

CHAPTER V

CONCLUSION REMARK

5.1 Conclusion

Based on the finite element analysis of the hip joint under simulated traction loading during the Direct Anterior Approach (DAA) procedure for Total Hip Arthroplasty (THA), the following conclusions were drawn:

1. Under simulated traction loading, stress distribution in the femur is primarily localized at the proximal femur (femoral neck area). The magnitude and pattern of this stress distribution are strongly influenced by lower limb positioning: increasing abduction consistently decreases peak stress and traction forces needed across the femur, whereas increasing hyperextension alters the joint space widening response. But, across all simulated lower limb positions and traction force magnitudes, the peak von Mises stress generated in the femur (up to 62.08 MPa) remains well below the ultimate tensile strength of cortical bone (120–150 MPa). This indicates that the stress distribution induced by axial traction alone does not exceed structural bone thresholds and is unlikely to be the primary cause of intraoperative fractures.

5.2 Suggestion

Based on the limitations encountered during this study, the following suggestions are proposed for future work:

1. Incorporate the ligamentum teres, hip joint capsule, and surrounding periarticular musculature as discrete structural elements to more accurately represent the soft tissue restraint that resists joint distraction in vivo. These structures likely carry a meaningful share of the physiological traction load.
2. Incorporate patient-specific bone properties, accounting for variation in bone mineral density associated with sex, age, and bone health status, rather than a

single generalized isotropic cortical bone property set, since the mechanical strength of bone varies considerably between individuals.

3. Validate the model further against additional independent clinical or cadaveric force–displacement data beyond the single reference point used in this study, to strengthen confidence in the overall force–displacement trend before the results are used to inform patient-specific or generalized clinical traction limits.

