3D Geometric Transformation for Dentistry Application

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BACKGROUND: Although there are convenient instructions for objects transformation by OpenGL on C++ Builder in published, they are appropriate for basic transformation. In dental application, the objects are moved by complicated transformation and concerned for the right anatomy position, such as moving the teeth on mandible that has curve shape in tooth alignment planning. Therefore independent directions are the essential requirement for the transformation in dental application.

PURPOSE: The aim of this study is to evaluate method to transform 3D objects (teeth, brackets) in independent directions. OpenGL on C++ Builder is required to solve this problem.

METHODS: First, the STL file of tooth models are read and the minimum and maximum values of position in X, Y and Z coordinate of each tooth are obtained. Then the 3D box, which has the volume of [(maximum X - minimum X) × (maximum Y - minimum Y) × (maximum Z - minimum Z)] is created on the moving object. The normal vectors on each face of 3D guiding box are evaluated. These vectors are the new axes for the transformation called Red, Green and Blue axes. The rotation of the 3D guiding box around its centre is the method to change the directions of the axes. The object is translated and rotated along the Red, Green and Blue axes. The centre of 3D guiding box is the reference for object rotation.

RESULTS: The results of the program have shown that the tooth models were moved on expected directions and kept in the right positions.

CONCLUSION: The order of translation and rotation is significant for rotation function. In this study, we rotated object around a centre of 3D guiding box (i.e. translation to origin, rotation at origin and translation to the original which is referred by 3D box centre). Because we can create a new axis by rotating the 3D guiding box so we can control the object to move in any directions.