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A comparative in vitro study of power output deterioration over time between Ho:YAG laser fibers from different manufacturers as a function of deflection and power input

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Introduction and Objective: To investigate the performance of different fibers from the industry in vitro and to identify the effect of time and 180° and 0° bend configurations on fiber power output.
Materials and Methods: In-vitro tests were carried out, using single-use Holmium:YAG laser fibers supplied by six (6) major manufacturers. Each of the fibers was tested with an energy input of 0.8, 1.4 and 2.0 Joules (J). A power detector was used to measure the power output after 1, 5, 10 and 15 minutes for three 15-minute cycles of continuous laser pulse. For the first two 15-minute cycles, the laser fiber was subjected to a bent configuration (180°) with a diameter of 25 mm. This configuration was maintained by fitting the ureteral catheter with the fiber into a pre fabricated mould with constant shape. Overall, thirty-six (36) new, single-use fibers were used. Analysis of the data was done using analysis of variance (ANOVA) and Tukey's honest significance test when the results of ANOVA were significant amongst groups. Statistical significance was defined as $p<0.05$ for all tests and comparisons between variables.
Results: No fiber fracture occurred. No statistical significance was identified between the reduction in energy output at the 15th minute of continuous use at 0 and 180 degrees deflection. The reduction in energy output at the 15th minute of continuous use at 180o was not found to be statistically significant for any fiber or initial energy input. The interaction in this time interval between type of fiber and energy input was not significant either. Only the differences in the energy output of the various fibers proved to have a statistical significance ($p=0,001$).
Conclusion: Fiber fracture and decline in performance is probably due to factors other than deflection and continuous use. Frictional forces that occur during lithotripsy as a result of the interaction of the fiber tip with the stone fragments may be responsible.