

# Lasers in dentistry

## *Lasery w stomatologii*

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### Abstract

Dental lasers are a large group of devices using a monochromatic, directional beam of electromagnetic radiation ranging from deep infrared to ultraviolet light. The multitude of uses makes these devices for comprehensive dental treatment. The clinical presentation of the SIROLaser Blue high power diode laser as an alternative to conventional surgical scalpel has been reported.

### Streszczenie

Lasery stomatologiczne to liczna grupa urządzeń wykorzystujących monochromatyczną, kierunkową wiązkę promieniowania elektromagnetycznego z zakresu od głębokiej podczerwieni do promieniowania ultrafioletowego. Mnogość zastosowań czyni z nich urządzenia do kompleksowej terapii stomatologicznej. W pracy przedstawiono przypadki klinicznego zastosowania lasera diodowego dużej mocy SIROLaser Blue jako alternatywa dla konwencjonalnego skalpela chirurgicznego.

### Introduction

The word "laser" is an acronym for the definition: "Light Amplification by Stimulated Emission of Radiation". The light generated by the laser has an impressive density of electromagnetic radiation from infrared wavelength to the x-ray spectrum. Collimation, directionality,

monochromaticity and coherence are some of the physical properties of laser radiation [1]. The device was built and used for the first time in 1960, by the dentist dr. Theodore Maimana. It was a ruby laser [2,3]. In Poland, the beginning of interest in lasers is in the 90s [4].

Lasers can be divided into:

- low- and high-energy;

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### Słowa kluczowe:

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- contact and non-contact;
- due to spectral ranges: A, B and C;
- due to laser centers: diode, argon, CO<sub>2</sub>, Er: YAG, Nd: YAG.
- due to wavelength: Class I (safe in all conditions), II, III, IV (dangerous for eyes and skin).

Low-energy lasers (up to 0.5 W) are biostimulators. Wavelength in range 630-1100 nm is not absorbed by the water but penetrates deep into the tissues. Biostimulation and analgesia occurs because of changing the activity of cells during irradiation.

After absorbing the beam, the temperature of tissues should not increase. Biochemical and bioelectric reactions in tissues trigger nerve fibers changes, microcirculation and immunomodulation. The result of the reaction is secondary to the analgesic and anti-inflammatory effect. When using biostimulatory lasers, staff are required to wear safety goggles. The main indications for using biostimulatory lasers (low power) are: rehabilitation of the tmj, acceleration of tissue healing after surgery, postoperative anti-inflammatory, anti-edema and analgesia, regeneration of nerve fibers. In addition, low energy lasers are helpful in: biological pulp therapy, periodontitis, sinusitis or neuralgia [5].

Today the division between "soft" and "hard" lasers (< 0.5 W and > 0.5W) is becoming not very sharp. Devices that are currently produced, thanks to the implemented programs, can be used both as biostimulation and to cut the tissues. The best example is a Nd: YAG laser that can be used as a biostimulation laser after proper configuration. High-energy lasers ("hard") are CO<sub>2</sub>, Nd: YAG, Er: YAG, Ho: YAG lasers.

## Nd: YAG (Neodymium-Yag) Laser

Widely used in endodontics, periodontology, dental surgery and conservative dentistry. The yeast-aluminum (YAG) crystal is an active center. This laser is characterized by high penetration of tissues and thus causes great damage [6]. The coagulation ring is approximately 5 mm. For comparison the CO<sub>2</sub> laser leaves the coagulation circle 0.5-1.5 mm. The device

can be operated in contact and non-contact mode. Light beam is transmitted by flexible fiber optics, providing operator comfort [3].

## CO<sub>2</sub> laser

The unit can operate in continuous and pulse mode, contact and contactless. CO<sub>2</sub> laser is one of the best known devices of this type, thanks to which it has a well-established position as a dental instrument. The active center is a carbon dioxide. The 10600 nm wavelength has a very high water absorption capacity but penetrates very shallowly into the tissue. The CO<sub>2</sub> laser is great for cutting soft tissue and hence it is called a "light knife". The disadvantage of the device is a multi-hinged, rigid frame, restricting access to oral tissues located deeper. The laser provides a bloodless treatment by producing tissue microcoagulants. It is easier to control the tissue ablative [1,2] than the Nd: YAG laser.

## Laser ER: YAG (Erbowa-Yagowy)

The active center is based on erb. The laser is called a "light turbine", but it works slower than a conventional air turbine tip. There is no phenomenon of hard tissue melting as opposed to CO<sub>2</sub> and Nd:YAG lasers.

The argon laser used in the polymerization of composite materials. Four times shortening of curing time and minimizing polymerisation shrinkage are the advantages of using this solution.

## High power LED lasers

The laser active center is a semiconductor. Radiation is transmitted through elastic fiber optics, which ensures high comfort. The devices have great applicability from biostimulation (low power) through endodontics to periodontics and surgery. Compared to other lasers, the diode devices are small in size and are air cooled. Mobility, comfort and a wide range of

treatment options, which is an interesting proposition for dental practice.

In the clinical cases shown below, SIRONA's SIROLaser Blue diode laser was used. The device has a built-in battery which makes it wireless. Predefined parameter give the ability to work in a variety of clinical situations. It is also possible to program individual settings.

## Case 1

A man, 35y., applied to the Dentistry Clinic of the Medical University in Lublin due to the discemination of the post-and-core reconstruction from the tooth 47. The proliferation of the peripheral gingival covered the root preparation. With the SIROLaser Blue laser the excess of soft tissues was removed. The treatment was comfortable for the patient despite the lack of local anesthesia.

## Case 2

A man, 45y., entered the Dental Clinic of the Medical University in Lublin because of the excess on the lower lip. Clinical study found mucocele. In local anesthesia, the change was removed. The postoperative period was resorbable 5.0.

## Summary

Treatment lasers provide comfort in the absence or minimal bleeding. Wounds heal quickly with minimized pain. Laser biostimulation gives the opportunity to accelerate soft tissue healing and reduce post-operative edema. High-power LED lasers, thanks to their compact size and field of application, equals Nd:YAG, making them an interesting proposition for dental practice.

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