Inactivation of skin cancer cells by atmospheric pressure He-O_2 plasma irradiated liquids

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In recent years, many researches have been conducted actively toward the practical application of cancer treatment using atmospheric pressure plasma. According to previous studies, chemically active species or radicals produced by plasma irradiation on some liquids such as normal saline, culture solutions, intravenous fluids, and so on, have been thought to induce apoptosis to cancer cells [1]. However, in order to realize the plasma treatment for practical cancer treatment, it is indispensable to develop a method that inactivates only cancer cells, or selective killing of cancer cells. The aim of this study is to develop a method realizes selective killing of cancer cells by use of atmospheric pressure plasma irradiated liquids.

It is generally known that cancer cells metabolize more actively than normal cells by absorbing large amount of oxygen, and it is also known that reactive oxygen species (ROS) induce DNA damage. These facts have been understood as an important factor to realize selective killing by other practical cancer treatments using ionizing radiation, which is called oxygen enhancement ratio (OER). Therefore, we tried to add O_2 gas to atmospheric pressure He plasma to generate ROS effectively. The mixing ratio of the He-O_2 mixed gas that maximizes the inactivation effect for cancer cells to normal cells was investigated. Furthermore, we also investigated the amounts of hydrogen peroxide (H_2O_2) and nitrite (NO_2^-) in the culture solution irradiated with the plasma.

In this reserch, a plasma irradiated culture solution, that is the plasma activated medium (PAM), was prepared with He-O_2 mixed plasma. Then, it was added to normal skin cells (HaCaT) and skin cancer cells (A375) to examine the difference of survival probabilities.

Figure 1 shows relative number of living cells of A 375 and HaCaT in cases of (a) He plasma irradiation (flow rates of He: 10 L / min) and (b) He-O_2 mixed plasma irradiation (He: 10 L / min + O_2: 150 mL / min). Higher killing efficiency of cancer cell than of normal cell was observed in He-O_2 mixed plasma.

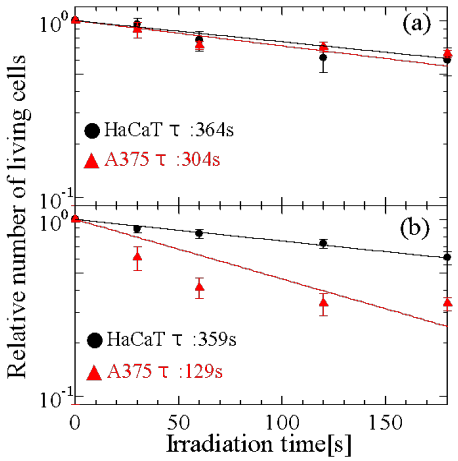

Fig.1 Inactivation effects of the cancer (A375) and the normal (HaCaT) skin cells irradiated with (a) He and (b) He+O_2 plasmas

References:

[1] H.Tanaka and M.Hori, Pharmacia, **51**,1053-1057 (2015).