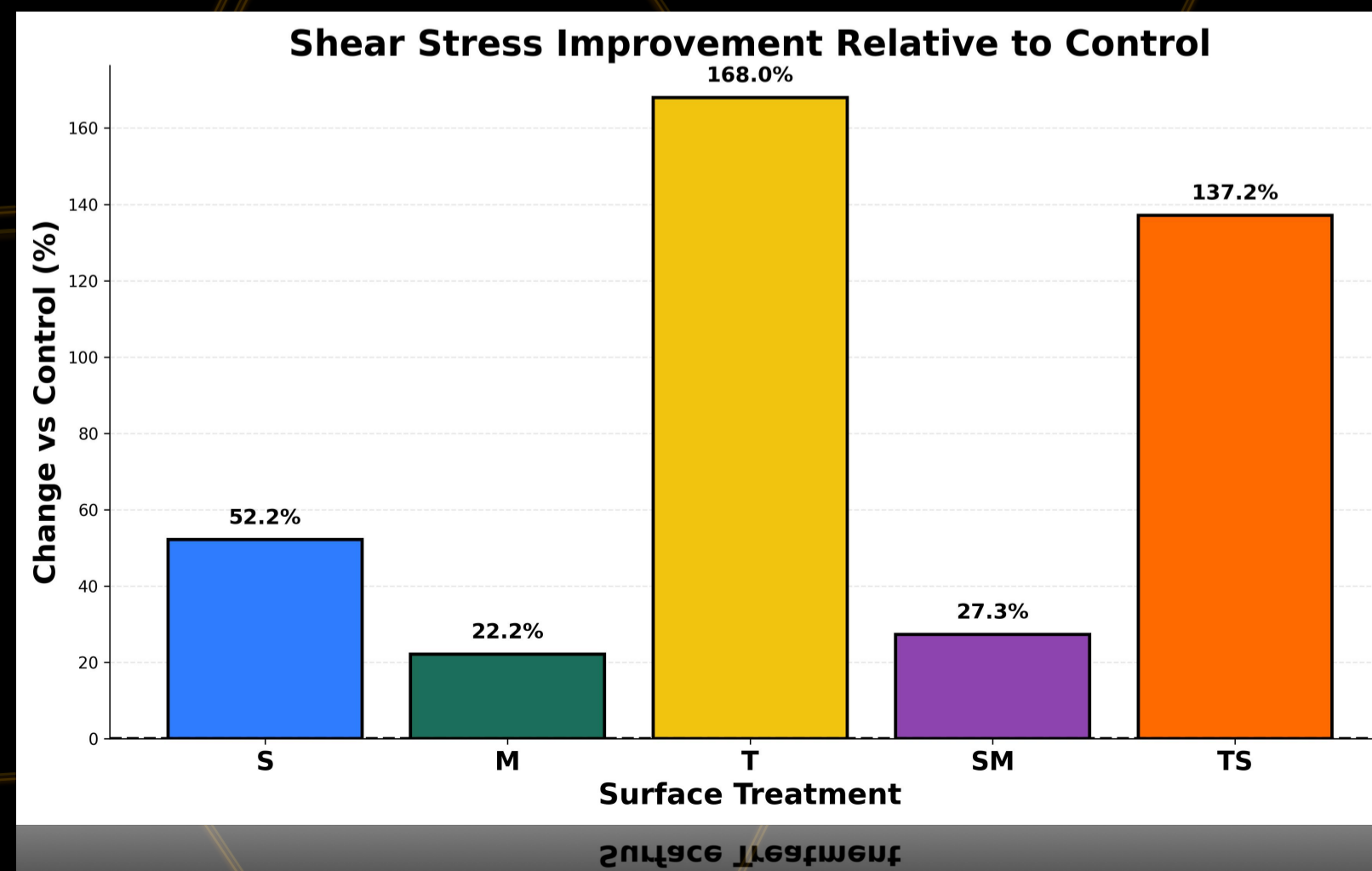
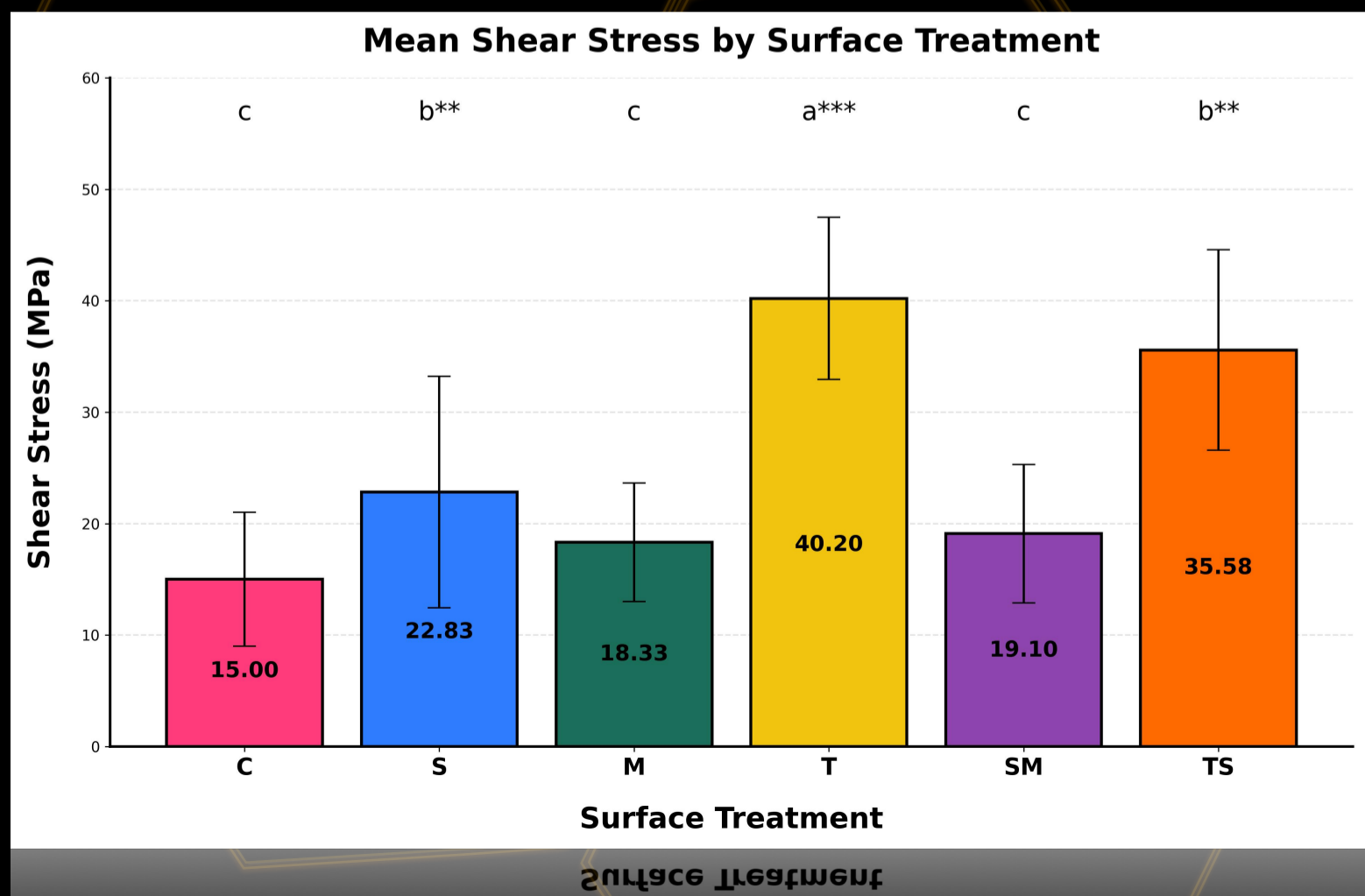


Specimens were then placed in a silicone mold to provide consistency during luting of the reline material, PMMA, to the modified surface. The mold was placed in a pressure pot.



All metrics showed a significant dependence on surface treatment.

The **T** group **outperformed** across **all** metrics.



# Surface modification with honeycomb geometry significantly improves PMMA adhesion to printed provisional resin without compromising structural integrity and decreasing laboratory steps.



Honeycomb geometry provides an **antirotational**, **mechanical interlock**, and allows for **force dispersion** throughout the reline interface **without additional modification** necessary, providing a promising alternative to traditional adhesive bonding methods for reline of printed provisionals.

## Benefits of STL Surface Modification

STL modification bypasses chemical and compositional variabilities created by different resins and printers that can alter bonding compatibilities to conventional reline materials.

STL modification builds the adhesive improvement *into* the final print, rather than subtracts *from* the final print to improve adhesion.

STL modification design is highly adaptable, and geometries can be tailor made for specific purposes.

## Limitations to STL Surface Modification

While designs of surface modifications are fully customizable, they are limited by the capabilities of the printer.

Proper print processing/handling technique is still needed to ensure geometry detail and trueness to STL design.

## Future Directions

Testing with other provisional materials, other resin types (ie for digital denture relining), and surface modification of printed zirconia for final restorations.

