

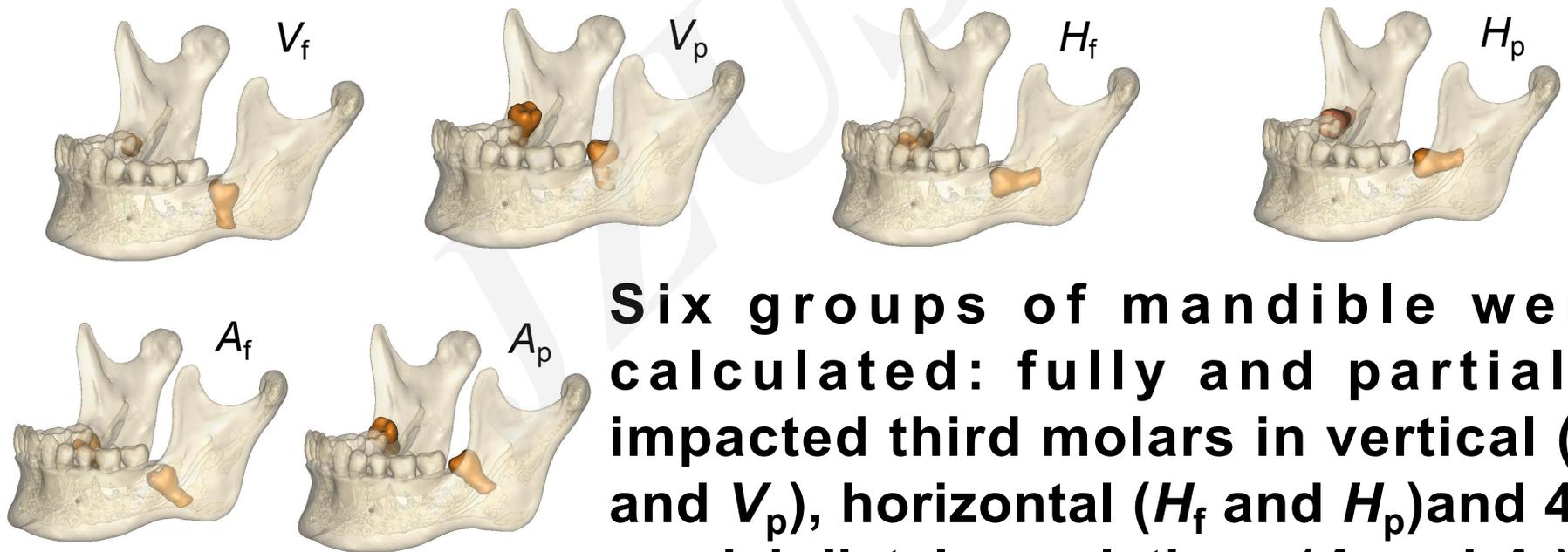
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# **A finite element analysis of the stress distribution to the mandible from impact forces with various orientations of third molars**

**Key words:** Finite element analysis; Third molar; Mandible; Biomechanical simulation

# Research Summary

This study mainly concentrated on the Von Mises stress distribution on mandible using finite element analysis, when the mandible has impacted third molars (IM3) at various orientations and is impacted by a 2000 Newton impact force either from the anterior midline or from the body.



Six groups of mandible were calculated: fully and partially impacted third molars in vertical ( $V_f$  and  $V_p$ ), horizontal ( $H_f$  and  $H_p$ ) and 45° mesial-distal angulations ( $A_f$  and  $A_p$ ).

# Innovation points

- **Inhomogeneous bone** properties were assigned with 9 levels based on the HU measured from CT images
- **The muscles** were reproduced by an equivalent spring system in the boundary conditions
- **Two Loadings** were applied on the midline and the angle field of mandible separately.
- **High risk areas** for fracture on condylar area and angle field were compared.

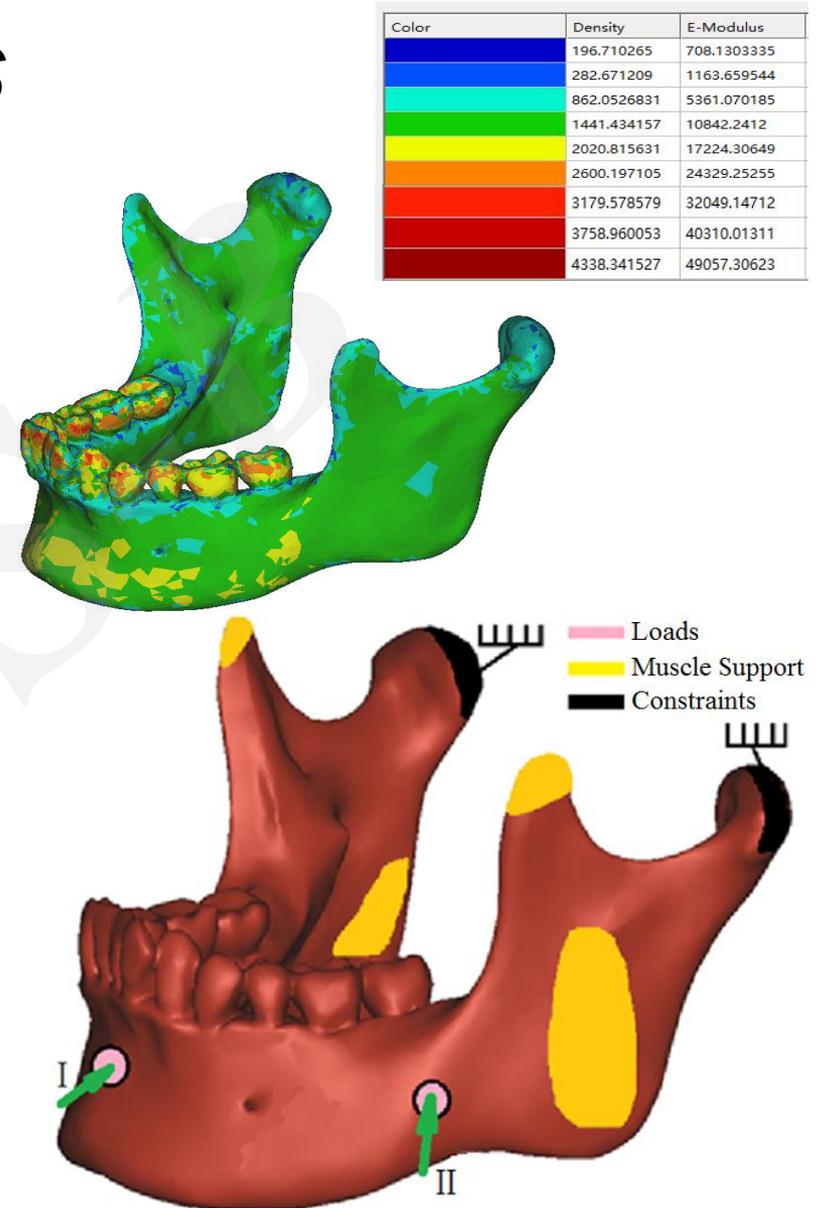
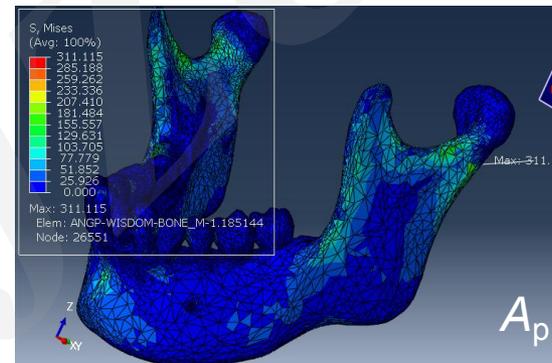
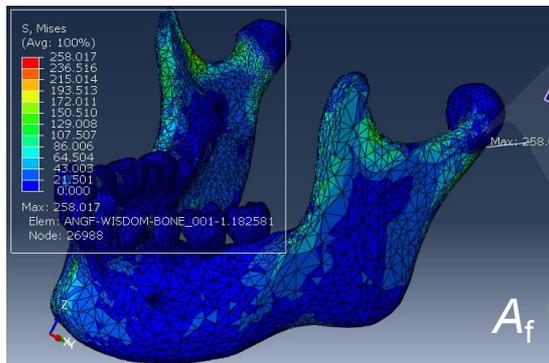
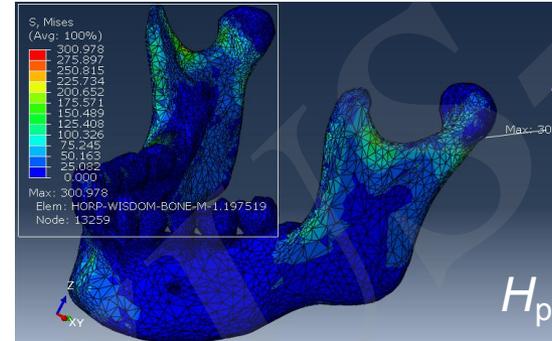
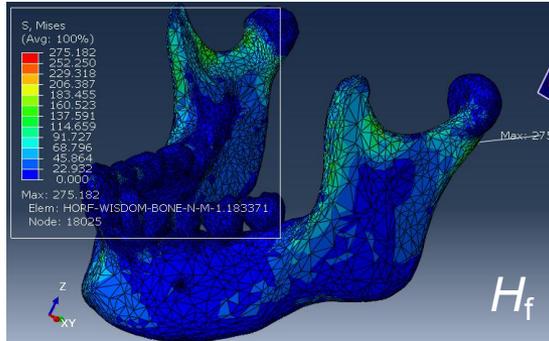
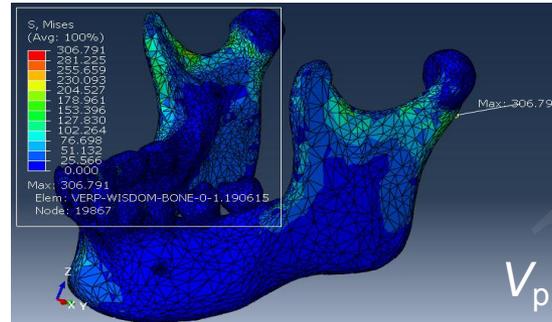
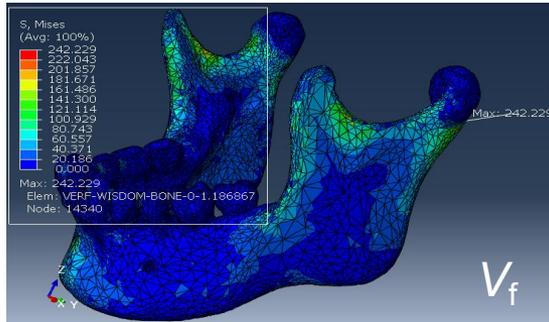


Figure 4

# Innovation points



- **Maximum stress** is always located in the left condylar region, the orientation of the IM3s having no significant effect.

- **Summary:** The risk of mandibular fracture is higher for partially than fully impacted M3s, with the angulation of impaction having little effect on fracture risk.

**Von Mises stress distribution to mandibles under 2000N impact force from the midline of the mandible with IM3s**

# ***Innovation points***

A series of comprehensive figures and table were generated to illustrate the biomechanical effects of 3<sup>rd</sup> molar to mandible.

**Table 1 | *Summary of maximum Von Mises stress in left and right angle and condyle regions of mandible with and without Im3s, under two loading conditions.***

**Figure 5 | Von Mises stresses on mandibular bone without 3rd molars under 2000N impact force**

**Figure 7 | Von Misses stress distribution to mandibles under 2000N impact force from left side of the mandibular angular area**

**Figure 8 | Von Mises stress distribution to the left angle of the mandible under 2000N impact force from left side of the mandibular angular area with IM3s**