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Recent advances in laser technology

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***Abstract**:Laser is an acronym for"light amplification by stimulated emission of radiation".Recent advances in laser technology will bring revolution in dentistry.The stimulated emission of photon by an excited atom,which triggers the release of a subsequent photon is responsible for the generation of coherant,monochromatic and collimated form of light or LASER.Absorption coefficient depends on the wavelength of incoming laser irradiation(1).Almost all soft tissue procedures like depigmentation of gingiva,treatment of white lesions, ulcers,frenectomy,fibrotomy,distomolarsurgery,ridgeaugmentation,crown lengthening can be done saving a lot of time with accuracy(2).*

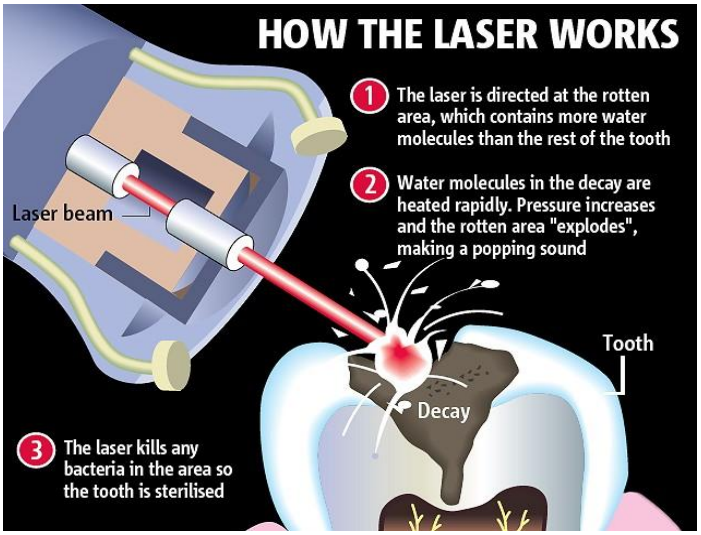
I. Introduction

Discovered by shallow and Towns in 1958.First working laser was built by Maiman of Hughes research laboratories in 1960 based on theories derived by Eienstein(3).Vein used ruby laser.Paghdiwala(U.S.A) in 1988 first time tested the ability of Er.Yaglaser.Diode Laser is very effective and safe tool tomake your clinical dental practice more yielding and predictable(4).Recent research in the field of laser wavelength absorption has led Biolase Technology the leader in medical and dental laser systems,todevelope the epic 10.

Epic 10 uses new technology with 940 nM wavelength provides greater patient comfort and superior bleeding control.Claire was one of the first person in UK to get Epic 10.

FDA approved Biolase Laser has truely revolutionized dentistry and Dr Wilson was the first to have it. In combination with airwater spray hydrokinetic YSGG Laser is able to replace the drill in many instances..No longer will the whine of the drill be heard,but rather a popping sound similar to that of popcorn popping.The dual wavelength waterlasei Plus no drills,no needles...its pain free in most cases(5).

Effects of lasers on human/oral tissues.....
37-50°.....hyperthermia.
60°.....coagulation protein denaturation.
70-90°....welding of tissues.
110-150°....vapourization.
200°....cartonization...(6).



Types of lasers....
1) Hard lasers....longer wavelength,cuts the tissue by aablation,used for tooth and bone applications....
2) Soft lasers....low energy wavelength,cuts tissue by coagulation,vapourization and carbonization.....(7).

Type	Active Medium	Dental Applications
Excimer lasers	Argon fluoride	Hard tissue ablation
	Xenon chloride	Dental calculus removal
Gas lasers	Argon...488nm,515nm	Curing of composites,tooth whitening....
	Helium neon...633nm	Analgesia,aphthous ulcer
	Carbon dioxide....9600nm,10600nm	Melanin pigmentation,dentine hypersensitivity....
Diode lasers	Indium-gallium-arsinide-phosphorous...635nm,670nm	Caries and calculus detection
	Galium-aluminum-arsenide	Implant,pulpotomy,RC disinfection
	Galium-arsenide...830nm,980nm	Subgingivalcurretage
Solid-state lasers	Neodymium:yttrium a alum in in garnet....1064nm	Ablation of plaque and calculus,removal of enamel caries
	Erbium group	
	Erbium:YAG...2940nm	Cavity preparation
	Erbium:yttrium	Scaling of root surfaces,osseous surgery
	Erbium,chromium:YSGG...2780nm	Metal tattoo pigmentation,ulcers,removal of gingival melanin.

Application in operative Dentistry:-

a) Diagnosis of Dental caries:-Diagnodent used for detection of occlusal and smooth surfaces.
b) Kitsch in 1992,illuminated carious and non carious tissues with Argon laser along with dark field photography.
c) Use of Er.Yag laser for cavity preparation(8).
d) Bleaching...with xenon plasma arc curing light
e) Photo polymerisation of composite resin...argon is used(9).
f) PAD(photo activated dye)for disinfection of root canal,periodontal pocket and deep carious lesions(10).
g) PAD(photo activated dye)for disinfection of root canals,periodontalpockets,deep caries.

Application in oral medicine:-

a) Tolonium chloride in high concentration for screening patients for malignancies of oral mucosa and oropharynx.
b) PDT(photodynamic therapy)in malignancies like multifocal squamous cell carcinoma(11).

Application in dental laboratory:-

a) laser scanning of casts can be linked to computerized milling equipment for fabrication of restorations from porcelain and other materials.
b) Helium cadmium laser polymerization of liquid resins in a chamber to create surgical template for implant surgery(12).

Application in periodontal therapy:-

a) Carbon dioxide, NdYag,diode lasers because of their excellent soft tissue ablation and hemoestaticCharacteristics, use of these lasers has been approved for periodontal and oral surgeries(13,14).
b) Used in gingivectomy,frenectomy,removal of melanin pigmentation,metal tattoos of gingiva(15,16).
c) Used in subgingival debridement and curettage(17).
d) Removal of granulation tissue during flap surgery(18).
e) Osseous recontouring,implant surgery(19).

Diode lasers:-

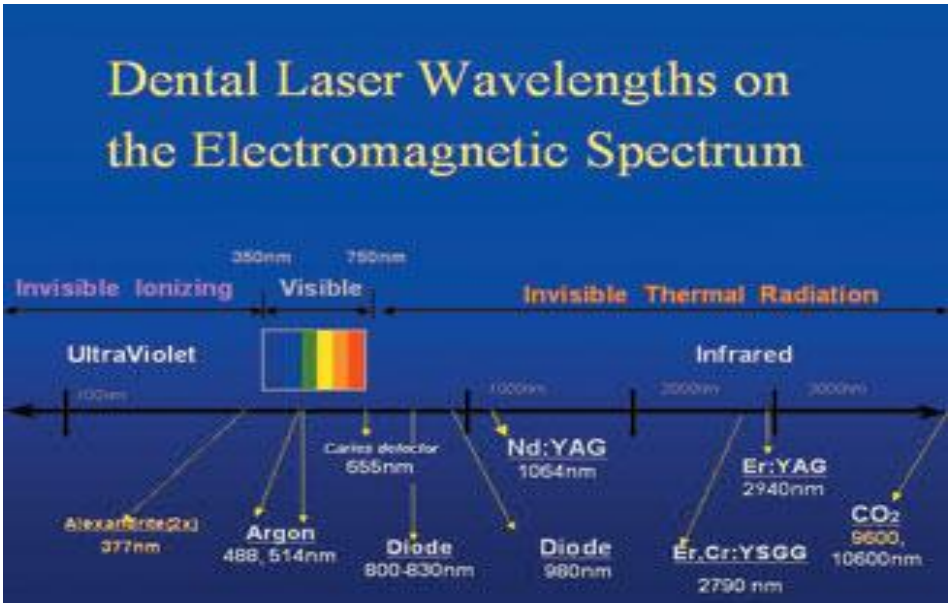
About 90% of dental soft tissue laser sold out today is diode laser because its less expensive sleek versatile and easy to use.

One important way in which laser therapy adds energy is through photon absorption by mitochondria."Bio"stimulation=Life stimulation.Four accepted effects in scientific literature are:-

i. Biostimulation/Tissue regeneration.
ii. Reduction of inflammation.
iii. Analgesia.
iv. Enhanced immune function/Antimicrobial(20).

Application in oral surgical procedures:-

a) Hemostatic Agent:-Electrocautery and suture ligatures control bleeding for small blood vessels. During recent military conflicts, particularly Iraq,there have been significant advances in hemostatic materials effective to control hemmorhage during battlefield.
b) In bone grafting.
c) Outpatient procedures like removal of impacted teeth and excision of oral lesions.
d) Treatment of canker sore and herpes lesion,laser can actually decrease the pain experienced by these sores(21).
e) Reconstructive procedures like alveolar cleft grafts,lefort I osteotomies,midfaceonlaygrafts,and grafting of mandibular continuity defect.



Advantages:-

1) Greater hemostasis,bactericidaleffect,minimal wound contraction.
2) Recently Er:YAG and Er,Cr:YSGG lasers developed for dental applications contain water molecules and applicable for both hard and soft tissues(22).
3) Erbium laser group for periodontal indications.
4) Operating time reduced,excellent wound healing(23).
5) Medically compromised patients since no medication is required like antibiotics and analgesics(24).

Disadvantages:-

1) Excessive tissue destruction by direct ablation and thermal side effects.
2) Destruction of attachment apparatus at bottom of pockets.
3) Ablation of root surface and gingival tissue within periodontal pockets(25).

Precautions before and during irradiation:-

a) Glasses for eye protection.
b) Prevent inadvertent irradiation.
c) Protect patients throat,oral tissues.
d) Use wet guaze packs to avoid reflection from shinny metal surfaces.
e) Ensure adequate high speed evacuation.

II. Conclusion

Large research effort internationally focused on developing new laser applications for dental ppractice,resincuring,cavity preparation and soft tissue surgery is at a high rate of refinement,having several decades of development up to the present time.The field of laser bases photochemical applications,particularly for targeting specific cells,pathogens or molecules.

For example an autopilot system for subgingivalddebridment.Each year several large meeting are held e.g International society for lasers in Dentistry(ISLD),European society for lasers in dentistry(ESOLA),academy of laser dentistry(ALD).

Looking to future,it is expected that specific laser technologies will become an essential component of contemporary dental practice over the next decade.....

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