JST project No.20

The detection of radiation induced radicals from teeth enamel by in vivo EPR (Electron paramagnetic Resonance) Dosimetry

Urgent funding for international collaborative research that arises from earthquake and subsequent tsunami and nuclear accidents

Japanese Research Team

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AIM: To establish the techniques for in-vivo Dosimetry in Japan that can provide stable and reproducible EPR measurements in connection with unplanned radiation exposures, in collaboration with the US team.

This project includes following issues :

1)Develop techniques to make the measurements using the incisors (extending in Japan the capabilities that previously were for premolar or molar teeth)

2)To make measurements from upper incisor with volunteers who live in FUKUSHIMA

The problems on "lying down" position

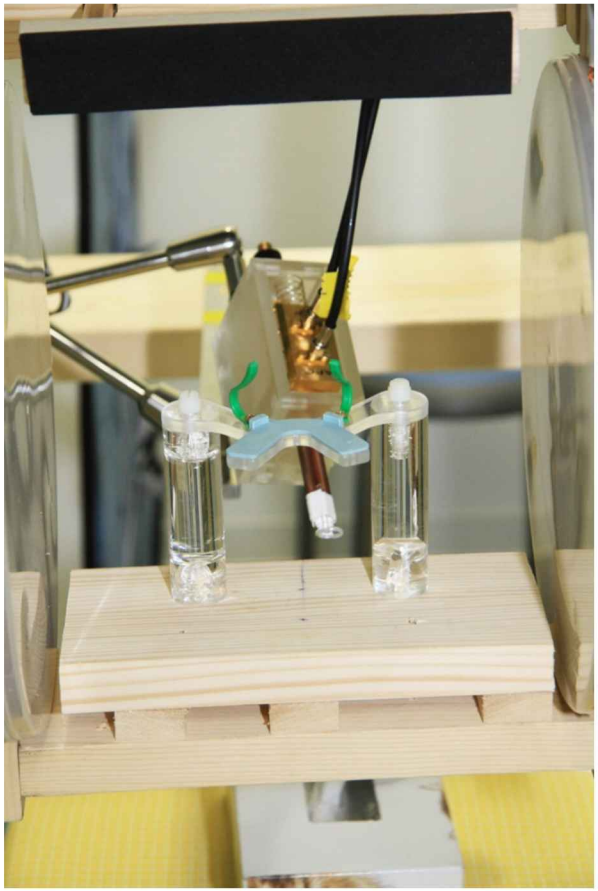
1. Uncomfortable, because saliva easily accumulate in the deep of the throat.

2. It is difficult to firm fixation of the detector loop on molar or premolar.

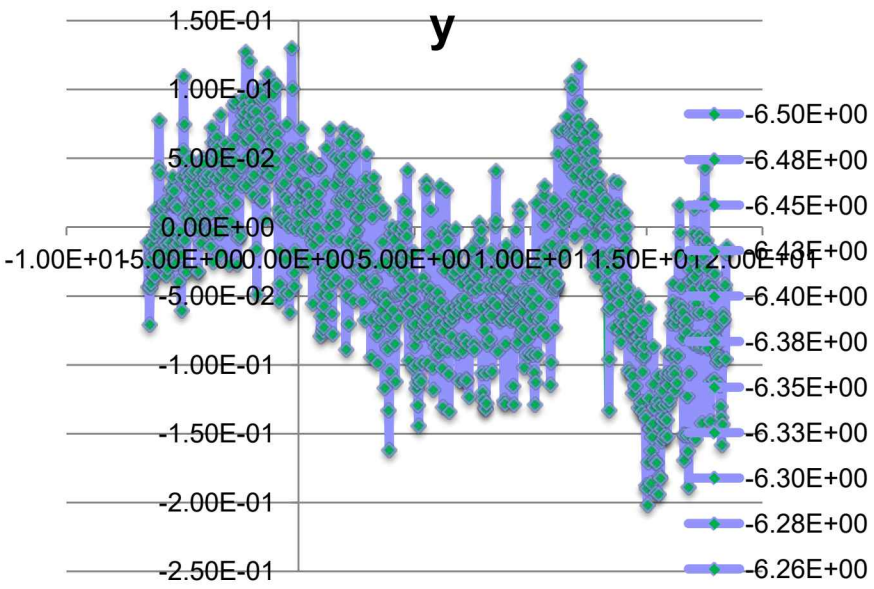
3. Limited field of view between the magnet at the lying down position makes the volunteer nervous or anxious .

We developed "incisor measurement on the sitting position supported by Dart-Dose CMCR and installed in the clinical system in NIPH.

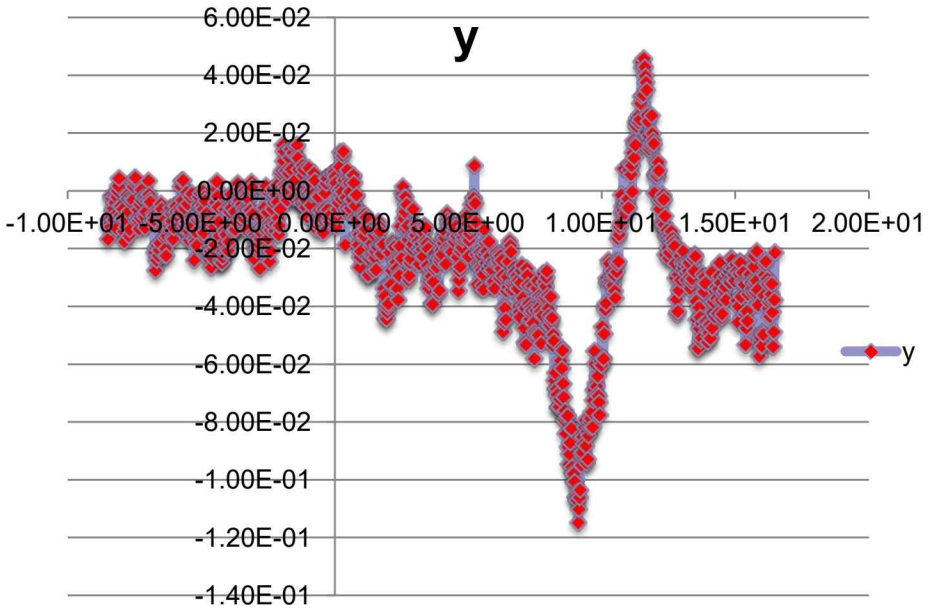
A wooden frame containing no magnetic materials was made for firmly but comfortably holding the head of volunteers sitting in a chair during the measurement. The resonator is held on the distal end of a lockable articulating arm that is mounted to wooden frame.

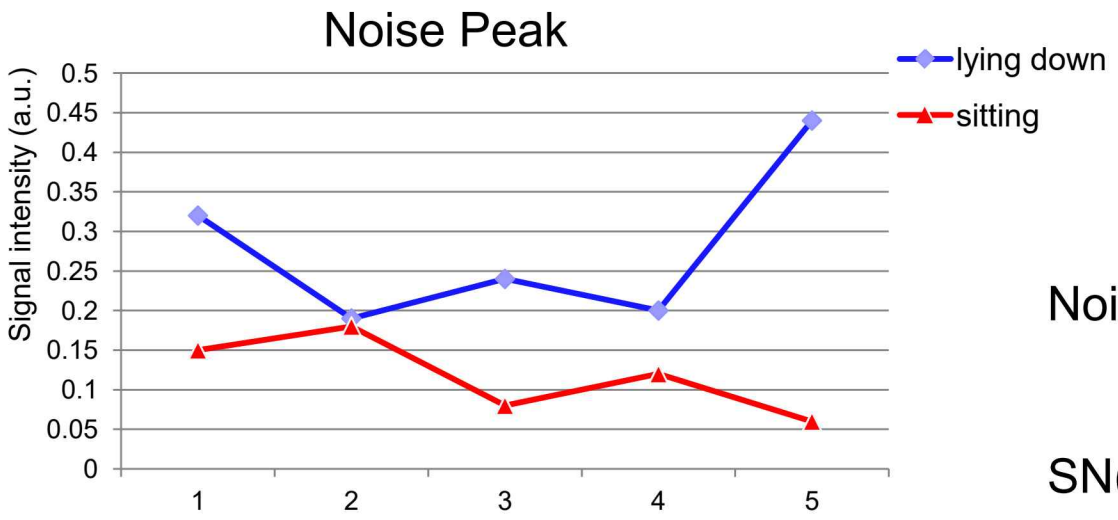


Lying down measurement



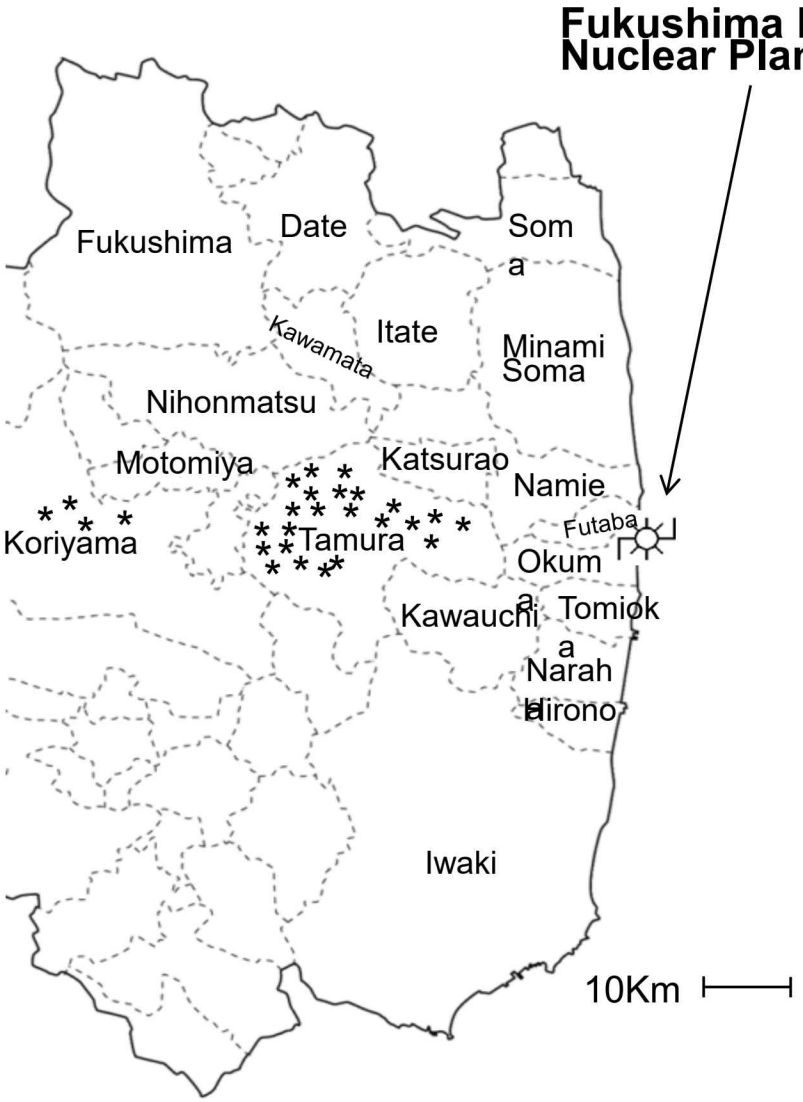
Sitting measurement





		lying down	sitting
Noise	mean	0.278	0.118
	SD	0.093	0.044
SN(PDT)ratio		1.21	2.03

Materials and Methods

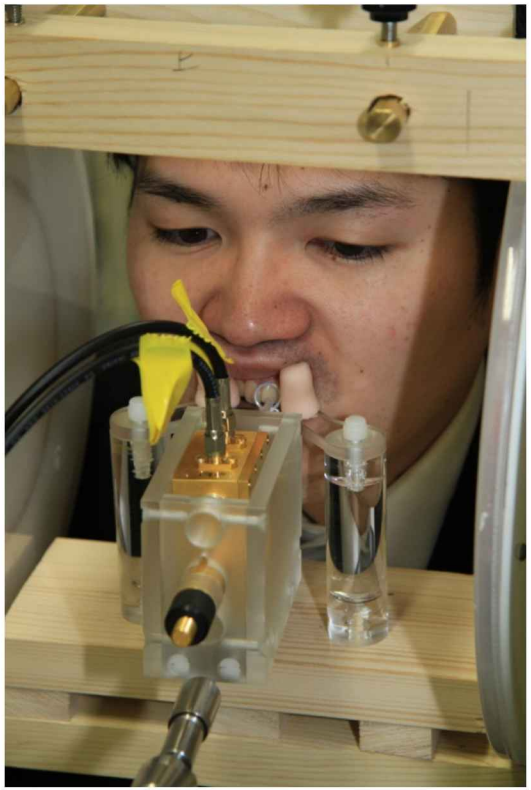


35 volunteers were enrolled in this study (male 15, Female 18, average age was 25 years). All volunteers had at least one complete healthy upper incisor. They were residents in Fukushima prefecture within the 60-80km distance from FUTABA-Machi where the FUKUSHIMA Nuclear Power plant I is located.

1.2 GHz (L-band) using a 41 mT permanent magnet with 50 cm pole separation. All measurements are performed using surface loop resonators that have been specifically designed for EPR measurements of the upper incisor teeth.

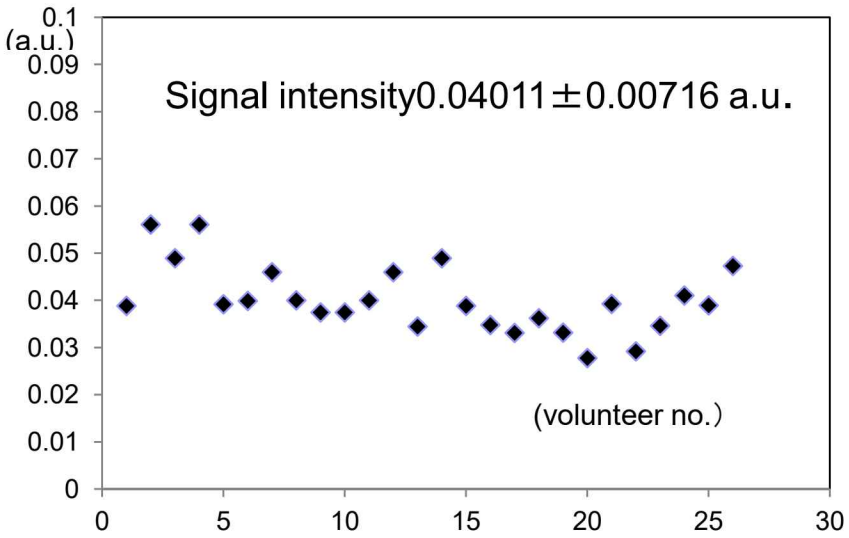
This protocol has been approved by the IRBs of NIPH (National Institute of Public Health, Japan), NIPH-IBRA#10039 and Kagawa University, Heisei#24-4.

Results

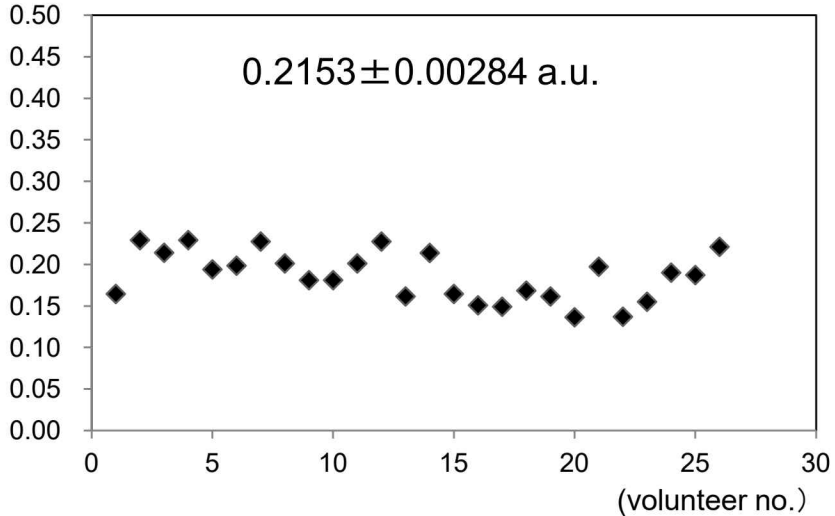


The teeth were positioned by use of a bite plate system which gently held the upper lip and kept the resonator loop on the surface of the tooth.

EPR signals



EPR/PDT ratio



Conclusions

1. We were able successfully to carry out, in vivo EPR measurements from human upper incisors in volunteers from Fukushima.

2. There were no indications of radiation-induced signals above background.

Future studies will focus on:

1. More detailed analysis of the background signals by increasing the number of volunteers who are measured
2. Determining the feasibility of longer measurements to lower the threshold level for detection of radiation-induced signals
3. Establishing the procedures for obtaining background measurements in individuals with a higher risk of exposure in the future
4. We also will seek to determine the psychological benefits for volunteers who have been measured.

We appreciate the support from JST

THANK YOU FOR YOUR ATTENTION