Purpose: Mandibular flexure may affect stress distribution in implant-supported fixed partial dentures; however, this factor has been overlooked in most finite element analyses of the mandible. The purpose of this study was to investigate the effect of two different superstructures on stress distribution in mandibular bone during mandibular deformation caused by clenching.

Materials and Methods: Three-dimensional finite element models consisting of the mandibular bone, six implants, and two- or three-piece superstructures were created. Muscle forces with definite direction and magnitude were exerted over areas of attachment to simulate two static bites of incisal and right molar clenching because, during these clenching tasks, a significant amount of mandibular deformation occurs. The stress analysis was performed using von Misses stress values.

Results: During right molar clenching, the two-piece superstructure showed increased stress values. During incisal clenching, the three-piece superstructure inhibited mandibular deformation more than the two-piece superstructure.

Conclusions: Mandibular deformation was an important factor in the stress distribution of the models, and it should be considered in the design of implant-supported fixed partial dentures in the mandible.