

The effect of non-powered hand tools' diameter on comfort and maximum hand torque

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Abstract

Introduction: The weak design of hand tools and their disharmony with the user's physical features comprise a major risk factor for upper limb musculoskeletal disorders. Hand-tool related injuries comprise almost 9% of all work-related injuries. The present study was conducted to examine the effect of hand tools' diameter on comfort and maximum hand torque and to estimate the optimal diameter for hand tools.

Methods: Participants included 6 men and 6 women with a mean age of 24.7 and a standard deviation of age of 5.84 years. Participants started to load and rotate the grip of 7 hand tools with different diameters with all their power and using a self-made tool for measuring the torque. The test duration, maximum torque and comfort level of the tool grip was then measured and the data obtained were analyzed using the ANOVA and the t-test.

Findings: The mean maximum torque value obtained was 1.88 (SD=0.95) newton meter, the time taken to reach the maximum torque was 13.96 (SD=9.03) seconds and the mean comfort level was 3.27 (SD=1.48) at a scale from 1 to 7. There was a significant difference between the maximum torque generated in the group of men and the group of women ($p<0.001$). The mean maximum torque obtained was 3.034 newton meter and the mean maximum comfort level was 4.67, achieved with a grip diameter of 38 mm.

Conclusion: The optimal hand tool diameter recommended for maximum user comfort and torque is 38 mm.

Keywords: Grip, Hand torque, Non-powered hand tools

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