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EXPERIMENTAL MEASUREMENT AND NUMERICAL SIMULATION OF TEMPERATURE DURING DRILLING WITH FOUR SPECIFIC DENTAL DRILLS

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Summary: High temperature during bone drilling is not required. The aim of presented study was experimentally measure and simulate thermal diffusion differences in the surrounding of the two specific drills during hole drilling into the polyurethane (PUR) foam block (from Sawbones Europe AB). Polyurethane (PUR) block was ("artificial bone") with 6 holes in 5mm depth for semiconductor termoelements. Holes for thermocouple were distributed in perpendicular direction along the drilling direction. These thermocouples measure thermal diffusion in according to the drill depth into the PUR blocks. Experiment was performed with and without cooling and in three different revolution speeds, 800rpm, 3000rpm and 5000rpm. Experimental investigation was realized on four types of drills. Two cylindrical and two conical drills from two different manufacturers: i) cylindrical Drill no.1610.928b Ihde Dental; ii) cylindrical Drill no.1610.928b-k Dentamechanik.
The aim of created numerical FE simulations was heat production analysis of drills during hole drilling into the polyurethane (PUR) foam cylinder. Final recommendation for the design of drills is based on obtained results of the heating production analysis.
Created FE simulations analyzed influence of the drill geometry to the heat production during drilling (friction drill on PUR foam). FE analyzes were focused only to friction problem and drill geometry optimization towards to heat reduction. Generally drilling is more complicated process, where are acted more factors (material removing, chip transport, drill geometry, drill size, cutting face cooling etc.