Effect of Class V Cavity Configuration and Loading Situation on the Stress Concentration

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Abstract : Objective: This study was to examine the stress distribution of tooth with different class V restorations under different loading situations and geometry by 3D finite element (FE) analysis. `Methods: A series of FE models of mandibular premolars containing class V cavities were constructed using micro-CT. The class V cavities were assigned as the combinations of different cavity depths x occlusal -gingival heights: 1x2, 1x4, 2x2, and 2x4 mm. Three alveolar bone loss conditions were examined: 0, 1, and 2 mm. 200 N force was exerted on the buccal cusp tip under various directions (vertical, V; obliquely 30° angled, O; oblique and parallel the individual occlusal cavity wall, P). A 3-D FE analysis was performed and the von-Mises stress was used to summarize the data of stress distribution and maximum stress. Results: The maximal stress did not vary in different alveolar bone heights. For each geometry, the maximal stress was found at bilateral corners of the cavity. The peak stress of restorations was significantly higher under load P compared to those under loads V and O while the latter two were similar. 2x2mm cavity exhibited significantly increased (2.88 fold) stress under load P compared to that under load V, followed by 1x2mm (2.11 fold), 2x4mm (1.98 fold) and 1x4mm (1.1fold). Conclusion: Load direction causes the greatest impact on the results of stress, while the effect of alveolar bone loss is minor. Load direction parallel to the cavity wall may enhance the stress concentration especially in deep and narrow class cavities.

Keywords : class v restoration, finite element analysis, loading situation, stress
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