



Advanced Dental Hygiene presents:

ROLE OF LASERS IN HYGIENE

Presented by:

Janessa Bock, RDH



Joy Raskie, RDH

**CEO AT ADVANCED DENTAL HYGIENE |
DENTAL LASER INSTRUCTOR | SPEAKER | EDUCATOR |
CONSULTANT | CLINICAL DENTAL HYGIENIST**



Get to know me!



Janessa Bock, RDH

**ASSISTANT DIRECTOR OF EDUCATION AT
ADVANCED DENTAL HYGIENE |
DENTAL LASER INSTRUCTOR | SPEAKER | EDUCATOR |
CONSULTANT | CLINICAL DENTAL HYGIENIST**



Meet the ADH
Team!

OBJECTIVES



Gain an understanding of new trends with lasers, how lasers have transitioned over the years and explore current research into lasers in hygiene



Examine how lasers work and what lasers are doing inside the body to help patients achieve their best oral health



Identify ideal patients for laser treatment, what kind of results to expect and how to increase profits utilizing lasers



Master tips to effectively implement lasers into every hygiene schedule and how to elevate your current laser therapy plan by introducing advanced laser modalities

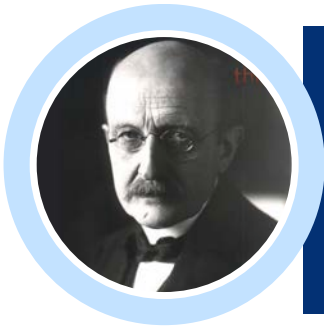
STATE LAWS ON LASER USAGE BY HYGIENISTS

States not allowing laser currently –
Florida, Mississippi, Louisiana, Ohio,
North Carolina (gray area), New Jersey
(gray area), Pennsylvania (gray area).

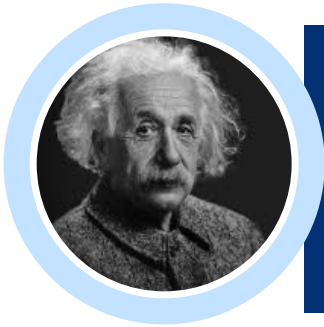


Step 1: Scan to find your state rules
Step 2: Top of the page, select your state

HOW DO DENTAL LASERS WORK?

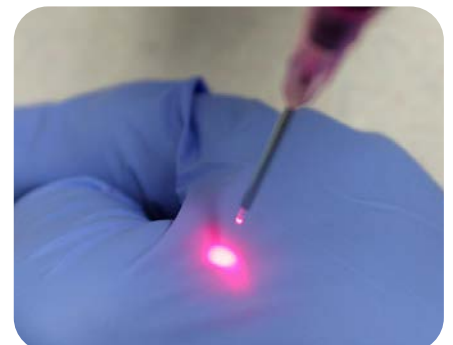
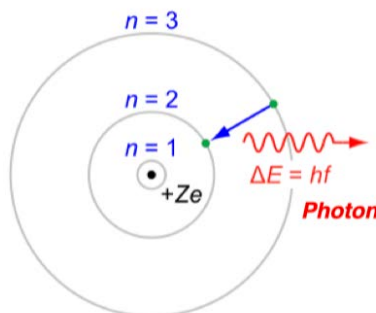
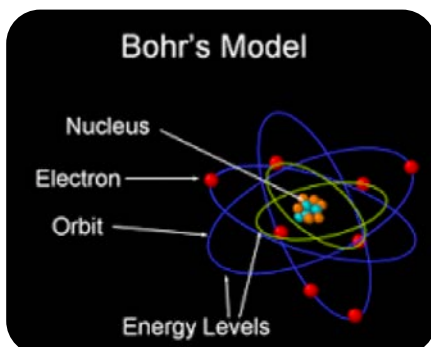


MAX PLANCK – German Physicist
1900–Light consisted of discrete and indivisible
packets of radiant energy that he named **quanta**
Elemental Unit of energy (E)



QUANTUM THEORY
In March 1905, Einstein created the quantum theory of
light, the idea that light exists as tiny packets, or
particles, which he called **photons**

HOW IS LIGHT PRODUCED



FIBER OPTIC DELIVERY SYSTEMS





Gain an understanding of **NEW TRENDS WITH LASERS**



- **Procedures pre-set for multiple clinicians** – Doctors, hygienists, specialists
- **Look of the laser** – Futuristic, light-weight, portable
- **Tips** – Uninitiated, Pre-initiated, Stronger tips, PBM

- **Multiple wavelengths in ONE LASER!** – For all clinicians, Hygiene only lasers
- **Using two wavelengths at ONCE** – Dual-wavelength



- Procedures are all set-up
- For all clinicians
- No Guessing
- Plug and Play | Turn-key
- Everyone loves EASY
- Futuristic
- Light-weight | Portable

NEWER LASER VS OLDER LASER



Laser Fibers | Laser Tips | PBM Attachments



Explanation of **INFLAMMATORY PROCESS**

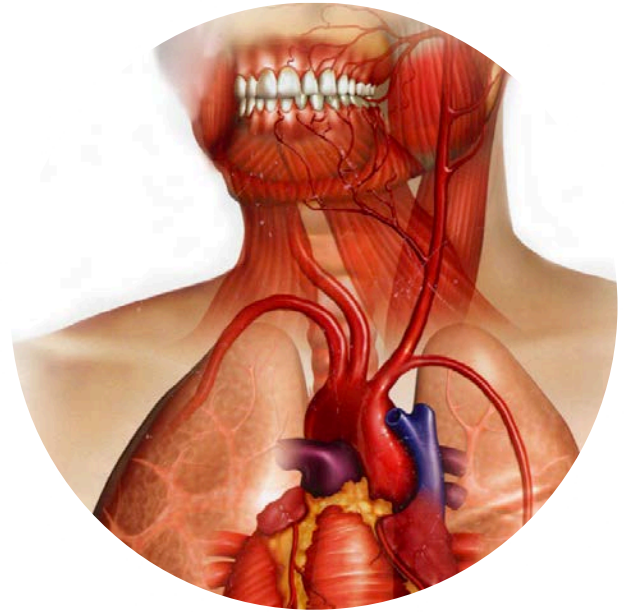
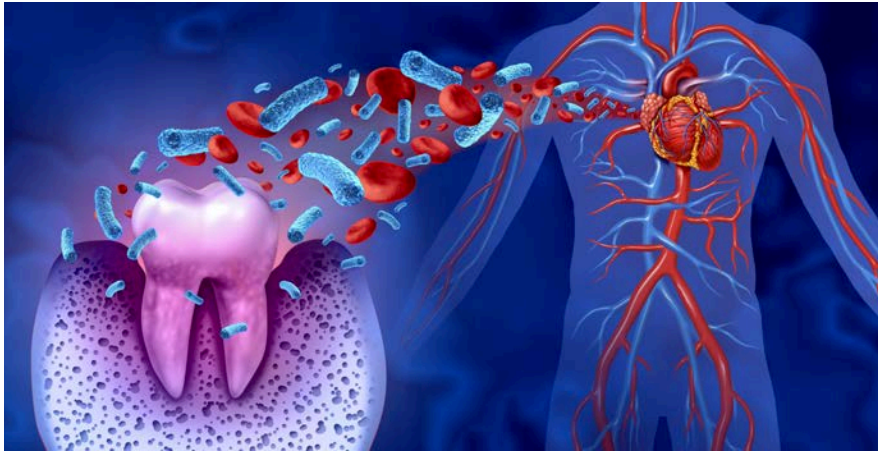
COVID - 19

- People 65+ yrs and older
- Smoking
- Diabetes
- Chronic lung disease/asthma (Mod-severe)
- Serious heart conditions
- Obesity
- Immune weakening medications
- Cancer treatment
- Bone marrow or organ transplantation
- Liver Disease
- Kidney Disease

PERIDONTAL DISEASE

- Advancing age
- Smoking
- Diabetes
- Pulmonary Disease
- Heart Disease (cardiovascular disease)
- Obesity/poor nutrition
- Medications
- Immunocompromised Status
- Low Birth weight and premature delivery
- Rheumatoid arthritis, osteoporosis
- Stress

MOUTH-BODY CONNECTION



- Hasturk, H., Kantarci, A. Activation and Resolution of Periodontal Inflammation and Its Systemic Impact. Periodontol 2000. 2015; 69(1): 255-273 doi:10.1111/prd.12105.
- University of Florida. (2005, March 31). Live Oral Bacteria Found in Arterial Plaque. ScienceDaily.
- Desvarieux, M., Demmer, R.T., Rundek, T., et al. Relationship between Periodontal Disease, Tooth Loss, and Carotid Artery Plaque: The Oral Infections and Vascular Disease Epidemiology Study (INVEST). Stroke. 2003; 34(9): 2120-2125. doi:10.1161/01.STR.0000085086.50957.22.
- Dhadse, P., Gattani, D., Mishra, R. The Link between Periodontal Disease and Cardiovascular Disease: How Far We Have Come in Last Two Decades? J Indian Soc Periodontol. 2010; 14(3): 148-154. doi:10.4103/0972-124X.75908.
- Fisher, M.A., Borgnakke, W.S., Taylor, G.W. Periodontal Disease as a Risk Marker in Coronary Heart Disease and Chronic Kidney Disease. Curr Opin Nephrol Hypertens. 2010; 19(6): 519-526. doi:10.1097/MNH.0b013e32833eda38.



30+ yrs = 47%
have Periodontitis



65+ yrs = 63%
has Moderate to Severe Periodontitis



ONE OUT OF EVERY TWO ADULTS HAS PERIODONTITIS



Eke PI, Dye BA, Wei L, Thornton-Evans GO, Genco RJ; CDC Periodontal Disease Surveillance workgroup: Prevalence of periodontitis in adults in the United States: 2009 and 2010. J Dent Res. 2012;91(10):914-920.

INFLAMMATION PROCESS

Gingivitis – the first stage of periodontal disease, is defined as “gingival inflammation without loss of connective tissue attachment”.

Periodontitis – The presence of gingival inflammation at sites where there has been a pathological detachment of collagen fibers from cementum and the junctional epithelium has migrated apically.

This also leads to tooth-supporting alveolar bone loss and eventually tooth loss itself

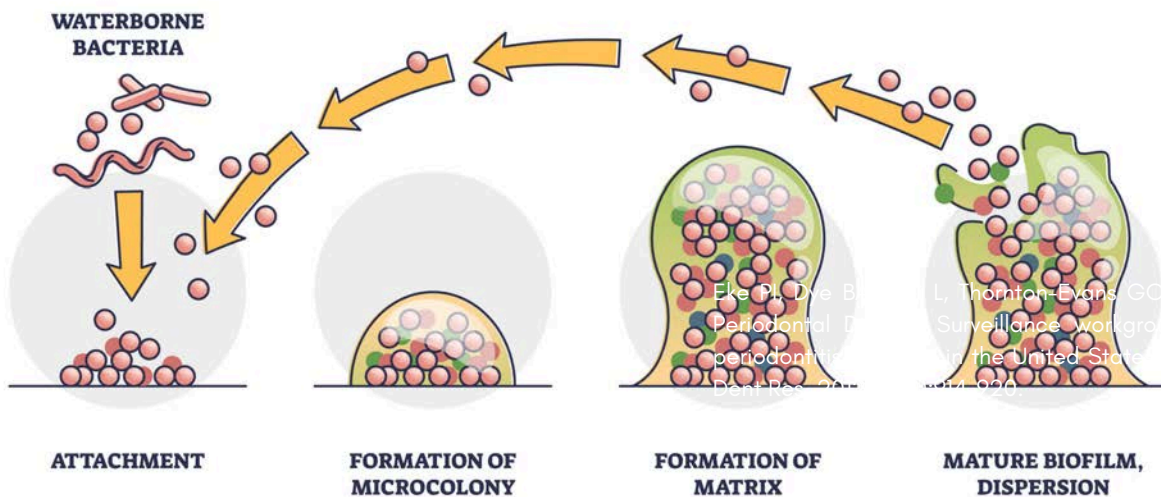
Armitage GC: Clinical evaluation of periodontal diseases, Periodontol 2000 7:39-53, 1995.



Manor A, Lebediger M, Shiffer A, Tovel H: Bacterial invasion of periodontal tissues in advanced periodontitis in humans, J Periodontol 55(10) 567-573, 1984.

What Is Really Going On?

BIOFILM



Pre-Procedural Rinses

MOUTHWASH ACTION

- Penetrates and breaks up biofilm to kill anaerobes and bacterial
- Oxidize volatile sulfur compounds
- Hard to get subgingival²

Drake, D: An In Vitro Comparative Study Determining Bactericidal Activity of Stabilized Chlorine Dioxide and Other Oral Rinses, J Clin Dent 2001;22:1-5.

Eakle WS, Ford C, Boyd RL. Depth of penetration in periodontal pockets with oral irrigation. J Clin Periodontol. 1986 Jan;13(1):39-44. doi: 10.1111/j.1600-051x.1986.tb01412.x. PMID: 3003166.



Chlorhexidine Mouthwash

(Not recommended with Laser or Perio treatment)

- **Inhibits Fibroblastic activity**
- Does **not** help the healing process
- This will negatively effect what you do after laser

It is well known that chlorhexidine is toxic to bacteria, but recent evidence has suggested that chlorhexidine may also have harmful effects on gingival fibroblast proliferation as well as collagen and non-collagen protein production in cell culture

- Faria G, Cardoso CR, Larson RE, Silva JS, Rossi MA: Chlorhexidine-induced apoptosis or necrosis in L929 fibroblasts: A role for endoplasmic reticulum stress. Toxicol Appl Pharmacol. 2009 Jan 15;234(2):256-65
 - suggested that CHX may induce death in cultured L929 fibroblasts
- Mariotti AJI, Rumpf DA: Chlorhexidine-induced changes to human gingival fibroblast collagen and non-collagen protein production. J Periodontol. 1999 Dec;70(12):1443-8.
 - Looked at effects of using Chlorhexidine in wound healing. It stops fibroblasts from working and healing the site. the introduction of commercially available concentrations of chlorhexidine to surgical sites for short periods of time prior to wound closure can conceivably have serious toxic effects on gingival fibroblasts and may negatively affect wound healing.
 - Kampf, G. Acquired resistance to chlorhexidine- is it time to establish an antiseptic stewardship initiative? Journal of Hospital Infections. 2016 Nov; 94(3): 213-227
 - Patients developed resistance to CHX



HOW IT WORKS:

- All ClōSYS products contain Cloralstan® (stabilized chlorine dioxide / sodium chlorite)
- ClōSYS is buffered & stabilized to:
 - Remains stable from time of manufacture to the time of use
 - Releases the active ingredient when introduced into mouth
 - pH balanced
- ClōSYS is naturally activated by:
 - Amino acids found in saliva
 - Oxidation of volatile sulfur compounds (saliva, bacteria)
- ClōSYS penetrates and breaks up biofilm to kill anaerobes and bacteria
 - Impedes plaque formation
- ClōSYS is safe and effective
 - Only mouthwash with this product (over 40 patents)
 - **Safe on Fibroblasts and collagen fibers!**

The Studies Show



- Each oral rinse was tested against a select group of bacteria known to be associated with periodontal disease and dental caries
- ClōSYS and Chlorhexidine rinses proved identical 100% kills against the periodontal pathogens at five minutes; in some cases, ClōSYS oral rinse achieved a higher kill at the one-minute mark over the chlorhexidine rinse

I. Drake, D: An In Vitro Comparative Study Determining Bactericidal Activity of Stabilized Chlorine Dioxide and Other Oral Rinses, J Clin Dent 2001;22:1-5.



Ultra Sensitive Rinse

Great for Dental Implant Procedures and Maintenance

- Study compared ClōSYS Ultra Sensitive rinse with a placebo in the non-surgical treatment of peri-implant mucositis.
- ClōSYS rinse significantly reduced plaque and gingival indexes over placebo.
- Implant sites where ClōSYS rinse was applied improved more significant and faster than non-implant teeth.
- ClōSYS may assist in the reduction of inflammation around dental implants.

Rezaei, N.M. et al. Treatment of Peri-Implant Mucositis using Stabilized Chlorine Dioxide Rinse, Peer-reviewed Poster Session #2339, International Assn. for Dental Research, Boston, July 2021



Healthy Implant



Peri-Implant Mucositis



Peri-Implantitis

WHAT IT DOES:

- Kills in 10 seconds 99% of Streptococci that cause dental plaques to form;
- Kills in 10 seconds 99% of major oral pathogens that cause gum disease;
- Inhibits re-growth of these bacteria for 36 hours.
- Protects tooth enamel and prevents cavities.

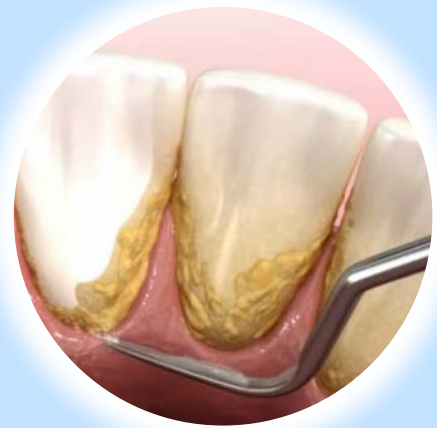
HOW/WHEN TO USE CLōSYS

- Put 3-6 Tablespoons in Waterpik with water (line the bottom)
- Significantly helps pockets remain stable and helps keep reinfection down
- Swish 2x day for 30 seconds after brushing/flossing
- Make sure to gargle in back of throat and tonsils
- Has been used to help fight off Strep Throat

SCALING AND ROOT PLANING

- Conventional Gold Standard to treat periodontal disease
- Removes bacteria from the tooth
- Aim is to eliminate plaque/calc b/c they contain bacteria that release toxins that affect the gingiva and periodontal attachment

Coulibaly NT, Kone D, Kamagate A, Yao AI, Brou E. Etude de l'efficacité du curetage parodontal dans le traitement des poches [Efficacy of scaling and root planing in the treatment of periodontal pockets]. *Odontostomatol Trop*. 2002 Mar;25(97):17-21. French. PMID: 12061242.

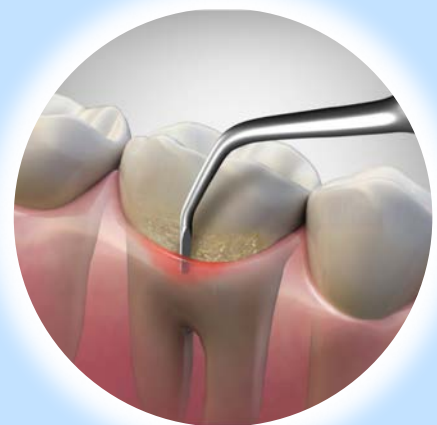


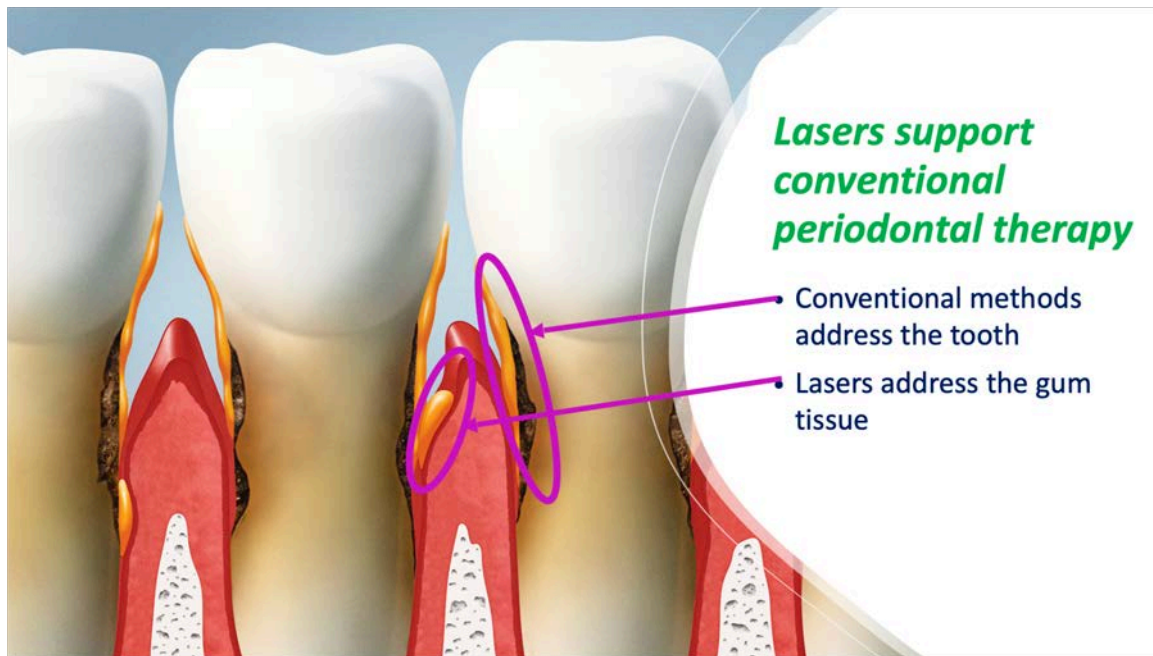
IS MECHANICAL INSTRUMENTATION ENOUGH?

- The combination of mechanized scaling and effective hand instrumentation in combination with adjunctive therapies affords optimal results
- "These results indicate that a single session of scaling and root planing is clearly insufficient to maintain a healthy subgingival microflora"

Torfason, T., Kiger, R., Selvig, K. A., & Egelberg, J. (1979). Clinical improvement of gingival conditions following ultrasonic versus hand instrumentation of periodontal pockets. *Journal of clinical periodontology*, 6(3), 165-176.

Sbordone, L., Ramaglia, L., Gulletta, E., & Iacono, V. (1990). Recolonization of the subgingival microflora after scaling and root planing in human periodontitis. *Journal of Periodontology*, 61(9), 579-584.





Research SRP + Laser | SRP Alone

In ALL articles ~ SRP + Laser = more bacterial reduction than SRP alone

- Significantly higher reduction in **periodontal pathogens** after **2 months** compared to SRP alone¹
- Considerable **bacterial elimination**, especially of **Actinobacillus actinomycetemcomitans**, from periodontal pockets²

1. Fenol A, Boban NC, Jayachandran P, Shereef M, Balakrishnan B, Lakshmi P. A Qualitative Analysis of Periodontal Pathogens in Chronic Periodontitis Patients after Nonsurgical Periodontal Therapy with and without Diode Laser Disinfection Using Benzoyl-DL Arginine-2-Naphthylamide Test: A Randomized Clinical Trial. *Contemp Clin Dent*. 2018 Jul-Sep;9(3):382-387.
2. Moritz A, Gutknecht N, Doertbudak O, et al. Bacterial reduction in periodontal pockets through irradiation with a diode laser: a pilot study. *J Clin Laser Med Surg*. 1997;15(1):33-37.
3. Crispino A, Figliuzzi MM, Iovane C, Del Giudice T, Lomanno S, Pacifico D, et al. Effectiveness of a diode laser in addition to non-surgical periodontal therapy: Study of intervention. *Ann Stomatol (Roma)* 2015;6:15-20.
4. Elavarasu S, Suthanthiran T, Thangavelu A, Mohandas L, Selvaraj S, Saravanan J. LASER curettage as adjunct to SRP, compared to SRP alone, in patients with periodontitis and controlled type 2 diabetes mellitus: A comparative clinical study. *J Pharm Bioallied Sci*. 2015;7(Suppl 2):S636-S642.
5. Gupta, Sunil Kumar et al. "An evaluation of diode laser as an adjunct to scaling and root planning in the nonsurgical treatment of chronic periodontitis: A clinico-microbiological study." *Dentistry & Medical Research*. 2016; 4(2): 44-49.

WHAT ARE WE DOING?

Laser Bacterial Reduction



This is like a pre-procedural rinse but reduces bacteria UNDER the gums

Lasers and Bacteria Research



Lasers are bactericidal

- The diode laser group showed **100% reduction of long-term bacteria** (Periodontal specific), whereas 58.4% of the controls showed an improvement
- The diode laser group **reduced their bleeding on probing (BOP) by 96.9%** compared to 66.7% in the control group

Moritz A, Schoop U, Goharkhay K, et al: Treatment of periodontal pockets with a diode laser. Department of Conservative Dentistry, Dental School of the University of Vienna, Austria, Lasers Sug Med 22 (5):302-311, 1998.

RESULTS AND INCREASING PROFITS

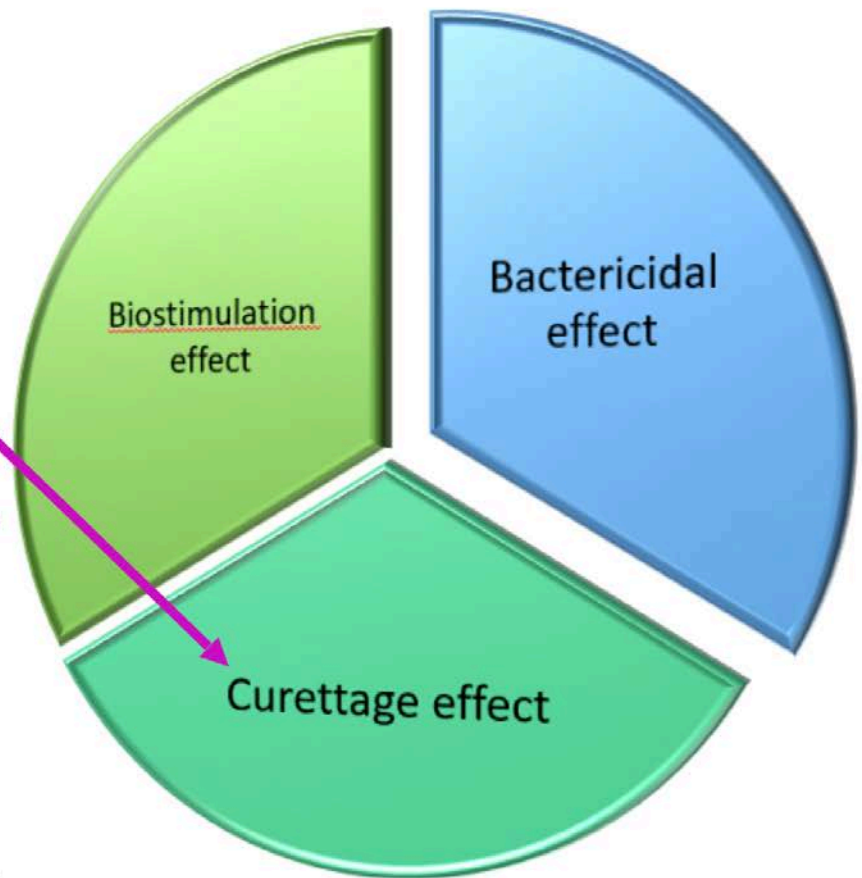
RESULTS WE SEE

- Less bleeding with cleaning
- Less sensitivity
- Pockets reduce overtime with good home care
- Overall better feeling after cleaning (patient feedback)

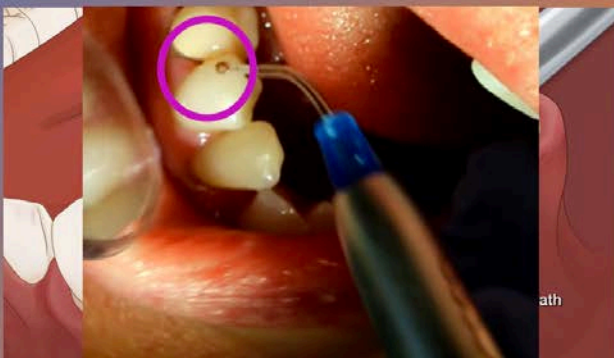
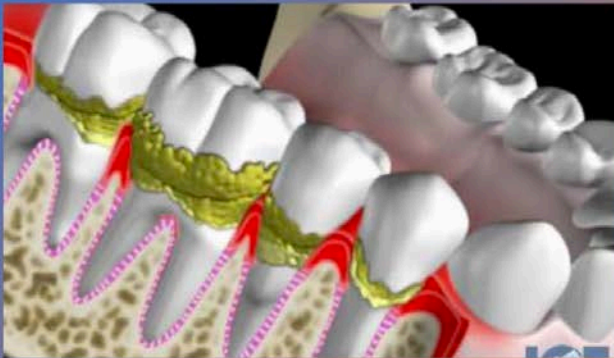


Laser Decontamination (Laser Curettage)

Laser curettage is an effective way to **remove colonies of different bacteria** thriving in **small pockets** located at the **base of teeth**. If left untreated, the condition can have an adverse effect on oral health and compromise the immune system^{1,2}



1. Zingale J, Harpenau L, Chambers D, Lundergan W. Effectiveness of root planing with diode laser curettage for the treatment of periodontitis. J Calif Dent Assoc. 2012 Oct;40(10):786-93. PMID: 23316559.
2. Lin J, Bi L, Wang L, Song Y, Ma W, Jensen S, Cao D. Gingival curettage study comparing a laser treatment to hand instruments. Lasers Med Sci. 2011 Jan;26(1):7-11. doi: 10.1007/s10103-009-0732-x. Epub 2009 Sep 30. PMID: 19789937.



Laser Curettage - Laser Decontamination

- Laser is attracted to *darker-diseased tissue* (red-orange complex bacteria)¹
- This nonsurgical therapy uses very low settings and **decontaminates** rather than cuts the tissue²
- Reduction in probing depths, better looking tissue
- Ideal for patients with periodontal disease, gum pocketing, gingival bleeding, medically compromised

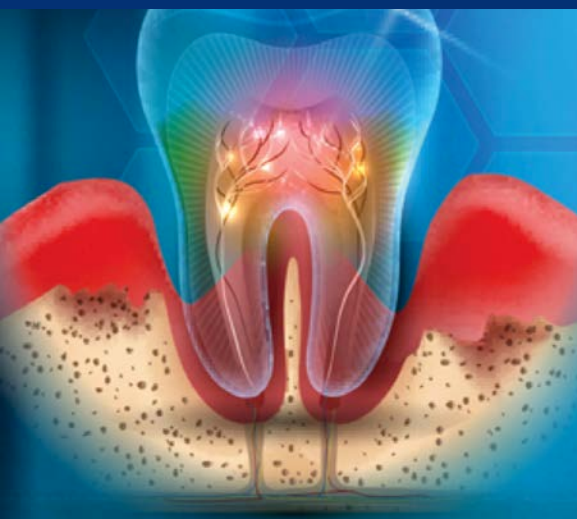
1. Convissar, RA: Principles and Practice of laser Dentistry, New York: Mosby, (3) 31. 2011. Print.
2. Coluzzi DJ, Convissar RA: Atlas of laser applications in dentistry, Chicago, 2007. Quintessence.

RESULTS WE SEE TYPICAL FEES

- Pocket reduction
- Gums heal quickly
- Bone regeneration
- Patients respond great



CAL ARTICLES AND LASERS



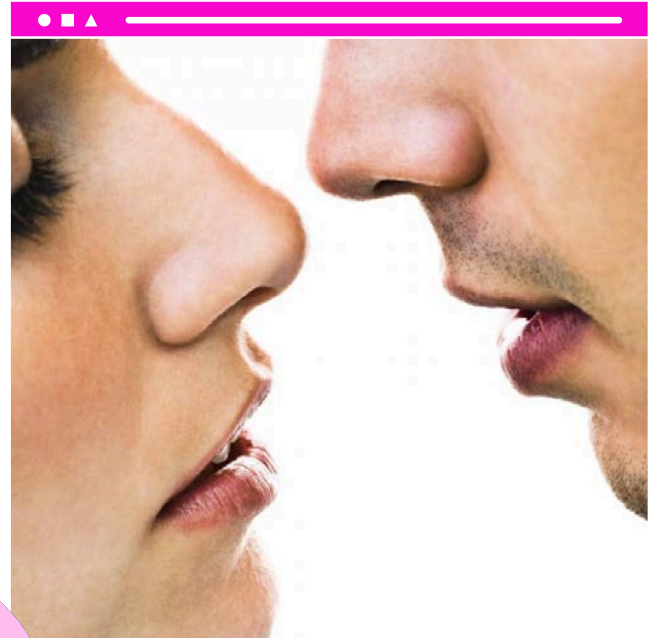
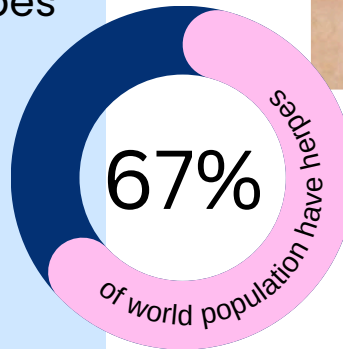
- 160 vertical bone loss defects randomly put into 2 groups – SRP | SRP+laser¹
- PI, BOP, GR, CAL, PD- all measured at 6 weeks, 12w, 18w, 6 months, 12 months¹
- Results – 76% of pockets in laser group had PD \leq 3mm after 1 yr compared to 56% in SRP only¹
- Total bacteria count significantly lower in laser groups at 12w and 6 mo follow up
- Specifically high decrease with *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Tannerella forsythia*, and *Prevotella intermedia*¹
- Conclusion – SRP + Laser has significantly reduced CAL and PD compared to SRP alone¹
- Diode laser group had significant improvement than non laser group²

1. Nammour S, El Mobadder M, Maalouf E, Namour M, Namour A, Rey G, Matamba P, Matys J, Zeinoun T, Grzech-Leśniak K. Clinical Evaluation of Diode (980 nm) Laser-Assisted Nonsurgical Periodontal Pocket Therapy: A Randomized Comparative Clinical Trial and Bacteriological Study. *Photobiomodul Photomed Laser Surg*. 2021 Jan;39(1):10-22. doi: 10.1089/photob.2020.4818. Epub 2020 Aug 31. PMID: 32865464.

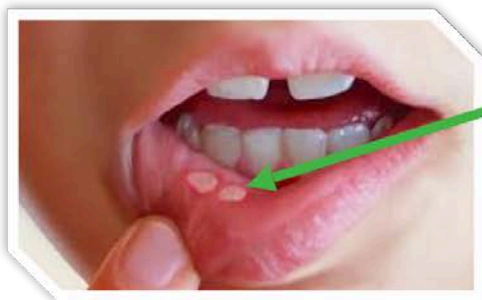
2. Khan, Farheen; Chopra, Rahul; Sharma, Nikhil; Agrawal, Eiti; Achom, Maydina; Sharma, Preeti. Comparative evaluation of the efficacy of diode laser as an adjunct to modified Widman flap surgery for the treatment of chronic periodontitis: A randomized split-mouth clinical trial. *Journal of Indian Society of Periodontology* 25(3):p 213-219, May-Jun 2021. | DOI: 10.4103/jisp.jisp_252_20

LESION TREATMENT

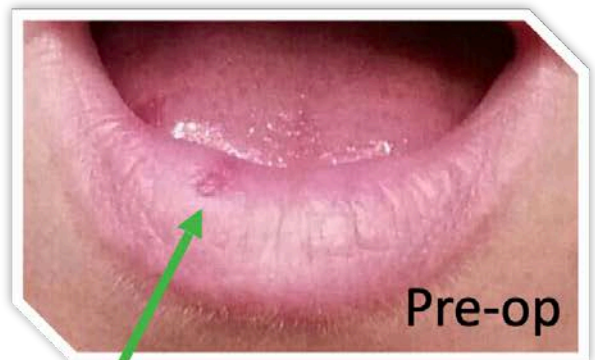
- 3.7 billion people have (HSV-1) under the age of 50
- 2 Types
- Herpes Simplex type 1
 - Oral-oral contact (herpes labialis)
- Herpes Simplex Type 2
 - Skin to skin - Sexually transmitted (genital herpes)
- Both highly infectious/incurable



World Health Organization. Herpes simplex virus. Available at: who.int/news-room/fact-sheets/detail/herpes-simplex-virus. Accessed March 27, 2020.



**Canker Sores
OR
Cold Sores**



Pre-op



One Day post-op

Desensitization Treatment

WHAT ARE WE DOING?

- Changing the viscosity of the fluid in the dental tubules
- Can use varnish afterwards

1

WHEN DO WE PERFORM THIS TREATMENT

- When the patient is experiencing sensitivity
- Beginning of hygiene appointment
 - Patient has better experience

2

IDEAL PATIENTS FOR THIS TREATMENT

- Anyone experiencing sensitivity
 - Dentin Hypersensitivity²
- This is for exposed dentin

3



1. Gojkov-Vukelic M, Hadzic S, Zukanovic A, Pasic E, Pavlic V. Application of Diode Laser in the Treatment of Dentine Hypersensitivity. Med Arch. 2016;70(6):466-469. doi:10.5455/medarh.2016.70.466-469

2. Asnaashari M, Moeini M. Effectiveness of lasers in the treatment of dentin hypersensitivity. J Lasers Med Sci. 2013;4(1):1-7.

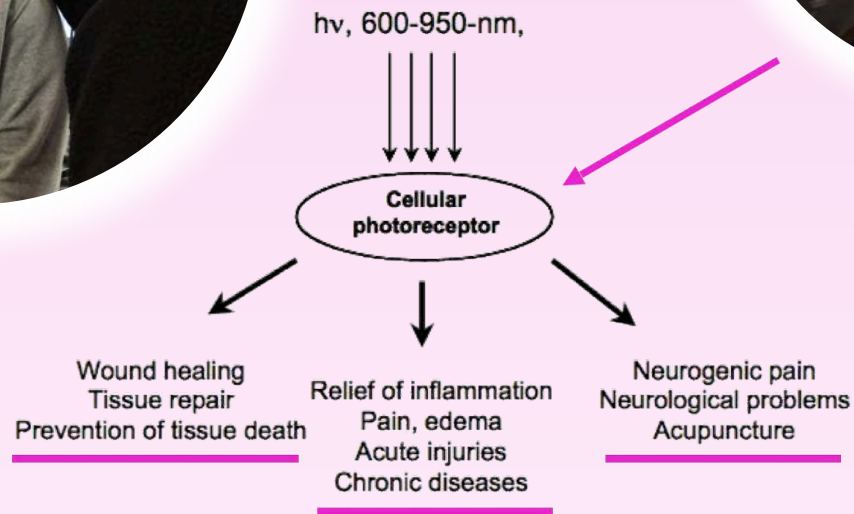
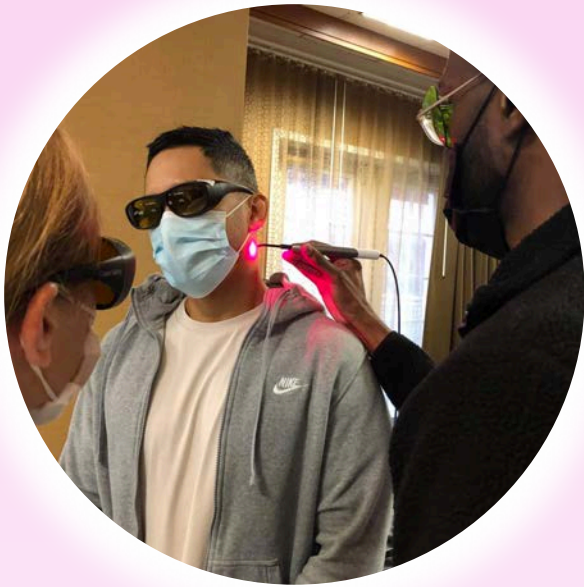


Advanced Laser Procedures



WHAT IS PHOTOBIOMODULATION

Photo (light), bio (life & cells), modulation
(modify or influence change)



Hamblin MR, Demidove TN. Mechanisms of low level light therapy. In: Hamblin MR, Waynant RW, Anders J, editors. Mechanisms for Low-Light Therapy, January 22 and 24, 2006, San Jose, Calif. Proc. SPIE 6140. Bellingham, Wash.: SPIE – The International Society for Optical Engineering, 2006:614001-1 614001-12.

MOVING DENTISTRY FORWARD WITH PHOTOBIOMODULATION

- 3CE
- Over 20 PBM procedures
- Settings, technique, videos, guide
- On-demand, watch at your own pace



SCAN the QR CODE
to REGISTER

LASER REGULATION IN THE USA

FDA (Food and Drug Administration) within them is the **CDRH (Center for Devices and Radiological Health)**

- Responsible for implementing and enforcing safety protocols for the various laser types and making sure all safety measures are being following
- Standardize the manufacture of laser products
- Owners manual instructs how to use the device for particular procedures and safety

OSHA (Occupational Safety and Health Administration)

- Federal gov agency. Primarily concerned with a safe workplace environment and worker safety



- 1.American National Standard (ANSI) for the Safe Use of Lasers Z136.1-2022; Laser Institute of America; Publisher
- 2.Barat, Ken. Laser Safety: Tools and Training. Boca Raton, Taylor & Francis Group LLC, 2014

WHO IS LASER SAFETY TRAINING FOR?

Detailed training in laser safety must be provided for all personnel using or working in the presence of class 3B & 4 lasers¹

Anyone that is associated with

- Operating the laser
- Prepping the laser
- Maintaining/servicing the laser
- Employers who are establishing proper laser safety policies and procedures and training programs

All training must be documented and documentation retained on file 1-2

REFRESHER TRAINING



- Retraining programs should be provided at minimum every 5 years (ANSI Z136.3 section 5.2.2)
- User that hasn't used laser in awhile might have forgotten
- User that uses laser daily may be more lax/complacent on safety duties and could use a refresher
- LSO determines intervals of retraining

Warning | Danger Sign PLACED OUTSIDE THE OPERATORY



Laser Glasses to be worn by everyone in room

(PATIENT, CLINICIAN, ASSISTANT)

Check the wavelength on glasses match wavelength on laser



Only use Soap and water to clean laser glasses/inserts



LASER LOUPES INSERTS



- Innovative Optics
- <https://innovativeoptics.com/>
- Contact Ryan 612-281-8662

- Orascoptic
- Universal inserts
- Covers 810-980nm

- FDA mandates each organization has a Laser Safety Officer
- Make sure everyone is following safety guidelines
- Checks safety glasses/laser-in-use, environment of laser
- Does a safety audit at least 1x a year
- Keeps records of all employees training



Laser Safety Officer Training (LSO)

Email JoyRaskieRDH@gmail.com

To be the 1st to know about our LSO training along with all safety forms your office needs to stay complaint



Training

- Seek out a perio/hygiene course
 - All team members attend (RDH/DDS)
 - This is where true implementation happens
- Proper hands-on laser training
 - Makes everyone feel comfortable and confident delivering laser therapy
- Verbalization training
- Verbalization + Hands-on technique confidence=better bottom line \$\$
- Team meetings to discuss what is working/not working

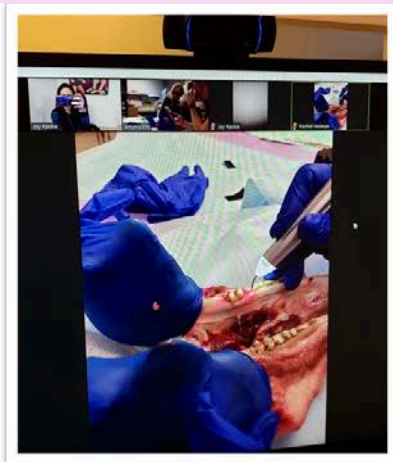


Diode Laser Training and Certification

Live and Online Laser Training Courses

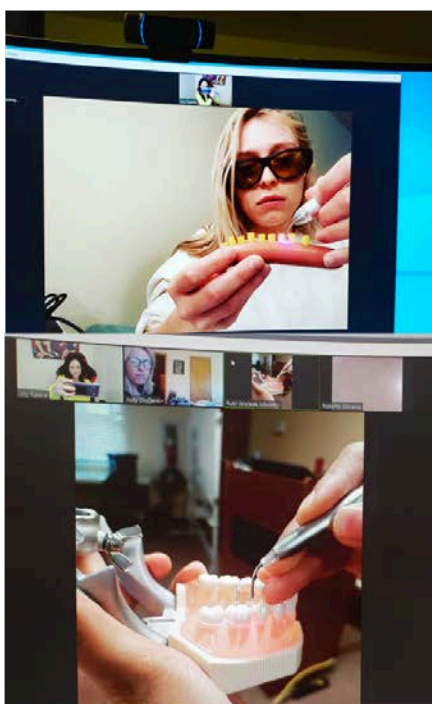
Advanced Dental Hygiene

AdvancedDentalHygiene.com



**Attend Online –
We can ship you
a laser for the
hands-on**

AdvancedDentalHygiene.com/12CEonline



**12CE Online Laser
Certification**

2.5 Hour Live, hands-on

With Your Laser

At your office/home

*Don't have a laser-we can
ship you a laser to borrow*

Confidence

Thank You!

I hope you had fun today and are now as excited about lasers as I am!!

Thank you for having me!



Let's create Excitement in your Dental Hygiene Practice with lasers?

Visit: AdvancedDentalHygiene.com

Online and LIVE courses **every week**



Contact Info:

Joy Raskie, RDH

Janessa Bock, RDH

AdvancedDentalHygiene.com

RESEARCH ARTICLES

1	K. Goharkhay, MD , DMD , A. Moritz, MD , DMD , P. Wilder-Smith, MD , DMD , U. Schoop, MD , DMD , W. Kluger, MD , S. Jakolitsch, MD , and W. Sperr, MD , DMD, Effects on Oral Soft Tissue Produced by a Diode Laser In Vitro, Lasers in Surgery and Medicine 25:401–406 (1999)
2	Hasturk, H., Kantarci, A. Activation and Resolution of Periodontal Inflammation and Its Systemic Impact. Periodontol 2000. 2015; 69(1): 255–273. doi:10.1111/prd.12105.
3	University of Florida. (2005, March 31). Live Oral Bacteria Found in Arterial Plaque. ScienceDaily.
4	Desvarieux, M., Demmer, R.T., Rundek, T., et al. Relationship between Periodontal Disease, Tooth Loss, and Carotid Artery Plaque: The Oral Infections and Vascular Disease Epidemiology Study (INVEST). Stroke. 2003; 34(9): 2120–2125. doi:10.1161/01.STR.0000085086.50957.22.
5	Dhadse, P., Gattani, D., Mishra, R. The Link between Periodontal Disease and Cardiovascular Disease: How Far We Have Come in Last Two Decades? J Indian Soc Periodontol. 2010; 14(3): 148–154. doi:10.4103/0972-124X.75908.
6	Fisher, M.A., Borgnakke, W.S., Taylor, G.W. Periodontal Disease as a Risk Marker in Coronary Heart Disease and Chronic Kidney Disease. Curr Opin Nephrol Hypertens. 2010; 19(6): 519–526. doi:10.1097/MNH.0b013e32833eda38.
7	Eke PI, Dye BA, Wei L, Thornton-Evans GO, Genco RJ; CDC Periodontal Disease Surveillance workgroup: Prevalence of periodontitis in adults in the United States: 2009 and 2010. J Dent Res. 2012;91(10):914–920.
8	Armitage GC: Clinical evaluation of periodontal diseases, Periodontol 2000 7:39–53, 1995.
9	Manor A, Lebendiger M, Shiffer A, Tovel H: Bacterial invasion of periodontal tissues in advanced periodontitis in humans, J Periodontol 55(10) 567–573, 1984.
10	Soares GM, Figueiredo LC, Faveri M, Cortelli SC, Duarte PM, Feres M. Mechanisms of action of systemic antibiotics used in periodontal treatment and mechanisms of bacterial resistance to these drugs. J Appl Oral Sci. 2012;20(3):295–309. doi:10.1590/s1678-77572012000300002
11	Walker CB. The acquisition of antibiotic resistance in the periodontal microflora. Periodontol 2000. 1996 Feb;10:79–88. doi: 10.1111/j.1600-0757.1996.tb00069.x. PMID: 9567938.
12	Nikaido H. Multidrug resistance in bacteria. Annu Rev Biochem. 2009;78:119–146.
13	Ince D, Hooper DC. Quinolone resistance due to reduced target enzyme expression. J Bacteriol. 2003;185:6883–6892.
14	Robicsek A, Strahilevitz J, Jacoby GA, Macielag M, Abbanat D, Park CH, et al. Fluoroquinolone-modifying enzyme: a new adaptation of a common aminoglycoside acetyltransferase. Nat Med. 2006;12:83–88.
15	Drake, D: An In Vitro Comparative Study Determining Bactericidal Activity of Stabilized Chlorine Dioxide and Other Oral Rinses, J Clin Dent 2001;22:1–5.
16	Eakle WS, Ford C, Boyd RL. Depth of penetration in periodontal pockets with oral irrigation. J Clin Periodontol. 1986 Jan;13(1):39–44. doi: 10.1111/j.1600-051x.1986.tb01412.x. PMID: 3003166.
17	Faria G, Cardoso CR, Larson RE, Silva JS, Rossi MA: Chlorhexidine-induced apoptosis or necrosis in L929 fibroblasts: A role for endoplasmic reticulum stress. Toxicol Appl Pharmacol. 2009 Jan 15;234(2):256–65
18	Mariotti AJ1, Rumpf DA: Chlorhexidine-induced changes to human gingival fibroblast collagen and non-collagen protein production. J Periodontol. 1999 Dec;70(12):1443–8.
19	Kampf, G. Acquired resistance to chlorhexidine- is it time to establish an antiseptic stewardship initiative? Journal of Hospital Infections. 2016 Nov; 94(3): 213–227
20	Rezaei, N.M. et al. Treatment of Peri-Implant Mucositis using Stabilized Chlorine Dioxide Rinse, Peer-reviewed Poster Session #2339, International Assn. for Dental Research, Boston, July 2021

RESEARCH ARTICLES

21	Coulibaly NT, Kone D, Kamagate A, Yao AI, Brou E. Etude de l'efficacité du curetage parodontal dans le traitement des poches [Efficacy of scaling and root planing in the treatment of periodontal pockets]. <i>Odontostomatol Trop</i> . 2002 Mar;25(97):17-21. French. PMID: 12061242.
22	Oza RR, Sharma V, Multani P, Balsara K, Bajaj P, Dhadse P. Comparing the Effectiveness of Ultrasonic Instruments Over Manual Instruments for Scaling and Root Planing in Patients With Chronic Periodontitis: A Systematic Review and Meta-Analysis. <i>Cureus</i> . 2022;14(11):e31463. Published 2022 Nov 13. doi:10.7759/cureus.31463
23	Torfason, T., Kiger, R., Selvig, K. A., & Egelberg, J. (1979). Clinical improvement of gingival conditions following ultrasonic versus hand instrumentation of periodontal pockets. <i>Journal of clinical periodontology</i> , 6(3), 165-176.
24	Sbordone, L., Ramaglia, L., Gulletta, E., & Iacono, V. (1990). Recolonization of the subgingival microflora after scaling and root planing in human periodontitis. <i>Journal of Periodontology</i> , 61(9), 579-584.
25	Fenol A, Boban NC, Jayachandran P, Shereef M, Balakrishnan B, Lakshmi P. A Qualitative Analysis of Periodontal Pathogens in Chronic Periodontitis Patients after Nonsurgical Periodontal Therapy with and without Diode Laser Disinfection Using Benzoyl-DL Arginine-2-Naphthylamide Test: A Randomized Clinical Trial. <i>Contemp Clin Dent</i> . 2018 Jul-Sep;9(3):382-387.
26	Moritz A, Gutknecht N, Doertbudak O, et al. Bacterial reduction in periodontal pockets through irradiation with a diode laser: a pilot study. <i>J Clin Laser Med Surg</i> . 1997;15(1):33-37.
27	Crispino A, Figliuzzi MM, Iovane C, Del Giudice T, Lomanno S, Pacifico D, et al. Effectiveness of a diode laser in addition to non-surgical periodontal therapy: Study of intervention. <i>Ann Stomatol (Roma)</i> 2015;6:15-20.
28	Elavarasu S, Suthanthiran T, Thangavelu A, Mohandas L, Selvaraj S, Saravanan J. LASER curettage as adjunct to SRP, compared to SRP alone, in patients with periodontitis and controlled type 2 diabetes mellitus: A comparative clinical study. <i>J Pharm Bioallied Sci</i> . 2015;7(Suppl 2):S636-S642.
29	Gupta, Sunil Kumar et al. "An evaluation of diode laser as an adjunct to scaling and root planning in the nonsurgical treatment of chronic periodontitis: A clinico-microbiological study." <i>Dentistry & Medical Research</i> . 2016; 4(2): 44-49.
30	Moritz A, Schoop U, Goharkhay K, et al: Treatment of periodontal pockets with a diode laser. <i>Department of Conservative Dentistry, Dental School of the University of Vienna, Austria, Lasers Sug Med</i> 22 (5):302-311, 1998.
31	Assaf M, Yilmaz S, Kuru B, Ipci SD, Noyun U, Kadir T. Effect of the diode laser on bacteremia associated with dental ultrasonic scaling: A clinical and microbiological study. <i>Photomed Laser Surg</i> . 2007;25:250-6.
32	Samulak, R., Suwała, M. & Dembowska, E. Nonsurgical periodontal therapy with/without 980 nm diode laser in patients after myocardial infarction: a randomized clinical trial. <i>Lasers Med Sci</i> 36, 1003–1014 (2021).
33	Ren, C., McGrath, C., Jin, L. et al. Effect of diode low-level lasers on fibroblasts derived from human periodontal tissue: a systematic review of in vitro studies. <i>Lasers Med Sci</i> 31, 1493–1510 (2016)
34	Conlan MJ, Rapley JW, Cobb CM. Biostimulation of wound healing by low-energy laser irradiation. A review. <i>J Clin Periodontol</i> . 1996 May;23(5):492-6. doi: 10.1111/j.1600-051x.1996.tb00580.x. PMID: 8783057.
35	Zingale J, Harpenau L, Chambers D, Lundergan W. Effectiveness of root planing with diode laser curettage for the treatment of periodontitis. <i>J Calif Dent Assoc</i> . 2012 Oct;40(10):786-93. PMID: 23316559.
36	Lin J, Bi L, Wang L, Song Y, Ma W, Jensen S, Cao D. Gingival curettage study comparing a laser treatment to hand instruments. <i>Lasers Med Sci</i> . 2011 Jan;26(1):7-11. doi: 10.1007/s10103-009-0732-x. Epub 2009 Sep 30. PMID: 19789937.
37	Convissar, RA: Principles and Practice of laser Dentistry, New York: Mosby, (3) 31. 2011. Print.

RESEARCH ARTICLES

38	Coluzzi DJ, Convisar RA: Atlas of laser applications in dentistry, Chicago, 2007. Quintessence.
39	Pamuk F, Lütfoğlu M, Aydoğdu A, Koyuncuoglu CZ, Cifcibasi E, Badur OS. The effect of low-level laser therapy as an adjunct to non-surgical periodontal treatment on gingival crevicular fluid levels of transforming growth factor-beta 1, tissue plasminogen activator and plasminogen activator inhibitor 1 in smoking and non-smoking chronic periodontitis patients: A split-mouth, randomized control study. J Periodontal Res. 2017 Oct;52(5):872-882. doi: 10.1111/jre.12457. Epub 2017 Apr 10. PMID: 28394081.
40	Suresh S, Merugu S, Mithradas N. Low-level laser therapy: a biostimulation therapy in periodontics. SRM J Res Dent Sci 2015;6(1):53-6
41	Nammour S, El Mobadder M, Maalouf E, Namour M, Namour A, Rey G, Matamba P, Matys J, Zeinoun T, Grzech-Leśniak K. Clinical Evaluation of Diode (980 nm) Laser-Assisted Nonsurgical Periodontal Pocket Therapy: A Randomized Comparative Clinical Trial and Bacteriological Study. Photobiomodul Photomed Laser Surg. 2021 Jan;39(1):10-22. doi: 10.1089/photob.2020.4818. Epub 2020 Aug 31. PMID: 32865464.
42	Khan, Farheen; Chopra, Rahul; Sharma, Nikhil; Agrawal, Eiti; Achom, Maydina; Sharma, Preeti. Comparative evaluation of the efficacy of diode laser as an adjunct to modified Widman flap surgery for the treatment of chronic periodontitis: A randomized split-mouth clinical trial. Journal of Indian Society of Periodontology 25(3):p 213-219, May-Jun 2021. DOI: 10.4103/jisp.jisp_252_20
43	Amid R, Kadhodazadeh M, Ahsaie MG, Hakakzadeh A. Effect of low level laser therapy on proliferation and differentiation of the cells contributing in bone regeneration. J Lasers Med Sci. 2014;5(4):163-170.
44	Pires Oliveria DA, de Oliveria RF, et al: Evaluation of low-level laser therapy of osteoblastic cells, Photomed laser surg 26(4):401-404, 2008
45	Dortbudak O, Haas R, Mallath-Pokorny G: Biostimulation of bone marrow cells with a diode soft laser, Clin Oral Implants Res 11(6):540-545, 2000
46	Malmqvist, Sebastian et al. "Using 445 nm and 970 nm Lasers on Dental Implants-An In Vitro Study on Change in Temperature and Surface Alterations." Materials (Basel, Switzerland) vol. 12,23 3934. 27 Nov. 2019
47	World Health Organization. Herpes simplex virus. Available at: who.int/news-room/fact-sheets/detail/herpes-simplex-virus . Accessed March 27, 2020.
48	Schindl AI, Neumann R. Low-intensity laser therapy is an effective treatment for recurrent herpes simplex infection. Results from a randomized double-blind placebo-controlled study. J Invest Dermatol. 1999 Aug;113(2):221-3
49	Liberman LH, Hutto T, Dudley A. Treating Herpetic Lesions With Laser Therapy. Dimensions of Dental Hygiene. 2020 Apr 28.
50	Javid K, Kurtzman G. Management of Oral Viral Lesions With a Diode Laser. Dentistry Today. 2019;Aug 1.
51	Namvar MA, Vahedi M, Abdolsamadi HR, Mirzaei A, Mohammadi Y, Azizi Jalilian F. Effect of photodynamic therapy by 810 and 940 nm diode laser on Herpes Simplex Virus 1: An in vitro study. Photodiagnosis Photodyn Ther. 2019 Mar;25:87-91. doi: 10.1016/j.pdpdt.2018.11.011. Epub 2018 Nov 14. PMID: 30447412.
52	"The treatment of herpes labialis with a diode laser (970 nm) – a field study." (2015).
53	Brignardello-Petersen R. Treatment of lesions associated with herpes labialis with low level laser therapy may result in a decrease of pain and recovery time compared with acyclovir. J Am Dent Assoc. 2017;148:e153.
54	Khalil M, Hamadah O. Association of photodynamic therapy and photobiomodulation as a promising treatment of herpes labialis: a systematic review. Photobiomodul Photomed Laser Surg. 2022;40(5):299-307. doi:10.1089/photob.2021.0186

RESEARCH ARTICLES

55	. Gojkov-Vukelic M, Hadzic S, Zukanovic A, Pasic E, Pavlic V. Application of Diode Laser in the Treatment of Dentine Hypersensitivity. Med Arch. 2016;70(6):466-469. doi:10.5455/medarh.2016.70.466-469
56	2. Asnaashari M, Moeini M. Effectiveness of lasers in the treatment of dentin hypersensitivity. J Lasers Med Sci. 2013;4(1):1-7.
57	Hamblin MR, Demidove TN. Mechanisms of low level light therapy. In: Hamblin MR, Waynant RW, Anders J, editors. Mechanisms for Low-Light Therapy, January 22 and 24, 2006, San Jose, Calif. Proc. SPIE 6140. Bellingham, Wash.: SPIE – The International Society for Optical Engineering, 2006:614001-1 614001-12.
58	Laser Institute of America (LIA). American National Standard for Safe Use of Lasers. ANSI Z136.1-rev. Florida: LIA, 2022. Print
59	Laser Institute of America. American National Standard for Safe Use of Lasers in Health Care. ANSI 136.3-rev. Florida: LIA, 2018. Print
60	Barat, K. Laser Safety Management. Taylor & Francis Group, LLC. 2006
61	Barat, K. Laser Safety: Tools and Training, Second Edition., Taylor & Francis Group, LLC, 2014
62	VanCleave, Andrea M et al. "The effect of intraoral suction on oxygen-enriched surgical environments: a mechanism for reducing the risk of surgical fires." Anesthesia progress vol. 61,4 (2014): 155-61. doi:10.2344/0003-3006-61.4.155
63	Douglas OH: Laparoscopic hazards of smoke, Surg Serv Manage AORN 3(3), 1997.
64	Ulmer B: Air quality in the operating room, Surg Serv Manage AORN 3(3), 1997.