Models of Gleno-Humeral Joint Stability

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ABSTRACT

In this paper two-dimensional and three-dimensional FEM models of gleno-humeral joint stability under ligaments and muscles actions were studied. In three-dimensional models we used solid elements TETRA4R for humerus, SHELL3T elements for glenoid fossa and very stiff TRUSS3D elements to simulate the contact. This joint is more stable at higher value of its natural frequencies. By analyzing the variation of the first natural frequency of the joint versus rotation of humerus in the three planes, in the range 0-180°, it comes out that the instability positions of humerus are: between 90°-180° (for Inferior-Superior rotation), 60° and 180° (for Lateral – Medial rotation) and 120° (for Anterior– Posterior rotation). These positions are in incidences of glenoid loosing.

For numerical models, with material properties of human bones, the value of subluxation force calculated using FEM was of 500N, which is very close to experimental values of Anglin and al. (510N-540N). This level of subluxation force is possible because of elastic ligaments and muscles action.

Traditional biomechanical methods have shown that there are specific activation patterns used to stabilize the shoulder. Using also the FEA model, we have shown how effective muscles are in stabilizing the shoulder. This modeling method provides a new tool to understand shoulder joint stabilization.

KEY WORDS: Gleno-humeral Joint, stability using natural frequencies

References

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