

LASER APPLICATIONS IN MEDICAL SCIENCE

Electronic Engineering, Electrical Engineering
Department

Supervisor: Dr. M.Ghazisaeedi

By: Raza Foroughi

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Chapter One

LASER

ABSTRACT :

This report covers the basic introductory with laser and laser applications.

The report is specialized in laser applications in medical science. We will discuss about the laser surgeries as laser eye surgery and laser cosmetic surgery, to understand the role of laser instruments in medical operations.

PREFACE :

Its now about 20 years that the laser technology is used in medical operations. The main purpose to use laser is to reach more careful and effective methods for curing diseases. By the way it offers almost painless and fast methods.

Although the laser is used in different parts of medical activities, but mainly it is used in two fields:

1. 2D or 3D imaging of different parts of body.
2. Using laser for cutting, removing and burning tissues.

By means of modern laser instruments surgeons benefit the high-resolution pictures, or 3D simulations of different

adjusting the wavelength of the laser beam. They can send their laser beams in to the inner parts of body with optical fibers and complete the surgery without cutting the skin of the patients and cause a bleeding.

History Of Laser :[1]

The research that was started in 1940 in the field of microwaves, in bell labs, by Townes and Schawlow, was about to present its results. They wanted to design a system for photography of molecular structures.

Although non of them could imagine the laser as the result of their research, they designed an instrument that, not only could be used in photography of molecular structures, but also it was the key for future technology in other fields, as well as communication and medical science.

In 1958 they presented the result of their research in a paper. And finally they registered their invention in 1960 in bell labs. In the same year, at Hughes Aircrafts, Theodore H. Maiman, designed the first practical laser.

Since 1958 many lasers are designed. The biggest one is as large as a house and the smallest one, which is a semiconductor laser, is as small as a salt crystal.

In 1964 scientists designed the CO₂ laser that caused a revolution in medical science.

Still we see new inventions about laser and each invention is a key for solving the science labyrinths.

How Laser Works?[1]

The first laser schawlow and Townes designed had a very simple structure.

A flash lamp was installed around a ruby rod and there was two mirrors at each end of the rod. A full reflective mirror and a semi-transparent one.

As soon as the lamp turns on, a bright beam of laser shines out. Laser light has some unique characteristics that make it different from other light sources:

1. Laser light is coherent
2. Laser light is mono-color

But how laser works?

Photons of the flashlight hit the electrons of ruby and send the electrons to a higher level of energy. The stimulated electrons come back to the lower level of energy radiating their energy in the form of light. This procedure continues and the mirrors reflect the produced light continually, till the intensity of the output light is stronger to be neglected.

LASER

acronym for Light Amplification by Stimulated Emission of Radiation.

Chapter Two

LASER APPLICATIONS

IN MEDICAL

SCIENCE

Introduction :

Since 1958, the invention of laser, different applications for this instrument is found and still after about 20 years the researchers find new applications for laser in different fields.

The first experiment was done in bell labs. A team of researchers under management of Schawlow and Townes was working on laser communication.

They sent a message to Crawford hill about 40Kms away of their lab.

All the applications of laser refer to its unique characteristics. And in medical science Laser is very accepted because of its wonderful applications. Below there are some of these applications in medical science.

Laser And Eye Surgery:[2]

In 1964 the CO₂ laser was invented in bell labs. The invention of this laser made accurate and fine surgeries possible.

There are some eye reflective errors that are curable by using laser technology.

Reflective diseases are: myopia, hypeopia and astigmatism. All these errors occur when there is a fine change in the shape of cornea. So when the surgeon uses a laser to cure the eye problem, he tries to reshape the cornea.

There are two types of laser eye surgery. The first one is called PRK (Photo Reflective Keratotomy). In this method the surgeon removes a thin layer of cornea, by means of a computer controlled laser. The proper laser for this surgery has a sharp beam that can makes a hole in a brand of human hair, without burning or breaking it.

Each pulse of this laser beam can remove 30 millionth of an inch of a tissue in 12 billionth of a second.

The second method is called LasiK(laser in-situ keratomileusis). In this surgery, which is completely a surgeon-dependent method, the surgeon uses a laser beam to cut a flap of the corneal tissue. This laser knife is called micro keratome.

Laser And Its Applications In Ear Surgery:[3]

Middle ear infection is a very usual disease in children, which may end in death, if not cured in time.

In old methods the surgeon used to use a surgical knife to make a hole in eardrum to bring out the infection.

This method was very dangerous and painful and there was a risk of deafness.

But the new laser technology, presents a new painless method that is called OtoLam (otologic laser-assisted myringotomy). In this method the surgeon makes a tiny hole in the eardrum by means of a laser and pulls out the infections. This method is painless and there is no risk of deafness.

Cosmetic Laser Surgery:[4]

Cosmetic laser surgery is a new way for plastic surgery. In this method a surgeon can use a laser beam to remove old signs of scars on the skin and even change the color of the skin.

In result the surgeons now have the ability to change the skin appearance and the case will look 10 to 20 years younger, and the result will last for 8 to 10 years. There are some risks in this kind of surgery for some people.

The skin of some people gets very red during the surgery, some other people especially those with dark skin, may find some fine changes in the color of their skin, where it was exposed to the laser beam.

Another use of laser in cosmetic surgeries, is to remove hair of face.

Laser And The Cancer :[5]

In the usual method for the treatment of cancer, which is chemotherapy, drugs would affect the ill and safe tissues both. But in a new method laser is used for turning on drugs, just in the ill tissues.

This method is called PDT (photodynamic therapy). In this method a photosensitizing drug is taken by the patient, and when it reaches to ill tissues, the surgeon shines a pulse of laser to the tissue and activates the drug just in the ill tissue. For inner tissues the beam of laser is directed to the tissue, through a fiber optic.

References :

- [1]. www.bell-labs.com
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- [3]. www.allhealth.com
- [4]. Omlc.ogi.edu
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