

SHORT COMMUNICATION

THE EFFECTS OF LASER RADIATION ON THE DESCENDENTS OF IRRADIATED RATS

J.W.R. Hernandez¹, C.A.A. Barbosa¹, L.A.O. Moderno² and N.A. Parizzotto²

ABSTRACT

The effects of low energy laser radiation on the descendents of irradiated rats were investigated by comparing natimortality and the frequency of congenital malformations in three experimental and a control group. Natimortality was not significantly different among the groups. However, cardiomegaly, anophthalmia, dilated abdominal viscera, and premature closures of cranial sutures were recorded only in the experimental groups.

Soon after its development in 1960, laser radiation was introduced to the medical practice, and is currently used as a therapeutic technique with some remarkable results in several applications such as pain relief, wound healing and nerve regeneration (Muller, 1986).

However, besides the beneficial results, its harmful effects must be also considered, and several basic investigations on the biological interactions between laser energy and tissues are in course. Some of the most important alterations already studied are concerned with DNA, RNA, protein and prostaglandin synthesis, with cellular proliferation and motility, with the release of neurotransmitters, with phagocytosis and with dissociation of oxyhemoglobin (Basford, 1989).

Taking into account that these modifications, occurring at the cellular level could ultimately be translated into alterations of the organism, it is important to study the possible *in vivo* effects of laser radiation at the phenotypic level. We have investigated such effects on the descendents of albino rats whose gonads were experimentally exposed

¹Departamento de Genética e Evolução, ²Departamento de Fisioterapia e Terapia Ocupacional, Universidade Federal de São Carlos, Rodovia Washington Luiz, Km 235, 13560 São Carlos, SP, Brasil. Send correspondence to C.A.A.B.

to a helium-neonium low energy laser radiation. The effects studied are concerned with natimortality and visible congenital malformations.

The studied sample consisted of three groups of five couples of adult albino Wistar rats, irradiated in their gonads with a daily point application dosage of 0.5 J/cm^2 , 5.0 J/cm^2 and 50.0 J/cm^2 , respectively. After this treatment, which took over 10 days, the couples were formed. The control group consisted of five couples of non-irradiated animals. The source of radiation was a He-Ne Biostimulators Plasmax II (KLD Biosistema, Ltda), which emits a beam of 632.8 nm with an output of 2.0 mW.

Natimortality

The 20 couples produced 226 descendents, of which 10 were stillborn (Table I). Natimortality was not registered in the control group, and this suggests that there is no residual effect of an unknown nature on foetal mortality in these animals. On the other hand, among the irradiated groups natimortality varied from 0.03 in the 0.5 J/cm^2 to 0.07 in the 5.0 J/cm^2 group. The Kruskal-Wallis statistical test revealed that these values are not significantly different ($H = 4.23$; D.F. = 3; $0.2 < p < 0.3$).

Table I - Natimortality and litter size according to laser dosage.

Dosage (J/cm^2)	Litter size	Stillborn
0	13	0
0	05	0
0	10	0
0	09	0
0	06	0
0.5	14	1
0.5	16	0
0.5	11	0
0.5	08	0
0.5	15	1
5.0	12	2
5.0	14	1
5.0	09	0
5.0	11	0
5.0	12	1
50.0	14	0
50.0	14	2
50.0	09	0
50.0	14	2
50.0	10	0

Visible congenital malformations

Two of the 216 alive descendents, both females born to a couple of the 5.0 J/cm^2 group, were anophthalmic, smaller than the other components of the litter, presenting a prominent forehead, and a staggering walk. One of these animals lived to adulthood (Figure 1), whereas the other died five days after birth.



Figure 1 - Anophthalmia in a descendent of the 5.0 J/cm^2 group.

Post-mortem examination was made on this last animal as well as in three others which died spontaneously, and the necroscopic observations were the following:

- Dosage: 0.5 J/cm^2 . Male, died before the 20th gestation day. Weight: 4.29 g. No external malformation. Global cardiomegaly and pulmonary hypoplasia. Apparently normal abdominal viscera. Delayed ossification.
- Dosage: 5.0 J/cm^2 . Female, small for age. Weight: 15 g. Evidence of premature closure of cranial sutures. Bilateral anophthalmia. Small mouth and ears.
- Dosage: 5.0 J/cm^2 Male. Weight: 24 g. Cardiomegaly. Intrabdominal testes. Dilated abdominal viscera.
- Dosage: 50.0 J/cm^2 . Male. Weight: 21 g. Bilateral opacification of the eyes. Dilated abdominal viscera. Intrabdominal testes.

It seems that these malformations were not correlated to the dosages of radiation, though since they appeared only in the experimental group, one must consider a possible mutagenic effect of low energy laser radiation.

We are now investigating the repeatability of these results, using different rodent species in a series of more controlled experiments.

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RESUMO

Os efeitos da radiação laser de baixa potência em descendentes de roedores irradiados foram investigados pela comparação da natimortalidade e da frequência de malformações congênitas entre grupos experimentais e o grupo controle. Quanto a natimortalidade, não foram detectadas diferenças significantes entre os grupos. Todavia, nos grupos experimentais foram registradas as seguintes malformações: cardiomegalia, soldadura precoce das suturas cranceanas, anoftalmia, dilatação das vísceras abdominais.

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