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## Changes in Orthodontic Cephalometric Reference Points on Application of Orthopedic Force to Jaw: Three-Dimensional Finite Element Analysis

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**Abstract:** The present study investigated the effects of two orthodontic appliances on changes in the cephalometric reference planes using the three-dimensional finite element method. We simulated the use of a headgear and an orthopedic facial mask, two devices for the application of orthodontic force to the jaw. Using a finite element model of the skull, orthodontic force was applied to the maxillary first molar in a posterior or anterior direction. Changes in the maxilla, mandible and cephalometric reference planes were ascertained by the three-dimensional finite element method. The results showed that posterior force caused a slight posterior displacement and clockwise rotation of the reference planes, while anterior force caused anterior displacement and counterclockwise rotation. Since the maxilla was displaced and rotated in the same direction, the degrees of cephalometric displacement and rotation of the maxilla were smaller than the actual values.

**Key words:** [Finite element method](#), [Orthopedic force](#), [Sphenoid bone](#)


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