Salwa Akl

بسم اللّه الرحمن الرحيم

مركز الشبكات وتكنولوجيا المعلومات

قسم التوثيق الإلكتروني

Salwa Akl

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

Salwa Akl

بعض الوثائق الأصلية تالفة وبالرسالة صفحات لم ترد بالأصل

B18491

DIODE LASER PHOTOCOAGULATION IN THE MANAGEMENT OF MACULAR LESIONS

Essay

Submitted In Partial Fulfillment For The Master Degree

In Ophthalmology

By

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(M.B.B. Ch)

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بسم الله الرحمن الرحيم

"وعلمك ما لم تكن تعلم

وكان فضل الله عليك عظيما"

صدق الله العظيم

سورة النساء (١١٣)

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INTRODUCTION

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In 1960, Maiman used ruby laser with a monochromatic emission of red light "693.4 nm" in producing an effective adhesive chorioretinitis. However, it was not useful in treating ophthalmic vascular diseases **(Maiman,1960)**. The relative importance of the wavelength led to development of blue green continuous wave argon laser by L'Esperance in 1968 which became commercially available in 1971 and was in widespread clinical use in 1975.

The early argon lasers had more than 70% of their radiation emitted in the blue light "488nm" which was close to the peak absorption of the luteal pigment "460nm" . Early treatment of macular diseases using such system resulted in damage to the inner retinal layers and a resultant loss of vision. Recently this problem had been addressed in two ways. First by the production of a new generation of argon lasers in which the blue emission is precluded from entering the eye by specialized optics within the laser (argon green) and second by the advent of a red light emitting laser, the krypton laser **(McHugh et al., 1989)**.

During recent years yellow "568 nm" and red "647.1nm" krypton lasers have been used particularly in the treatment of macular diseases where transmission through the xanthophyll pigment is desirable .

Dye lasers will be of increasing use in the years ahead because of their ability to produce wavelengths in any portion of the visible spectrum at relatively high powers **(L'Esperance, 1989).**

However, disadvantages of argon, krypton and dye lasers include: high electrical consumption, low efficacy of electrical to optical conversion, bulky laser tubes and high maintenance costs **(McHugh et al. 1989).**

In 1962, the first semiconductor diode laser was developed with limited clinical use due to its low output. Recently, semiconductor technology has led to the development of gallium, aluminium, arsenide (Ga Al As) diode laser which is characterized by high output in excess of 1 watt with light emission in the 720-890 nm. wavelength region. Also diode laser has compact size , little heat generation , simple air cooling system and long operating life with low maintenance costs **(Balles et al., 1990; Jacbson et al., 1990).**

The aim of the study

The aim of this study is to review the advantages and disadvantages of using diode laser in management of different macular lesions in comparison to other laser types.

General Principles of Laser

General Principles of Laser

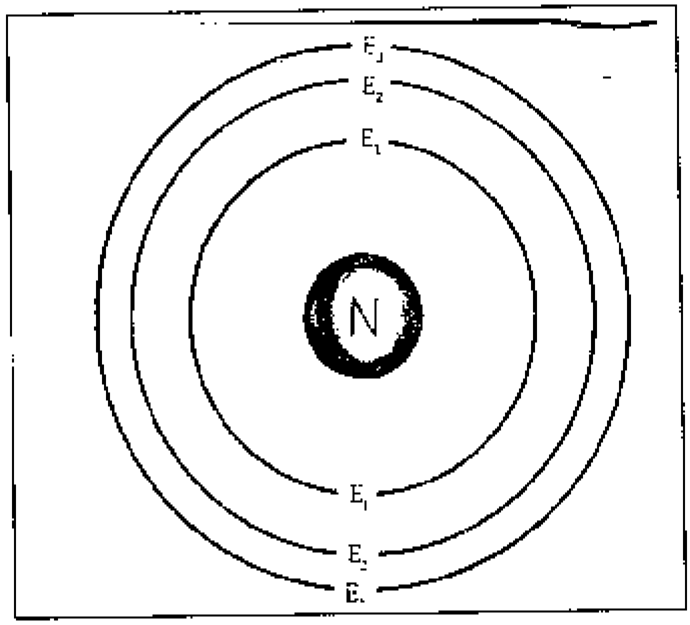
White Light:

Light is made up of photons, discrete packets of energy that are emitted when an electron, which orbits the nucleus of an atom, drops from a higher to a lower energy level. Just as an atom can emit a photon, an atom can also absorb a photon by converting one of its electrons to a higher energy level. Photons consist of discrete amounts of energy, because electrons can exist only in immutable energy levels, called quantum states (Fig.1). White light results from the spontaneous emission of radiation.

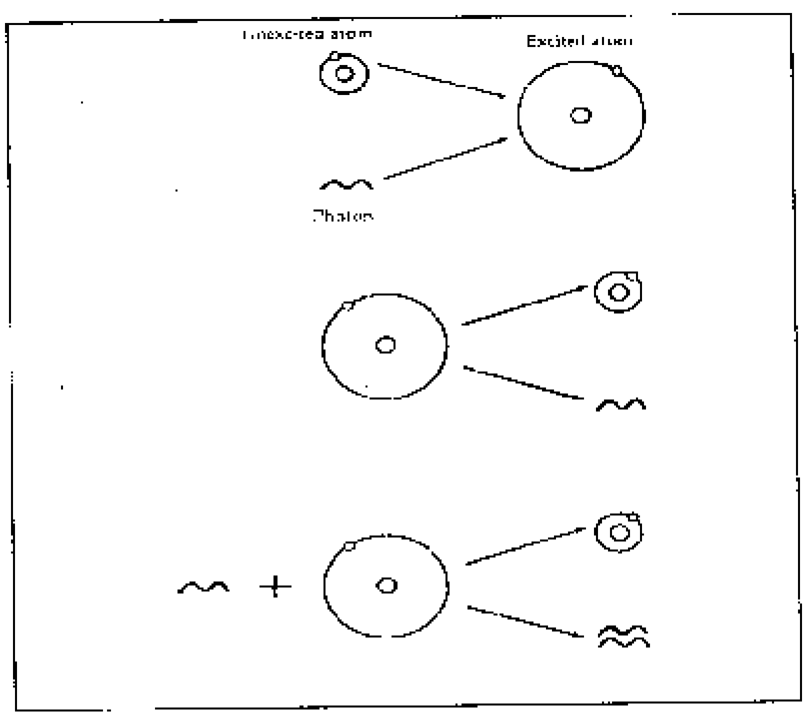
Laser light:

Laser is an acronym for Light Amplification by **S**timulated Emission of **R**adiation a term that highlights the key event that creates laser light. It is stimulated emission of radiation, a process by which electrons in an excited state undergo an energy drop (Fig.2). **(Sigelman, 1984).**

Albert Einstein explained the mathematical relation of three atomic transition processes: stimulated absorption, spontaneous emission and stimulated emission. According to the fundamental principles of quantum physics, certain atomic energy transitions are highly probable or "allowed". Light energy can readily induce such an allowed transition causing the energy of the atom to move from its ground state **(E0)** to an excited state **(E1).** The atom absorbs a quantum of energy at a predictable frequency appropriate to cause the specific transition. If the source of illumination was white light, a



(Fig. 1) : Atomic structure. Electron levels ranging from low energy (E_1) to highest energy (E_3) surround nucleus (N) [Sigelman, 1984].



(Fig. 2): Unexcited atom and photon unite to produce excited atom (top). Fall of atom from excited to unexcited state gives off photon (middle). Interaction of photon and excited atom produces unexcited atom and two photons of identical wavelength (bottom) [sigelman, 1984].

discrete frequency would be subtracted (Line spectra) from the illuminating beam Each atomic element has a characteristic line spectrum. This process is known as stimulated absorption.

Because the lowest energy state is the most stable, the excited atom soon emits a quantum of energy at the same frequency in order to return to the ground state. This process can occur without external stimulation (spontaneous emission) or in conjunction with further stimulation by another quantum of light at the same transition frequency (stimulated emission). Radiation emitted by spontaneous emission occurs randomly in time, whereas radiation emitted by stimulated emission is in phase with the stimulating wave. Therefore, stimulated emission is coherent. After stimulated absorption the majority of energy release is through spontaneous emission occurring incoherently in all directions and only
a small fraction of the energy is normally released as coherent stimulated emission. The laser environment, however, amplifies only the stimulated emission. **(Steinert 1985).**

***Structure of Laser* :**

A laser consists of three components , namely :-

*a laser medium

*a method for exciting the atoms or molecules in the medium .

*an optical cavity (laser tube) around the medium which acts as a resonator **(Willshaw,1993).**

The laser medium:

The medium can be a gas (argon , Krypton ,carbon dioxide , or helium with neon), a liquid (dye),a solid (an active element supported by a crystal , such as neodymium supported by yttrium –