

## Controlling Vibration Exposure when Drilling into Concrete: Findings from Two Studies

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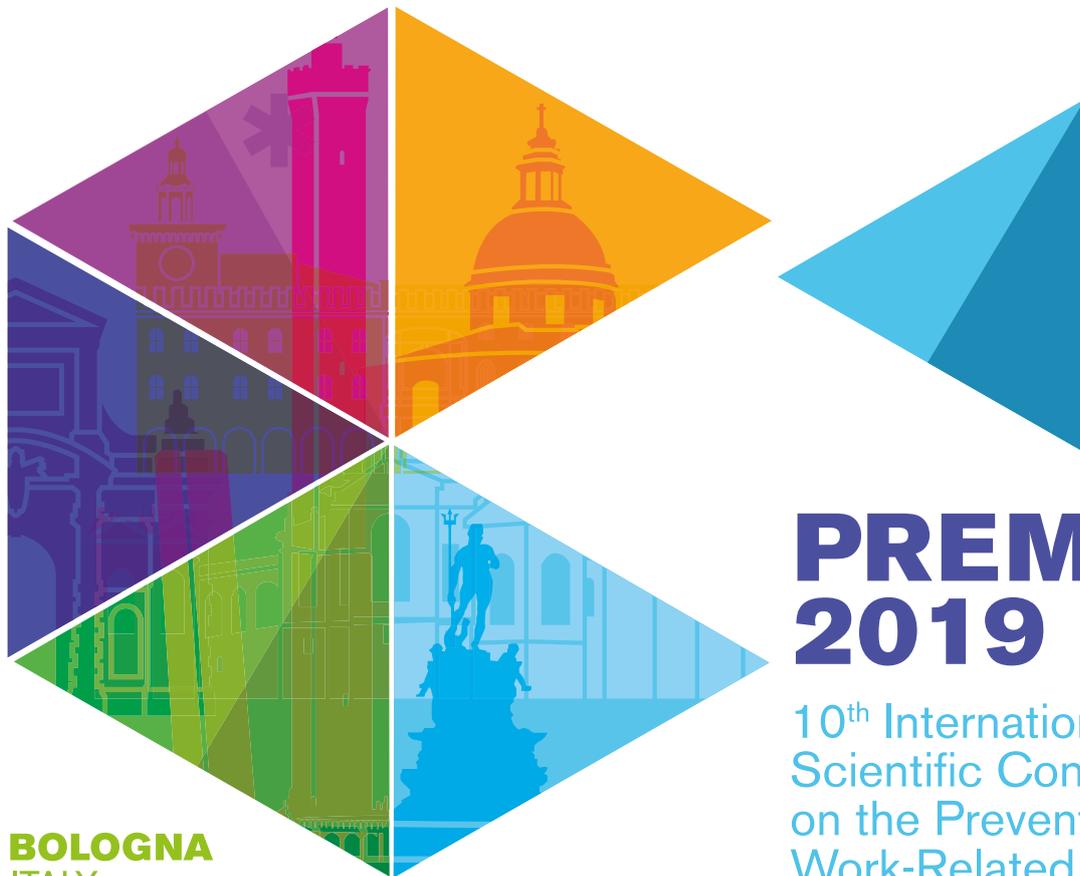
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**Background:** Drilling large holes into concrete is commonly performed in commercial construction to attach anchor bolts and rebar in order to hang pipes or to add concrete to an existing structure. Exposure to vibration may lead to musculoskeletal disorders including hand-arm vibration syndrome. Findings from 2 studies evaluating the effects of force on bit and drill type on handle vibration levels are presented.

**Methods:** A validated robotic test bench system (Int J Ind Ergon 2017; 62:17-20) was used to repeatedly drive a drill bit, under force control, into concrete block (19 mm diameter, 100 mm depth), while both productivity and handle vibration were measured according to ISO standards (28927-10; 5349-1). The first study compared an electric rotary drill to a pneumatic rock drill of similar mass. The second study used an electric drill repeatedly drilling holes with different feed forces in the 120 to 220 N range.

**Results:** For the first experiment, the mean weighted total handle vibration was significantly lower ( $p=0.002$ ) for the electric drill ( $7.15 \pm 0.11$  m/s<sup>2</sup>) than the pneumatic drill ( $39.1 \pm 2.5$  m/s<sup>2</sup>). Productivity was not significantly different ( $p=0.15$ ) between the electric drill ( $9.09 \pm 0.09$  mm/s) and the pneumatic drill ( $8.69 \pm 0.37$  mm/s). For the second study, from 120 to 170 N of feed force, the total handle vibration level increased from 7.5 to 8.5 m/s<sup>2</sup> and productivity increased from 9.6 to 11.2 mm/s. However, between 170 and 220 N of feed force, changes in vibration level and productivity were negligible.

**Conclusions:** Contractors and construction workers should be advised to consider using an electric rotary drill instead of pneumatic drill for drilling into concrete. In addition, workers should be notified that applying large push forces to an electric drill does not increase productivity but may increase the risk of fatigue and injury.



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SEPTEMBER 2019

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