

# Stiffness and Strength of Mature Dental Pastes

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## Objectives:

In this project, dental cement pastes are studied both experimentally and based on multiscale models in order to upscale stiffness and strength from the microscopic scale to the application scale.

## What Experimental Techniques are used?

Grid nanoindentation is used to characterize the mechanical properties of the microstructural constituents of dental cement paste in terms of the indentation modulus and indentation hardness.

Ultrasonic pulse transmission and uniaxial compressive strength tests are used to quantify the macroscopic stiffness and strength, respectively.

## Multiscale Modeling Methods

The multiscale modeling is used to upscale microstructural properties to the macroscopic application scale. When the microstructure properties in the multiscale model are set correctly, the computed results correspond with the values that are determined by the experimental techniques.

## Outcome of Multiscale Research

A multiscale representation of the studied materials and macroscopic effective mechanical properties indicates the presence of microstructural defects that weaken the material.

However, the microstructural investigation of dental cement pastes revealed that these materials are built from stiffer and harder hydration products compared to the ones found in ordinary Portland cement pastes used in the construction sector.

