

# MECHANICAL BEHAVIOR OF PORCELAIN DENTAL BRIDGES UNDER MASTICATORY FORCES

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## Premises

State of stress and strain in porcelain dental crowns is the most important issue that can determine their lifetime.

Stresses, as a result of masticatory actions, can be determined by metal crown design, variations in wall thickness, porcelain variation in thickness, differences in mechanical behavior of the metal part and porcelain, as well as any defect in the crown.

Here there are analyzed through FEM simulations some aspects related to a real crown before and after porcelain covering. In order to fulfill the research, a crown bridge was 3D scanned after casting. The STL file was imported in SolidWorks © Dassault Systèmes, and the total simulation force on the three teeth was of 800 N uniform distributed on upper surface.

## Analyses

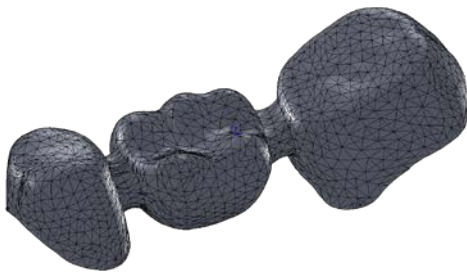


Figure 1. FEA Mesh of the dental crown



Figure 2. Stresses in dental crown

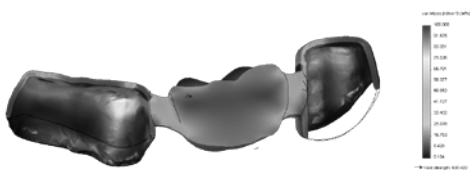


Figure 3. Stresses in dental crown - section

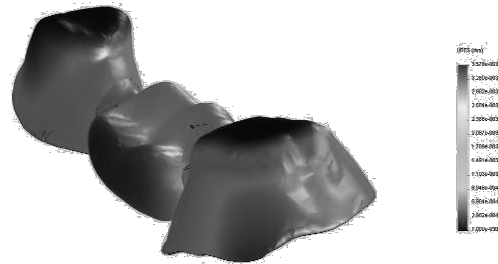


Figure 4. Strains in dental crown

The 3D scanned dental bridge, after importing and preprocessing of the triangle mesh in SolidWorks is presented in Fig. 1. The simulation results for the static load are presented in Fig. 2, 3, and 4: stresses (global and section) and strains.

## Discussion

As can be observed, there are regions with stresses up to 230 N, and displacements up to 3.5  $\mu\text{m}$  especially in the body bridge and lateral faces of the two crowns. The porcelain was added also on the 3D scanned model, and the analyses were conducted with similar masticatory forces.

Adding the porcelain on the dental crown revealed similar effects, with lower amplitude. Such analyses offer the possibility of better positioning of the body bridge, with less strain in the porcelain. As the new dental technology offer 3D printing of bridges, such studies can conduct to longer lifetime. Considering also dynamic behavior and thermal effects, the design can be further improved.

## Acknowledgments

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## References

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