EFFECTS OF MATERIAL THICKNESS ON THE STRESS DISTRIBUTION OF OCCLUSAL VENEER: AN EXTENDED 3D FINITE ELEMENT ANALYSIS

Credit SRIKUM[1*], Chaiy RUNGSIYAKULL[2], Pisaisit CHAIJAREENONT[1] and Pimduen RUNGSIYAKULL[1]

1 Department of Prosthodontics, Faculty of Dentistry, Chiang Mai University, Chiang Mai, Thailand; Credit_sr@cmu.ac.th (Corresponding Author)
2 Department of Mechanical Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai, Thailand

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ABSTRACT

This study investigates the effect of material thickness on the stress distribution within lithium disilicate occlusal veneers through an extended 3D finite element analysis. Occlusal veneers, favored for restoring posterior teeth, offer a conservative restorative approach that maintains more of the natural tooth structure compared to conventional crowns, thus potentially enhancing structural integrity and support for the restoration. However, lithium disilicate, despite its favorable aesthetics, is susceptible to fractures under occlusal loading, making an understanding of stress distribution essential for improving occlusal veneer durability. This study analyzed eight occlusal veneer models of varying thicknesses (0.3, 0.5, 0.8, and 1.0 mm), applying an occlusal load of 400 N to each. Models were divided into two groups: one with predefined crack initiation points, representing weakened areas, and a control group without these points. The analysis of von Mises stress distribution revealed that thinner occlusal veneers (0.3 mm) experienced significantly higher stress concentration, especially in loading zones, while stress distribution became more uniform as thickness increased to 0.8 mm and 1.0 mm, resulting in reduced peak stress values. Consistent stress patterns were observed across both groups; however, crack propagation occurred exclusively in the group with predefined crack points, where cracks extended along the mesio-distal axis, decreasing in propagation distance as thickness increased. These findings suggest that greater occlusal veneer thickness can significantly mitigate stress concentration and crack propagation, highlighting a potential pathway to extend the longevity and resilience of occlusal veneers in clinical practice.

Keywords: Occlusal Veneer, Lithium Disilicate, Stress Distribution, Crack, Finite Element

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