

## **Biomechanical Analysis of the Right Elevated Glenohumeral Joint in Violinists during Legato-Playing**

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### **ABSTRACT**

**BACKGROUND:** Many statistics reveal that violin players suffer most often from musculoskeletal disorders compared to musicians of other instrument groups. A common phenomenon, especially observed in violin beginners, is the tendency to elevate the right shoulder during playing the violin. This can probably lead to serious disorders in long-term practice with repetitive movements.

**OBJECTIVE:** For this reason, this study investigated the relationship between the right shoulder elevation and the force in the right glenohumeral joint during violin playing. It was hypothesized that the forces in the right glenohumeral joint are higher during playing with the right shoulder raised compared to playing in normal posture.

**METHODS:** Motion capture data from four experienced violinists was recorded and processed by means of musculoskeletal simulation to get the force and elevation angle while playing with raised shoulder and in normal position.

**RESULTS:** The results indicate that the absolute values of the resulting force, as well as the forces in the mediolateral, inferosuperior, and anteroposterior directions, are higher in playing the violin with the shoulder raised than in a normal posture.

**CONCLUSIONS:** Elevating the right shoulder while playing the violin may pose a potential problem.

**KEYWORDS:** biomechanics, violin, shoulder elevation, shoulder joint force, musculoskeletal disease.