

**Complement Changes In diabetic retinopathy patient's Blood
After Laser Treatment
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Abstract

Diabetic retinopathy is one of most important complications of diabetes mellitus that can be treated by Nd:YAG laser. Laser is used in ophthalmic practice for photocoagulation and photodisruption

The purpose of this study is to evaluate changes in immunological value after treatment of diabetic retinopathy by laser.

Blood samples from 12 patients suffering from diabetic retinopathy were taken before and after laser treatment to coagulate retina to prevent leakage and hemorrhage to avoid deterioration of vision.

The study showed clear changes in the values of immunology. main changes were in complement(C3,C4) values which increased as noticed after treatment because all light-induced biological effects depend on the parameters of irradiation, the results suggest that the laser irradiation may play two principle roles in immunological changes. One, is stimulation of cellular proliferation, and stimulation of cellular differentiation that is responsible for different types of immunoglobulin. The other suggestion is that laser is acting as a triggering factor which induces systematic effects through the circulation when laser interacts with living cells so it has systemic effects through circulating blood.

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Introduction

The absorbed portion of a laser radiation can produce wavelength dependent and wavelength independent interaction mechanisms. A wavelength dependent interaction mechanism involves, photochemical signs such as photodynamic therapy, biostimulation and photochemical ablation due to volume stress. On the other hand the wavelength dependent mechanism also involves photothermal interaction leading to coagulation, vaporization, carbonization, melting and photothermal ablation due to thermal stress. When the laser pulses are extremely of short pulse duration a wavelength independent interaction mechanism occurs and different phenomena manifest itself such as photodisruption and plasma induced ablation. Interaction of ultrashort pulsed laser at high intensities causes optical breakdown at the tissue surface. The electrons from molecules in target tissue that gain energy will be freed and produce a collection of free electrons, and ions, called plasma. In Photodisruption rapid expansion of plasma creates acoustic and shock waves that combined with latent tissue stress incise the target tissue, producing photodisruption. In general photodisruption may be regarded as a multi-cause mechanical effect starting with optical breakdown. The primary mechanisms are shock wave generation and cavitation, completed by jet formation if cavitations collapse in fluids and near a solid boundary. In this way the tissue is disrupted mechanically. Nd-YAG laser is most useful when very high energies are required as in photodisruption procedures. Such high energy emissions can only be sustained for picosecond and femtosecond

The most important application of disruptive interaction is posterior capsulotomy of the lens-frequently being seen as a complication after cataract surgery and also laser induced lithotripsy of urinary calculi. Laser used in clinical ophthalmologic practice can be subdivided into those for photocoagulation and for photodisruption. If the raised temperature reaches a certain critical level coagulation of the tissue will occur. To photocoagulate the retina, energy needs to be absorbed in sufficient quantity to cause significant local temperature rise. An average luminance from a continuous wave laser, set at 1mW, during photocoagulation is 10000 mW/cm². This is sufficient to raise the temperature to 30 degree of Celsius and to coagulate retinal pigment epithelium. The study show compare Immunological investigations (C3,C4) after laser treatment.

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Materials and methods

Blood samples were taken from 12 patients inflicted with diabetic retinopathy (at medical city teaching, specialities hospital) before and after laser treatment. The experimental period was 8 months. The average age was between 50-75 years. Each patient was treated with certain laser parameters as shown in table (1)

Table (1) Laser parameters for each patient

Case No.	Pulse duration sec.	Spot size μm	No. of shoot	Duration of operation min.	power mW
1	0.2	200	143	10	300
2	0.2	60	121	15	220
3	0.2	300	1000	20	400
4	0.2	80	45	30	600
5	0.2	100	56	20	350
6	0.2	200	683	25	700
7	0.2	200	720	20	300
8	0.2	100	140	10	200
9	0.2	60	120	20	400
10	0.2	200	150	15	200
11	0.2	200	56	30	400
12	0.2	90	122	35	600

Radial immunodiffusion (RID) plates (for C3, C4) were used.

- A 5 W maximum power, CW mode, Nd: YAG medical laser system used in this study, with diode laser of 633nm as aiming beam.

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Results

There was clear changes in the values of immunology specially in complement(C3,C4). there was a normal in the (C3,C4) values except in case No. 4 and case No. 10 in (C3) value , in both cases there is slight decrease in the values before laser treatment (there is no immunology diseases according to the history of cases)as shown in table (2). After laser treatment, there was a high increase in the (C3,C4) values (but in same cases the increase ranged from mild to moderate) as shown in table (2). The diffusions of the blood serum in complement plates are shown in figure (1)

Table (2):- complement values after irradiation

Case No.	C3 gm/dl		C4 gm/dl	
	Before	After	Before	After
1	91	101	20	26
2	105	150	41	50
3	97	156	36	50
4	86	100	20	40
5	101	155	27	38
6	96	107	39	44
7	90	140	42	44
8	98	130	33	40
9	93	155	46	50
10	83	95	37	49
11	86	154	36	49
12	91	130	20	44

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Figure (1) Serum diffusion in C3, C4

Discussion

The pathogenesis of diabetic retinopathy consists of structural changes in the retinal capillary wall and rheological changes resulting in closure of capillaries and leakage from the diseased vessels wall. The treatment of diabetic retinopathy was achieved by using high energy frequency doubled Nd-YAG laser. The mechanism of the treatment is based on photothermal effects. Photothermal treatment affects on the retinal capillary wall and closure of capillaries. This treatment can prevent the permanent bleeding. With decreasing leakage following focal laser treatment exudates in the fovea will slowly resolve but will leave behind an RPE scar with associated poor visual acuity. In recent years, there are several reports that find the same finding of thm immunological tests of this study, but they differ in the regions of human's body on which laser is applied, like "biostimulation of bone marrow cells with a diode soft laser" the aim of this study was to determine the effect of continuous wave diode

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laser irradiation on osteoblasts-derived mesenchymal cells. Others studies are by Nicolau and colleagues (2002) from Brazil demonstrated the positive effect of low level laser therapy on the stimulation of bone with promotion of bone remodeling at injury sites without changes in bone architecture, increased bone volume and increased osteoblasts surface through increased resorption and formation of bone with higher opposition rate. A positive effect on bony implants has been demonstrated by DÖrtbudak (2002) and Guzzardella (2003). The effect of the laser irradiation on osteoblastic cells has been reported by Yamamoto(2001) and Guzzardella (2002). All these studies have the same results in which complement(C3,C4) were increased after laser treatment. Other studies in the same field of low laser radiation were used for the radiation of red blood cells in the presence or absence of epinephrine. The red blood cells deformability was increased by epinephrine.

This study showed clear changes in the values of immunological tests after irradiation with laser, . The main changes were in complement values which show increase in (C3,C4) levels after laser treatment. Because all laser- induced biological effects depend on the parameters of irradiation. The results suggest that the laser irradiation may play two important roles in immunological changes. One is stimulation of cellular proliferation , and stimulation of cellular differentiation that is responsible for different types of immunoglobulin. The other suggestion is that laser is acting as a triggering factor which induces systematic effects through the circulation, laser interaction with living cells and has systemic effects through circulating blood.

Conclusion

- The main changes were in immunological complement C3 , C4
- These results suggest that laser irradiation may play two roles in immunological change. One, is stimulation of cellular proliferation, the other is stimulation of cellular differentiation that is responsible for different types of complement and immunoglobulin.
- There was change in complement result from modification of immunoglobulin level after laser treatment and then increased level C3 , C4 were found.

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- Statical analysis of the detects a very symmetric distribution C3 , C4 level at the past operative period of the patients who had diabatic retinopathy and were irradiated with 532nm laser light where compared with pre and post operation.
- The aim of laser therapeutic is not the inflammatory, be cause the process is extremely important for diabatic retinopathy.
- Nd-YAG laser is important to observe that the complete treatment consisted of variable of laser irradiation within days after treatment.
- After laser treatment, the patients no need to use special drugs or any interference with routine life.

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