Apparent Modulus of Honeycomb Structure: A Guideline for Porous Structure Implant Design

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Abstract

Objectives: To investigated the apparent modulus of honeycomb to be used as a guideline for facilitating porous structure implant design.

Methods: Apparent modulus of each honeycomb model was developed based on finite element analysis. Geometry of honeycomb structures included circumcircle radius of 2 mm, 3 mm, and 4 mm with wall high of 0.5 mm, 1.0 mm, 1.5 mm, and 2.0 mm.

Results: Hexagonal shape of honeycomb structure with circumcircle radius 2 mm was compared with circle with 2 mm diameter, both with wall thickness of 1 mm. The relationship is best described by logarithm equation with coefficient of correlation above 0.99. It was found that reduction of modulus for circular shape is 60 percents. The value is greater than hexagonal pattern which is 50 percents of reduction.

Conclusions: The relationship between height of honeycomb and reduction of apparent modulus of each specific circumcircle radius of honeycomb is best described in logarithm equation and as a guideline for facilitating porous structure implant design.

Keywords: dental implant, finite element analysis, honeycomb structure, modulus of elasticity, porous structure