# Growth rate of mouse tumor of local hyperthermia treated with paclitaxel coated Duplex Stainless Steel thermo-rods

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**Statement of Purpose:**

Local hyperthermia with thermo-rod is able to destroy the heat-sensitive tumor cell by heating between 42□ and 46□. When a paclitaxel coated thermo-rod made of duplex stainless steel (DSS) is exposed in the alternating induction magnetic field, it may generate unique therapeutic heat and start to release paclitaxel into tumor site suppressing growth rate. This paclitaxel coated thermo-rods may improve the current problems of chemotherapy by controlling the drug release rate at hyperthermia temperature. In this study, the tumor growing potential of BALB/c mouse implanted with the 15%paclitaxel coated thermo-rods and exothermic characteristics were investigated.

**Methods:**

Thermo-rods made of the DSS wire (KOS Ltd., Korea) was ϕ1.0mm in diameter and 7mm in length. It's surface was coated with the mixture of 15% paclitaxel(Sigma, USA) and 85% polyethylene co-vinyl acetate (PEVA)(Sigma, USA). And the coating thickness was about 0.25mm and width was about 5mm in wide.

In vivo studies were performed with 6-week-old male BALB/C mice (19-21g)(Hyochang Science, Korea). The mice were acclimatized for 2weeks after arrival, provided with food and water, and kept in an environment with alternating 12hours light and darkness. The mice were inoculated subcutaneously on both lateral peritoneal sides of the BALB/C mice with $3\times10^5$ CRL-1888 tumor cells suspended in 100μL of DMEM medium. After 2 weeks of inoculation, 2~3 paclitaxel coated thermo-rods were implanted into each tumor through a 13G needle, under anesthesia with zoletil (6μL/g) and rompun (4μL /g). The experimental group was divided into 4 groups; induction heated group of bare thermo-rod implanted mouse and no induction heated group, and 15%paclitaxel coated thermo-rods inserted and induction heated group and no induction heated one. After 3 days of implant surgery, the experimental groups were exposed in RF induction magnetic field(In-sung, Korea, 7kW, 114kHz) for 60 minutes hyperthermia every day. The weight of mouse and tumor size were measured with an electric balance and a vernier calipers every other day. The location of thermo-rods implanted in mouse tumor was confirmed with x-ray pictures at the final stage. The effectiveness of hyperthermia with a paclitaxel coated thermo-rod on tumor growing potential was evaluated on the basis of this measurement.

**Results:**

The maximum saturated temperature of the paclitaxel coated thermo-rod measured from the exothermic temperature increasing curves within a calorimetric chamber was about 46℃. The initial heating power of thermo-rods calculated using a Kim's curve method is between 0.52~0.65J/g·sec. The tumor volume growing curve of mice with respect to the reciprocal of animal care time is well accordance with the regression equation y = A exp(-B). The value of "A" is an intersection of y axis represents a final expected tumor volume. The exponent of "B" is equivalent to the growing potential of the tumor. The average tumor growing potential of control group is about 45mm$^3$day, and the exposed control in the induction magnetic field is slightly reduced to 41mm$^3$day. The average growing potential of 15% paclitaxel thermo-rod before hyperthermia is about 42mm$^3$day which is similar value of the control one. However, the average growing potential of the post-hyperthermia is dramatically reduced to 22mm$^3$day because of the thermal and/or chemical damage on the tumor site.

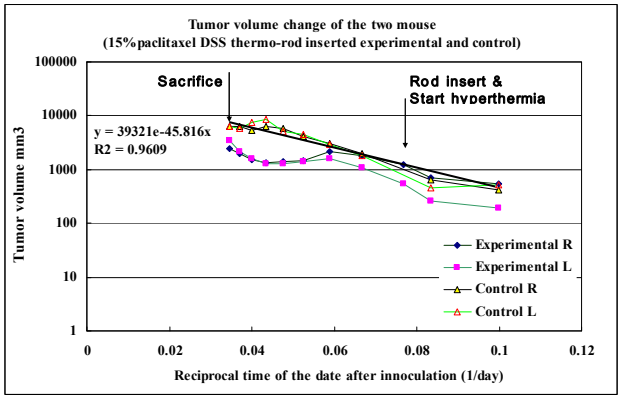


Figure. Tumor volume growing curves of experimental group implanted with 15%paclitaxel coated thermo-rod and control group

**Conclusions:**

The 15% paclitaxel coated DSS thermo-rod on mouse tumor may able to obtain a constant hyperthermia temperature up to 46 ℃ within an RF induction magnetic field. The tumor growing potential can be reduced from 42mm$^3$day to 22mm$^3$day by hyperthermia with paclitaxel coated thermo-rods.

**References:**

Y. K. Kim, H.W. Choo, E.M. Hwang and S.M. Choi. "Tumor growing potential of the mice implanted with 15% paclitaxel coated thermo-rods", Bioceramics22(2009) Vol. 22, pp773-776, www.bioceramics22.com

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