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## A holographic study of variations in bone deformations resulting from different headgear forces in a macerated human skull

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### ABSTRACT

The effects of headgear on maxillary displacement and the resulting growth modifications are not completely understood, especially regarding the complex relationships between initial and secondary skeletal reactions on one hand and the influence of the direction and magnitude of the applied force on the other. The aim of the present investigation was to study, by means of holographic interferometry, the initial bone displacement occurring in response to headgear traction applied at different force magnitudes and in different directions. Orthopedic forces of 560 grams and orthodontic forces of 354 grams were simulated on a macerated human skull. The forces came from high-, straight-, and low-pull headgear traction directed above, through, and below the center of resistance of the maxillary first permanent molars. Immediate skeletal changes were recorded by laser holography. Initial displacements of the maxilla and zygomatic arch in both horizontal and vertical planes were evaluated on frontal and lateral holograms. In most cases, both force magnitudes caused substantial displacements in both planes, albeit to different extents. Complex bending, and rotational, translational, and relative displacements were observed. The direction of displacement did not strictly coincide with that of the applied force. The results of this study indicate that both orthodontic and orthopedic headgear traction may lead to complex initial three-dimensional skeletal displacement in directions not always corresponding with the direction of the applied force.

**KEY WORDS:** Headgear, Orthopedic effects, Skeletal displacement, Macerated skull, Holography.

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