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PowerScope 2 functional appliance: A 3D finite element simulation of its action on the mandible

A B S T R A C T

PowerScope 2 is a fixed functional appliance for patients with Class II malocclusion and a retrognathic mandible, that has recently received attention due to its pronounced advantages, for both orthodontists and patients.
Objective: of study: This study evaluated the action of the PowerScope 2 appliance for correcting Class II malocclusion and the stresses and displacement of the mandible during loading using three-dimensional finite element analysis (FEA). The sites of the mandibular skeletal and/or dental corrections were also distinguished.
Materials and methods: Using the AutoCAD (2010) Program, a 3D model of the human mandible with teeth was created based on a CT image of a 20-yr-old patient**.** Orthodontic stainless-steel brackets with Standard Edgewise (0.022 in) slots bonded to five mandibular teeth and inserted into a bounded tube on the first molar were simulated. A rectangular archwire (0.019 × 0.025 in) ligated the brackets. The created models were uploaded to the Autodesk Inventor Professional Computer Program (FE) version (2020).
Results: The FEA presented the three-dimensional results qualitatively and quantitatively as von Mises stress and displacement. The colour ruler on the upper left side demonstrates the stress and displacement distribution pattern of the mandible, with the minimum value in blue and the maximum value in red. Mandibular movement was achieved three-dimensionally. There was obvious sagittal forward mandibular movement, and high stress was observed at the chin prominence (the pogonion). In the transverse plane, the mandible was highly bent buccally, especially at the gonial angle and antegonial notch. In the vertical plane, the highest ranges of mandibular movements were seen in the chin, the anterior part of the mandibular body, and the associated dentoalveolar region.
Conclusions: The results of this FEA, PowerScope 2 functional appliance proved to be effective as a Class II malocclusion corrector. Its mode of action on the mandible was achieved in three planes of space, and its orthodontic
effects were gained dentally and skeletally. An bbvious sagittal forward mandibular movement was observed, particularly at the chin prominence. Apparent buccal bending, especially at the gonial angle and antegonial notch, was observed. Vertically, the chin and anterior part of the mandible, with the associated dentoalveolar structures, were clearly stressed under the action of this appliance