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Biosafety in the Use of Radiation: Biological Effects Comparison Between Laser Radiation, Intense Pulsed Light and Infrared and Ultraviolet Lamps in an Experimental Model in Chicken Embryos

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1. Introduction

Physics is the science that studies the interaction between matter and energy. This discipline studies the general properties of bodies, the forces that modify the transfer of energy and the interaction between particles. Physics now has many branches, and one of them is the Biomedical Physics.

Biomedical Physics in Medicine applies the principles and methods of physics. This will generate new knowledge and progress towards new horizons in the management of certain diseases. Thus the study of radiation led to progress in the field of diagnosis and therapy of some diseases.

Radiation it's called all energy that propagates as a wave through space. Radiation can be classified as ionizing radiation (cosmic rays, gamma rays, x-rays) and non-ionizing radiation. The concept of non-ionizing radiation includes ultraviolet (UV), infrared (IR) and others lasers.

Non-ionizing radiations are those that radiation interaction with matter does not generate ions due to its energy content is relatively low.

Non-ionizing radiation (laser, ultraviolet and infrared) are commonly used in medicine for diagnosis and therapy. However, they have a deleterious effect on organogenesis (organ formation).

1.1 Ultraviolet radiation (UV)

UV radiation is part of the natural light. According to its wavelength is recognized groups A (400 - 320 nm), B (320 - 290 nm) and C (290 - 200 nm).

UV radiation sources are natural (the sun) and artificial (hospitals, industries, cosmetics, etc.).

UVC radiation does not reach the surface because it is retained by the layer of ozone in the stratosphere.

The natural radiation that reaches us is UVA and UVB. The UVC is the most dangerous to health because of its higher energy.

As for the benefits of using ultraviolet (UV), is recognized for use in phototherapy of patients with psoriasis, vitiligo and other skin diseases. In addition, ultraviolet rays have a bactericidal action, allowing its use in pressure ulcers.

However, involvement of UV radiation in different pathologies has led to the approach of concepts such as photo-aging, accelerated aging process due to modification by UV radiation, DNA (deoxyribonucleic acid) and lipids membrane and induction of programmed cell death (apoptosis) of epithelial cells and the activation of enzymes degrading the collagen in the skin.

While studying the effects of ultraviolet radiation on the apoptotic induction and angiogenesis the results are mixed for use in the therapy of skin diseases including cancer and photocarcinogenesis, understood as the mechanism of DNA mutation due to the alteration of repair when damaged by UV radiation.

Ultraviolet radiation is involved in the alterations of protein synthesis, the immunosuppressive properties and its relationship to skin cancer and change in the synthesis of melanin.

Ultraviolet radiation B are related to the induction and progression of cutaneous melanoma in mice, so its use helps to know the specific immune processes committed to these cancers, and thus to develop new treatments for melanoma. This type of radiation has also been used experimentally to elucidate the mechanisms of cellular radioresistance in ovarian cell lines.

1.2 Infrared radiation (IR)

Other natural rays are infrared (IR) or infrared radiation (the prefix infra means below, correspond to an emission of energy in the form of electromagnetic waves in the spectrum located immediately after the red zone). These rays have wavelengths between 800 and 0.25 nm and cause heating of the exposed regions, being the less penetrating wavelength formerly called them "calorific rays."

As for the infrared rays have a wavelength between 800 and 0.25 nm, cause heating of the exposed areas and those are more penetrating radiation of shorter wavelength. Special lamps are used commercially to produce 14,000 to infrared.

Its heating effect allows blood vessels to dilate and increase blood flow.

They are also used in conjunction with hyperthermia and photodynamic therapy to treat tumor in the ablation of organs, and therapy of processes related to inflammation of nerves, muscles and joints.

It has been postulated that IR produce a higher activity of phagocytosis and metabolic reactivity in infectious and has been used in phototherapy of patients with certain skin tumors.

However, the intracellular level, has shown that infrared radiation acting microtubule disrupting the centrosome (organoids) in mammalian cells in vitro.

1.3 Laser radiation

The laser light (artificial) could be defined as an amplification process that culminates in the production of a light. In turn, electricity is the band of the electromagnetic spectrum including UV radiation, visible light and IR radiation. The laser light is not normally found in nature and is of extraordinary intensity.

The best known property is the emission of beams of highly monochromatic, coherent and directional light.

There are different laser for medical use, classified as high-power-like carbon dioxide (CO₂), for surgical use, and low power-such as Helium-Neon (He-Ne) for clinical use.

The term laser means in English Light Amplification by Stimulated Emission of Radiation.

The laser is a device or devices that produce a very special light (visible or invisible depending on their wavelength), created by man and acts like solid matter.

Einstein laid the theoretical basis for his work on the Quantum Theory of Radiation in 1917, by which the energy (light) can be converted into mass and mass into energy.

As light is reflected, the laser is absorbed, burning, and changes its direction through different lenses. As solid mass you can cut, melt, burn, and transmit.

The use of laser energy is not without several problems as the high price of the apparatus and the need for prior learning to use. In addition there is one type of laser that fits all applications, but each type has its sitting indications, many of which are unique to it.

From the medical point of view the use of laser can be used to remove tumors, seal blood vessels to reduce blood loss, sealed lymph vessels to reduce swelling and decrease the spread of tumor cells and nerve endings sealed to reduce postoperative pain.

Aesthetic laser therapy treatments can be used to remove warts and moles and to remove tattoos. It is also used to treat stretch marks, cellulite, sagging skin, acne sequels. It is based on the fundamental physiological properties of the laser, anti-inflammatory, spasmolytic and antiphlogistic effects and bio-stimulants. (Andreu & Valiente Zaldivar 1996).

Lasers and biomedical use:

- Solid lasers: the most used is Neodymium-Yag laser. In ophthalmology it is used to coagulate tissue. It is also used to treat hyperpigmentation of the skin
- Gas lasers: they are the most widely used therapeutic and amongst these the helium-neon laser, used in beauty treatments, therapies reductive, etc. (red), the argon laser used in dermatology (bluish green) and the laser CO₂ used in surgery as a scalpel.

The Helium-Neon laser is used to treat various conditions "satisfactory" mainly osteomioarticular (rehabilitation), skin disorders and wound healing.

Among the lasers used in medical practice are the 308nm excimer. This type of laser emits 85% of ultraviolet (UV) B and 15% of UV radiation type A.

Contraindications: The laser should not be used in patients affected by neoplasia (cancer). Nor can it be used in the presence of acute infections and in patients treated with photosensitizing drugs or remedies. Not recommended laser surgery in people with pacemakers or pregnant women.

In a previous study, we irradiated chick embryos and new born chickens with He-Ne laser, infrared and ultraviolet radiation, finding post irradiation histopathologic changes. (Samar et al., 1993, Avila et al., 1994, Samar et al., 1995)

1.4 Intense Pulsed Light (IPL)

In addition to the laser, since 1995 it also has been available a device that emits at 308 nm, called intense pulsed light (IPL) which is basically a XeCl lamp that has proved to be a useful tool for the treatment of the changes of the skin. The IPL provides high energy pulsed excitation consisting of 85% of ultraviolet radiations UV B and 15% of radiations UV A. This technology is also known as "Photoderm". Although the active medium of this lamp is also XeCl, the emission is polychromatic but also non-coherent; therefore is not a laser. However,

the use in medicine and the risks associated with it are comparable to the medical lasers of the high energy (class 3b and 4) and therefore their use should be subject to the same safety guidelines. (Spencer & Hadi, 2004). (Town, et al. 2007).

The IPL is used in a similar way to the excimer laser in the treatment of various pathologies of the skin: psoriasis, vitiligo, etc. Clinically it is also used to stimulate the regeneration of the cartilage in degenerative processes. It has been postulated that its action is based on the activation of the cell division, collagenous and elastic fibers formation, regeneration of blood vessels, cicatrization of bone tissue and reepithelization of damaged tissue. (Schoenewolf et al. 2011)

Nevertheless, there are some discrepancies in results obtained with animal experimentation on the medical use of not-ionizing radiations. (Chan et al. 2007)

However, the biological effect of the 308 nm IPL has not been investigated using the chick embryos as sensor.

1.5 Objective

Different studies led us to establish preliminary results concerning the action of He-Ne laser, ultraviolet, infrared, LIP on the different tissues of chick embryos and in salivary glands and tongue of newly hatched chicks.

We also carry out the observation of effects that these types of radiation have on the chorioallantoic membrane of chick embryos, particularly on the formation of new blood vessels.

Moreover, the exposure time and the amount of non-ionizing radiation doses used in animal experiments and in medical practice are not yet fully known. Thus, our experimental design established in embryonated eggs and newly hatched chicks will contribute to the quantitative analysis (exposure and dose) of radiation mentioned above.

The purpose of this chapter describes the biological effects comparison between laser radiation, intense pulsed light and infrared and ultraviolet lamps in an experimental model in chicken embryos.

The chick embryo is a good model to evaluate direct effects of ionizing radiation because of easy handling and availability ITS.

Describe the most important results with different sources that emit non-ionizing radiation.

2. Materials and methods

2.1 Experimental model of chicken embryo

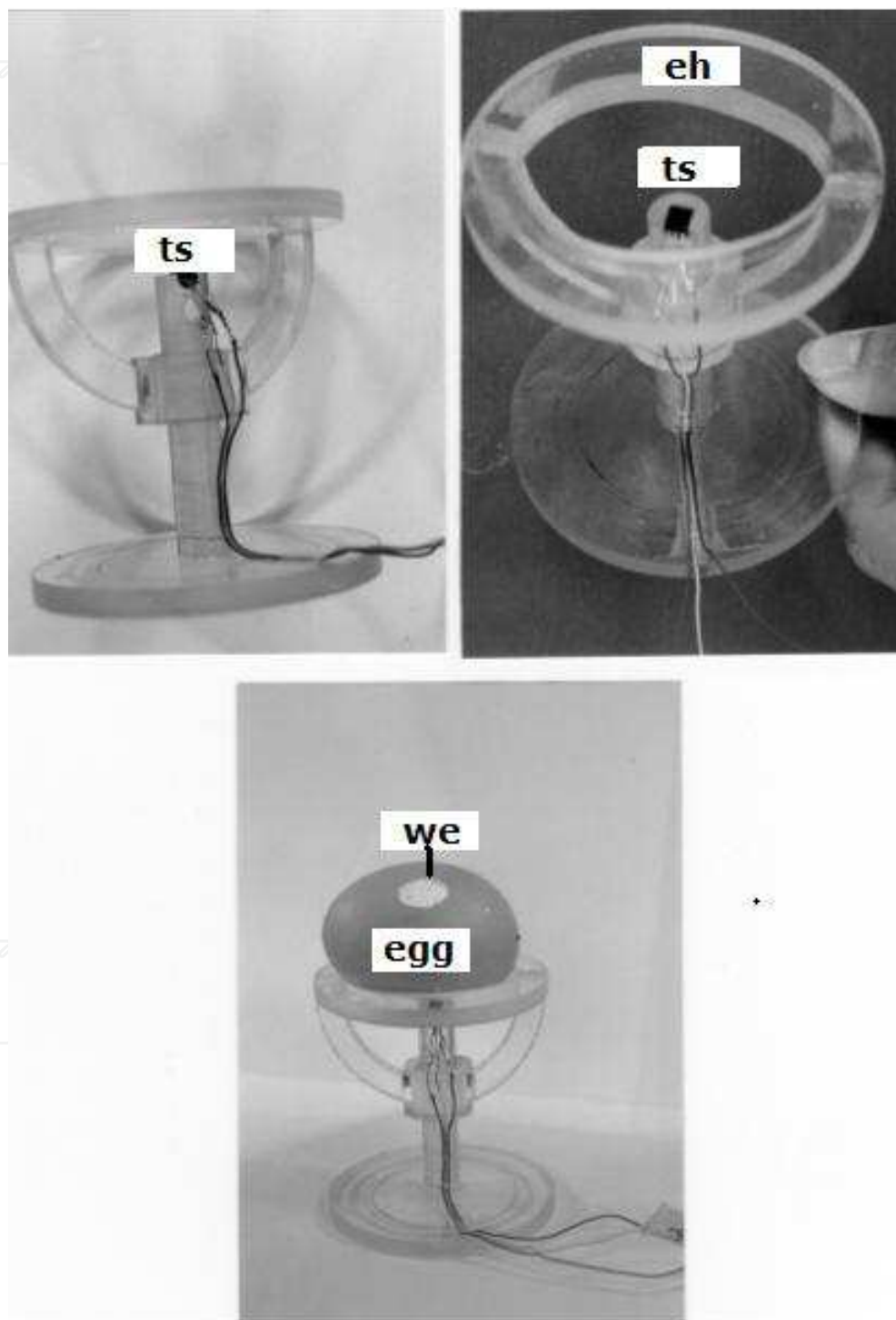
We used the chick embryo model as a mechanism for measuring biological effects of radiation on tissues, and this is an interesting method to be easily replicable.

Also to compare the results obtained by applying the radiation we have established in previous studies, the sequence of morphological changes, biochemical and histochemical occurring during differentiation and growth of the tongue, stomach, and ovaries both mesonephros "in ovo" as "in vitro" from 7 to 21 days post-birth immediately.

The problem groups were irradiated for 5 minutes through a window opened in the egg shell, and the eggs were maintained aseptically for 24hs in an incubator. We used the following radiations: intense pulsed light (excimer laser wavelength 308 nm) He-Ne laser (power 5mV, wavelength 632.8 nm), UV germicidal lamp and IR lamp OSRAM infraphil.

The control group were irradiated and only opened a window in the eggshell. All controls and aseptically problems remained in an incubator at 37 ° C for 24 hours post-irradiation.

The samples taken was fixed in Bouin and were processed by routine histological technique and stained with: hematoxylin and eosin; conventional Histochemistry: PAS for the demonstration of glycoproteins, Alcian Blue at pH 2.5 and 1.0 for the demonstration of glycosaminoglycans sulfated and sulfated; Toluidine blue at pH 3.8 to demonstrate basophilic and metachromatic substances, alcohol-resistant.



Sample (egg) with thermic sensor (ts). Egg holder (eh). Window in the egg shell (we).

Fig. 1. The system adaptable to the experimental requirements.

2.2 Infrared radiations

In 1996 we published design of a thermic detection system applied to chick embryonated eggs irradiated with infrared rays (Avila et al. 1996).

Infrared radiations are widely used in medical therapeutics. It has been argued that doses and periods of time employed in experimental animals are higher than those used in clinic. Thus, we considered of interest to analyse aspects of dosimetry and thermic effects of infrared rays with current methods in medical practice, using in ovo chick embryo as a model of easy control.

To this end we designed a system to measure temperatures and their acquisitions and software for its handling. The system consists of: a) thermic points: thermocouples or termistores adaptable to the experimental requirements and calibrated with a greater precision within a range of ten degrees around the incubation temperature; b) acquirer circuit of thermic data (hardware): it generates a time base that varies with the thermic sensor. Software: the PC XT or AT detects changes in the time base by means of a programs' in a Turbo Pascal; c) storage and analysis of data allows, through a menu the scale selection, time of program data to be acquired, storage and recovery of the diskette information and graphic impression; d) chick's embryonated eggs.

This system allows to measure temperature distribution in small physical spaces with little disturbance of the system to be measured in irradiated bodies, to analyse variations of the temperatures in time and to secure a greater confidence and automatism to obtain the required data. Figure 1.

2.3 Experimental Intense Pulsed Light (IPL) system with and without different filters (Avila et al. 2009)

To carry out the studies of the effects of the radiation on the different tissues in embryos of chicken we designed the experimental plan that is shown in the Figure 2.

The system consists of an Intense Pulsed Light (IPL) radiation source of 308 nm from DEKA model: Excilite (XeCl Excimer Light) wave length of 308 nm, capable to emit a radiation density of 4,5 J/cm². The emission spectrum of this lamp was characterized in this work and is shown in the Figure 2.

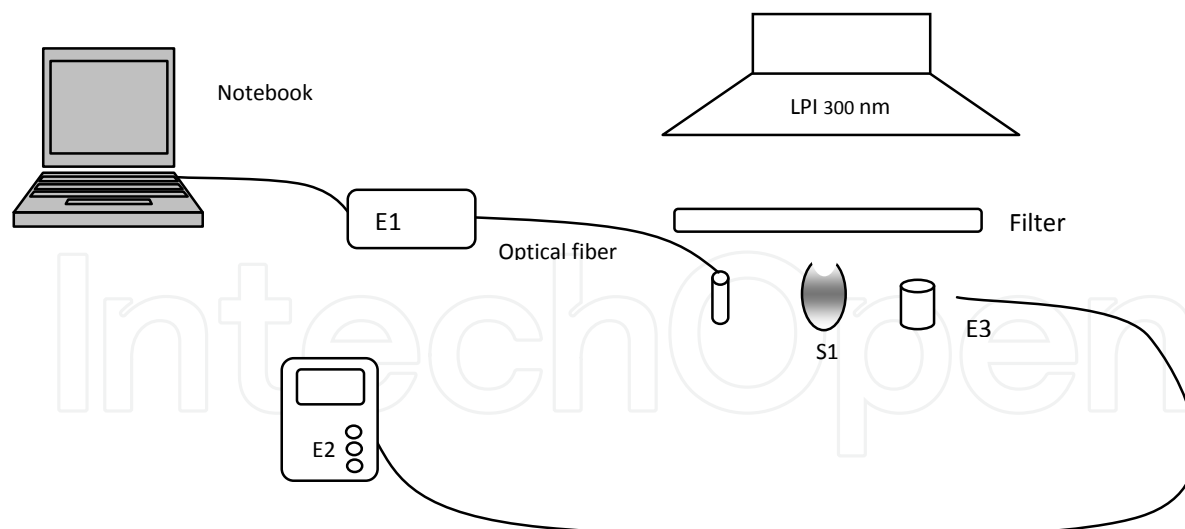
Besides we used a filter set:

Acetate: Colorless, Orange, Green, Blue and Yellow.

Cellophane: Colorless, Orange, Green, Blue, Yellow and Red

A spectrometer (E1) Ocean Optics model HR4000 was used to characterize the emission of the IPL and the filters used in this work. The measurements of energy were carried out with an energy meter (E2) Scientech model 756 and a sensor (E3) model 362 with complete range (200nm to 1m). With this system we measured the total emitted energy per surface unit, mJ/cm², on each sample with the different filters used and also the variation of the emission spectrum of the IPL after passing through the filter.

Optical characteristics of the light emitted by the XeCl lamp were determined, Intense Pulsed Light (IPL), using the experimental plan shown in Figure 2. The typical emission spectrum of this lamp was obtained by means of this system We determined that 85% of UVB radiation emitted by the IPL corresponds to 307.94 nm and only 15% to UVA centered in 367,5 nm. This implies that the effects seen on the tissue samples were due mainly by only one emission with very similar characteristics to the effects that could be caused by a laser radiation of this wave length.



E1: Spectrometer Ocean Optics HR4000, E2: Energy meter, E3: Energy sensor, S1: sample (egg), LPI: IPL source (308 nm). (Avila et al, 2009)

Fig. 2. Scheme of the experimental setup

In Table 1 we shown the light intensity transmitted in the different units by the IPL with the different filters used of acrylic (Ac) and cellophane (Cel) with the exposure time that are normally given for skin treatment. The selection criteria used for the filters to work with were those which showed a transmittance grater than 30%. This transmittance percentage guarantees the possibility to observe the effects of radiation on tissues.

Filter	Exposure time /s	Transmitted Intensity (mW)	Transmitted Fluence (mJ/cm ²)	Filter absorbance	Filter transmittance (%)
None	20	18.1	147.50	0.00	100
F1: Green acetate	20	0.46	3.74	1.59	2.5
F2: Blue acetate	20	0.00	0.00	2.00	0.0
F3: Clear acetate	20	0.00	0.00	2.00	0.0
F4: Yellow acetate	20	0.00	0.00	2.00	0.0
F5: Orange acetate	20	6.70	54.60	0.43	37.0
F6: Red Cellophane	10	3.29	13.40	1.04	9.1
F7: Clear Cellophane	10	18.0	73.34	0.30	49.7
F8: Yellow Cellophane	10	2.2	8.96	1.21	6.07
F9: Blue Cellophane	10	0.48	1.95	1.87	1.32
F10: Orange Cellophane	10	9.2	37.50	0.60	25.0
F11: Green Cellophane	20	5.25	42.8	0.53	30.0

Table 1. Intensity of the light from the XeCl lamp (IPL) transmitted through the different filters, measured at 30 cm from the lamp. (Avila et al. 2009).

Once we characterized the IPL emission and the filter absorption we proceeded to radiate the chicken embryos by previously removing their white membrane (below the shell of the egg). We first carried out a set of measurements without using any filters and later using the filters that were previously selected.

Before starting the radiation process in the different samples we determined the absorption spectrum of the albumen of the egg and of the white membrane. From these results we determined that the white membrane should be removed before the radiation of each sample since it has a very large absorption coefficient to the study wave length and would not permit to determine the effects of the radiation in the embryo tissues.

The acetate filters (transparent and orange) and cellophane filters (transparent orange and green) allow to the passage of the radiations producing biological effects in the organs of the chicken embryo, for this reason it is not recommended to be used as a filter.

The acetate filters (green, blue and yellow) and cellophane filters (red, yellow and blue) do not allow to the passage of radiation, without showing any biological effects in the chicken embryo.

3. Results

3.1 He-Ne laser irradiation

3.1.1 Chick embryo mesonephros

A study on the effects of He-Ne laser irradiation on glomeruli and renal tubules of the chick embryo mesonephros at 7 days of in ovo development was made. (Avila et al, 1992)

To this purpose, He-Ne laser irradiation (potency: 5 mW, wavelength: 632.8 nm) was beamed for 5 minutes through a window opened in the egg shell, and the eggs were maintained aseptically for 24 h in an incubator.

Mesonephros were dissected out and processed for hematoxylin/eosin, periodic acid-Schiff, and Alcian blue at pH 2.5 and 1.0, toluidine Blue at pH 3.8.

In controls, the glomeruli were formed by coiled capillaries with a homogeneous basement membrane, the proximal tubules presented a high cubic epithelium with acidophilic cytoplasm and a developed brush border. Distal and collecting segments were lined by cubic epithelium. An alcianophilic and PAS-positive reaction stood out at the membrane coats of the proximal tubules and tubular and glomerular basement membranes. No glomerular alterations were observed during the experiment. However, there was a marked enlargement of the tubular interstitium, with edema and lymphohistiocytic inflammatory infiltration. Some tubular cells desquamated to the lumen. Other cells presented a raveled apical surface. Some nuclei were dispersed out, and mixing with chromatin, formed diminutive granules. Pyknotic nuclei were seen occasionally. Epithelial necrosis and cytoplasmic debris in the lumen were also noted. For mucins, some zones showed brush border coats of the proximal tubules as discontinuous.

3.1.2 Chick embryo ovary

We published in 1992 the structural changes induced by He-Ne laser on the chick embryo ovary. (Avila et al. 1992)

The morpho-histochemical alterations that occur in the chicken ovary at 7 days of incubation after irradiation with He-Ne laser of a potency of 5 mw and at a wavelength of 632.8 nm were studied.

The embryos were irradiated for 5 minutes through a window opened in the eggshell and aseptically maintained in incubator for 24 hours. The gonads were dissected out and processed for the following techniques: H/E, PAS, Alcian blue, and Toluidine blue.

Controls: The ovaries were formed by a germinative or superficial epithelium, with germ and epithelial cells, and by primary sex cords compressed between them, although separated by a reduced stroma. The cords contained germ cells. The surface coat of the germinative epithelium presented a thin layer of PAS positive, alcianophilic at pH 2.5 and orthochromatic material. Basement membranes and intercord extracellular substance were also PAS positive. Problems: Disorganization of the tissue structure was well manifest in irradiated gonads, accompanied by negativization of the histochemical reactions. A lymphocytic infiltration was also found. No structural alterations were observed in germ or epithelial cells.

It is concluded that laser radiations would act producing decrease of the mucosubstances associated to the plasma membrane and basement membrane.

They would also provoke the appearance of an inflammatory mononuclear infiltration.

3.1.3 Newborn chicken

3.1.3.1 Structural and cytochemical modifications in the lingual glands of the newborn chicken irradiated with He-Ne laser (Avila et al. 1997)

Despite the increasing and successful use of laser in Medicine and Odontology, the possible iatrogenic and otherwise deleterious side effects of this radiation remain mostly unknown. In previous studies, it was shown that both the embryonic and the post-hatched chicken constitute reliable experimental models for this type of studies.

Hence, the purpose of the present work was to analyze the structural and cytochemical alterations of the lingual glands of the newborn chicken irradiated with low energy He-Ne laser.

This laser produced regressive structural changes of the glands towards the embryonic stage as well as hyperplasia of the reserve glandular basal cells. Furthermore, a decrease in the glycoprotein content and a rise in the sulfated glycosaminoglycans were also found.

These results corroborate the pathogenic effects of the He-Ne- laser on the experimental model employed and, at the same time, emphasize the importance of considering, regarding clinical applications, possible previous neoplastic alterations as well as adverse reactions which might appear once laser therapy has been installed.

3.2 Intense Pulsed Light (IPL)

3.2.1 Tongue of the chicken embryo

3.2.1.1 Biological effects on the lingual cartilage of the chicken embryo

In 2009 we described the biological effects produced by intense pulsed light (Xe-Cl) on the cartilage of the tongue chick embryo using various filters. (Avila et al. 2009)

The Laser used correctly in the medical practice offers clear advantages compared with traditional therapies. The improvement and even the elimination of many significant skin lesions can be achieved with reduced risks to patients. However, it is important to keep security measures and understand the possible effects on an experimental model.

The chick embryo is a good model to evaluate the direct effects of non-ionizing radiation for its easy handling and availability. The purpose of this communication is to show our

histological findings in organs of the chick embryo with and without protective barrier to be subjected to radiation excimer.

We used the following emitter: intense pulsed light (excimer Xe-Cl laser of 308 nm wavelength). It was irradiated embryos through an open window on eggshells. Aseptically the eggs were kept for 24 hours in an incubator. The protective barriers were used with and without colored glass, latex, cellophane, paper, polycarbonate of different colors and thicknesses.

The tissue changes observed are consistent with possible side effects of these photothermal radiations we warned about possible side effects when they are applied indiscriminately. We believe it is important to explore different means to safeguard the safety of operators and patients. Figure 3.



Fig. 3. Tongue of chicken 15 days of incubation in "ovo" irradiated with Intense Pulsed Light (Xe-Cl) 308 nm wavelength. Stain: hematoxylin and eosin. 5 x . The most striking findings consisted degenerative changes at the level of cartilage necrosis following groups glandular mucosa nature, accompanied by leukocyte infiltration, vascular wall thickening at the expense of the tunica media, perivascular edema.

3.2.2 Chick embryo wing

3.2.2.1 Histopathologic findings in epithelium and stroma of the chick embryo wing irradiated with intense pulsed light of 308 nm

Intense Pulsed Light (IPL) is used in medical practice enabling improved significantly even elimination of many skin lesions of patients. However, it is important to keep safety

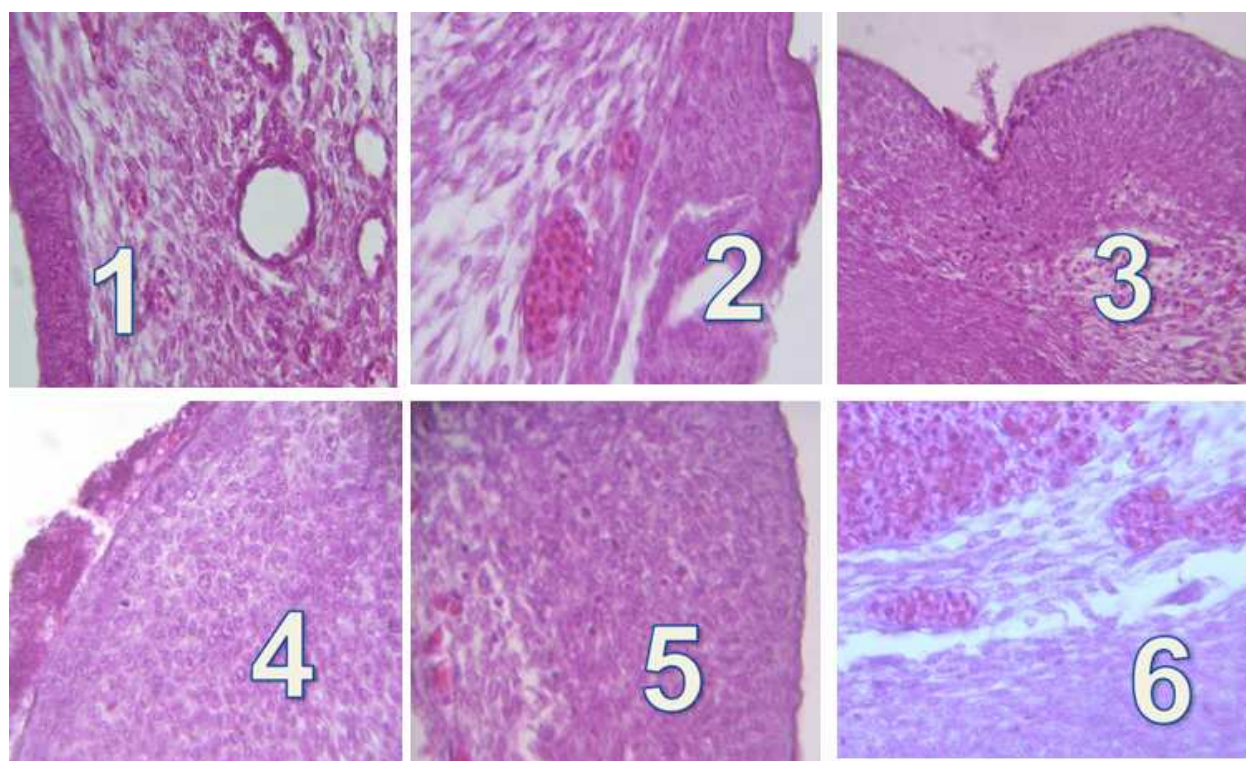
measures and know the possible effects on an experimental model. The chick embryo is a good model to evaluate the direct effects of ionizing radiation is its easy handling and availability.

The purpose of this communication is to show our histopathological findings in chick embryo wings with and without barrier protection when subjected to intense pulsed light radiation.

We used intense pulsed light of 308 nm wavelength Excilite model DEKA brand, Luz Excimer (XeCl) Wavelength 308 nm. Embryos were irradiated through an open window in the eggshell without barriers (controls) or barriers (problems). The eggs were maintained aseptically for 24 hours in an incubator. The barrier used was transparent cellophane without color and a green.

The most outstanding results obtained without a barrier, with clear cellophane and green were epithelial haematic fibrinous exudate and epithelial hyperplasia. In the stroma are varying degrees of vasocongestion, erythrocyte extravasation, and focal hemorrhage and edema, mononuclear infiltrate. It is concluded that tissue changes observed are consistent with possible changes produced by these collateral photothermal radiation, which warns of possible adverse effects when these are applied indiscriminately. Figure 4.

We believe it is important to study the means to ensure the safety of operators and patients.



1. Control. 10 X H / E. 2. Problem:epithelial hyperplasia. 40 X. H / E. 3. Problem: Extravasation erythrocytes. 40 X H / E. 4. Problem: Fibrinous exudate 40 X. H / E. 5. Problem: epithelial hyperplasia, edema and mononuclear infiltrate (3), which migrate into the epithelium sectors 40 XH / E. 6. Issue: Stromal with vessels congestion and epithelial hyperplasia. 10 X. H / E

Fig. 4. Epithelium and stroma of the chick embryo wing 15 days irradiated with (problem) or without (control) intense pulsed light of 308 nm.

3.2.3 Heart of the chick embryo

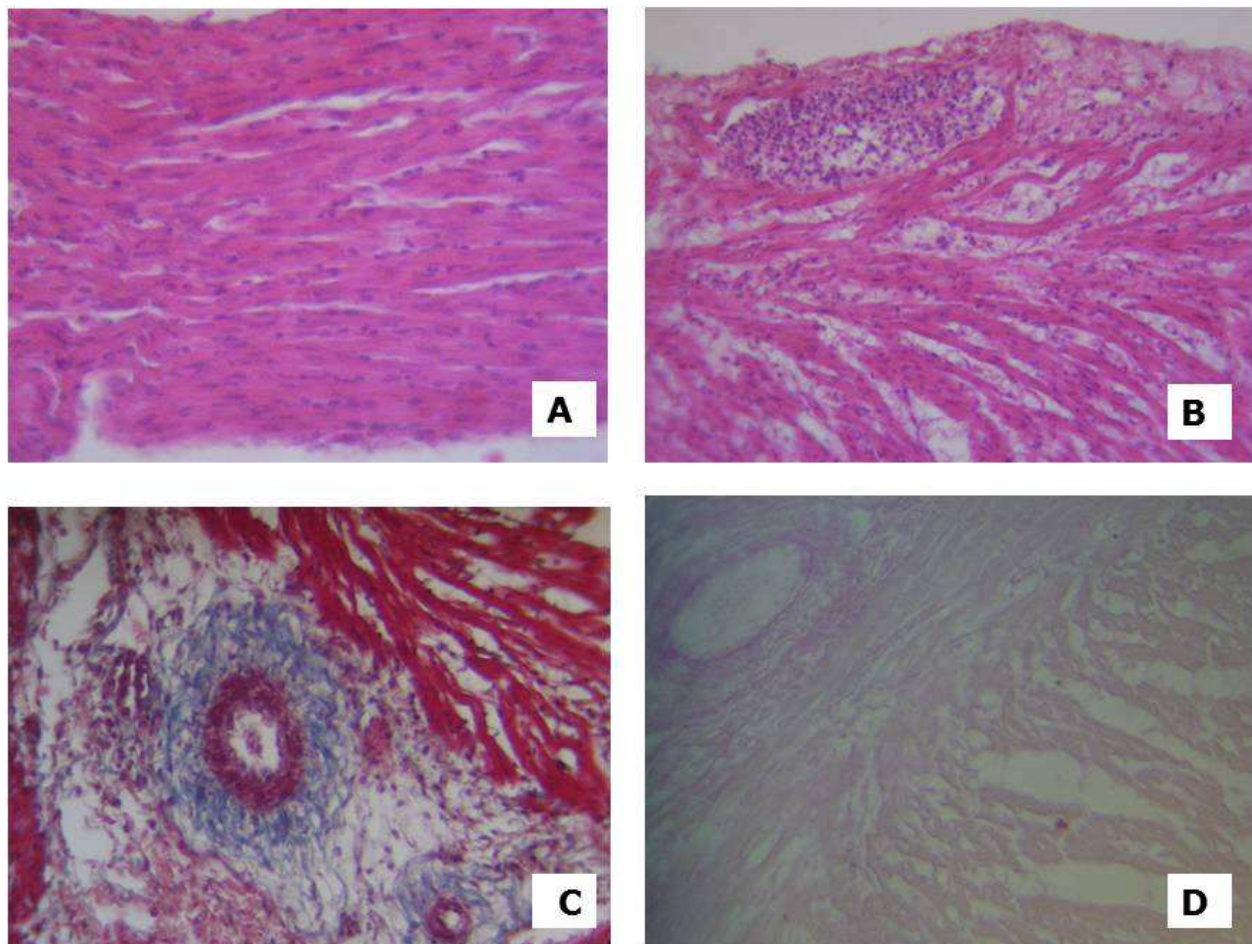
3.2.3.1 Biological effects on the heart of the chick embryo

The 308 nm excimer laser is a new application in cardiology for the treatment of congenital heart malformations, vascular and ischemic cardiomyopathy. (Spencer & Hadi, S. M. 2004).

This type of laser emits 85% of ultraviolet (UV) type B and 15% of UV radiation type A.

However, the literature does not describe the changes that occur in myocardial cells and surrounding embryonic tissue when exposed to this type of laser.

Moreover, the intense pulsed light therapy with high-energy UVB spectrum is used in a manner similar to the excimer laser in different conditions. Intense Pulsed Light (IPL), is based on generating a polychromatic light source, high intensity incoherent.



A. Control: cardiomyocytes. Coloration hematoxylin / eosin. B. Problem: disorganized tissue with interstitial edema, vasocongestion, exudate. Pericardium with leukocyte exudate. Coloration hematoxylin / eosin. C. Problem: Interstitium with blood vessels. Cardiomyocytes. Masson's Trichrome Staining. D. Problem: Interstitium and cardiomyocytes. Reduction of glycoproteins. PAS Staining

Fig. 5. Heart of the chick embryo 15 days days irradiated with (problem) or without (control) intense pulsed light of 308 nm.

4. Discussion and conclusion

The chick embryo is a good model to evaluate direct effects of ionizing radiation is its easy handling and availability.

We irradiated chick embryos and newly hatched chicks with He-Neon laser and infrared radiation (IR) and ultraviolet (UV) radiation found histopathological changes post. On the other hand, in the databases searched found no experimental studies on the biological effects of radiation from pulsed light of 308 nm (XeCl Excimer Light) in chick embryo organs. So also did experiments with intense pulsed light corroborating deleterious effects on organs of chicken embryos.

On the other hand, in the databases searched found no experimental studies on the biological effects of radiation from pulsed light of 308 nm (XeCl Excimer Light) in chick embryo organs. So also did experiments with intense pulsed light corroborating deleterious effects on organs of chicken embryos.

Authors studied the Influence of UV-B radiation on embryonic development of chickens Hampshire breed and considered that it is possible to state that short-lasting UV radiation appealing can have positive influence on organisms, which can be used in medicine for preventive end treating purposes. (Veterany et al. 2004)

Some authors (Schroeder et al. 2008) imply that IRA-radiation is capable of altering gene expression which brings forward a pro-aging phenotype of the skin. Apart from minimising exposure to natural IRA and responsible use of artificial IRA sources, the questions arises how a protection against the detrimental effects of IRA can be achieved.

The XeCl (IPL) lamp used in these experiments present a very monochromatic spectrum of emission of 307,94 nm and its effects could be very similar to those corresponding to a XeCl laser. The IPL is normally used for skin treatment for which the spectroscopic characterization carried out lets us determine the effects of this wave length on the tissues. (Nahavandi et al., 2008) The filters used basically acted only as intensity attenuators and they let us determine which optic material is more convenient for the protection of the personnel that uses this type of IPL.

It is because of this that we investigated the histopathological changes produced on an organ of the oral cavity of the chicken, the tongue and especially those centered in the cartilage, being similar to those described in prior publications produced in different organs of the embryo of chicken radiated with ultraviolet radiation, infrared and HeNe Lasers. (Samar et al., 1993, Avila et al., 1994 , Samar et al., 1995)

Clinically it is used as cartilage stimulus for its regeneration in the degenerative processes. It's been postulated that its action is based on the cell multiplication, the formation of collagen and elastic fibers, the vessel regeneration, the scar formation of bony tissues and the re-epithelization of the damaged tissue. (Baumanna et al., 2006 and Andreu & Zaldivar 1996).

Others authors. (Baumanna et al., 2006) studied the influence of laser radiation in human osteoarthritic condrocytes using different wave lengths (laser diode of 690nm and laser Nd: YAG of 1064 nm), power densities and exposition times and they observed that uaign a specific set of parameters (2 W; 16W/cm²; 60 s; 120 J) they observed an increase in the synthesis of the matrix (material of cartilage originating from 36 patients). They also describe that, using a very high power density, but a constant energy density, a reduction of the rate was produced (28%) of synthesis of the matrix.

By using only the filters with a transmittance greater than 30%, we could guarantee the possibility to observe the biological effects in tissue radiation.

Many countries have published safety guidelines for the use of lasers and most of them are harmonized with the international standards of the International Electrotechnical Commission (IEC). The maximum limit permitted of the exposure with the (MPE) laser used in international safety standards of the IEC are based on guidelines of the International Commission in the protection against the non-ionizing radiation (ICNIRP). (Moseley 1994; Sliney 2006; Parker, 2007).

The CIS 825-1 norm (1993) is set for the manufacturers; However, it also offers some limitations oriented on the safety for users. All commercial lasers must exhibit the risk classification indicated.

We repeat that the use of IPL in spite of having similar biological effects than UV Lasers, do not have an equal standard safety classification.

The study of different types of radiation in our experimental model allowed to obtain information regarding the behavior of cells and tissues. We believe it is important to study the various means to ensure the safety of patients and operators. Also allow those responsible for advising on the lamps to regulate medical and aesthetic use.

We conclude that these tissue changes are compatible with photothermal side effects of this radiation that warn us about possible adverse effects of dose and time used experimentally.

5. References

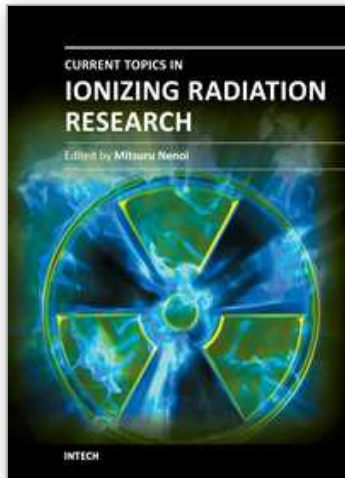
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Since the discovery of X rays by Roentgen in 1895, the ionizing radiation has been extensively utilized in a variety of medical and industrial applications. However people have shortly recognized its harmful aspects through inadvertent uses. Subsequently people experienced nuclear power plant accidents in Chernobyl and Fukushima, which taught us that the risk of ionizing radiation is closely and seriously involved in the modern society. In this circumstance, it becomes increasingly important that more scientists, engineers and students get familiar with ionizing radiation research regardless of the research field they are working. Based on this idea, the book "Current Topics in Ionizing Radiation Research" was designed to overview the recent achievements in ionizing radiation research including biological effects, medical uses and principles of radiation measurement.

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