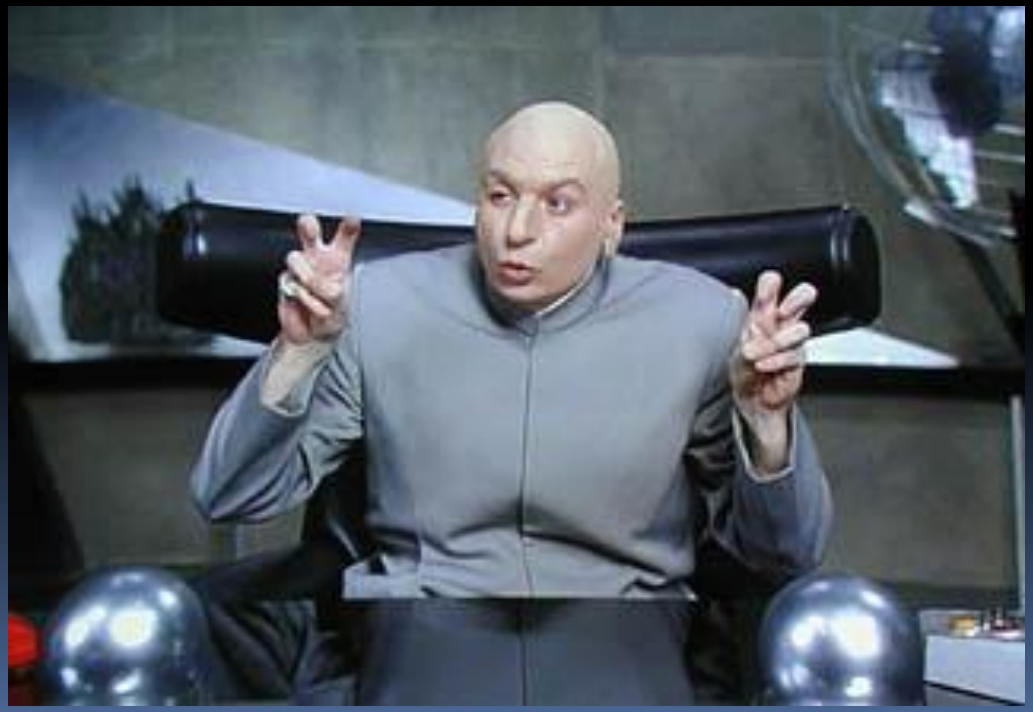
LASERS IN PERIODONTICS

Inland Empire Perio Study Club
November 17, 2017



NO CUT • NO SEW
NO FEAR

Roadmap

- Background
- Mechanism of Action
- Laser Types
- Literature
- Case Studies

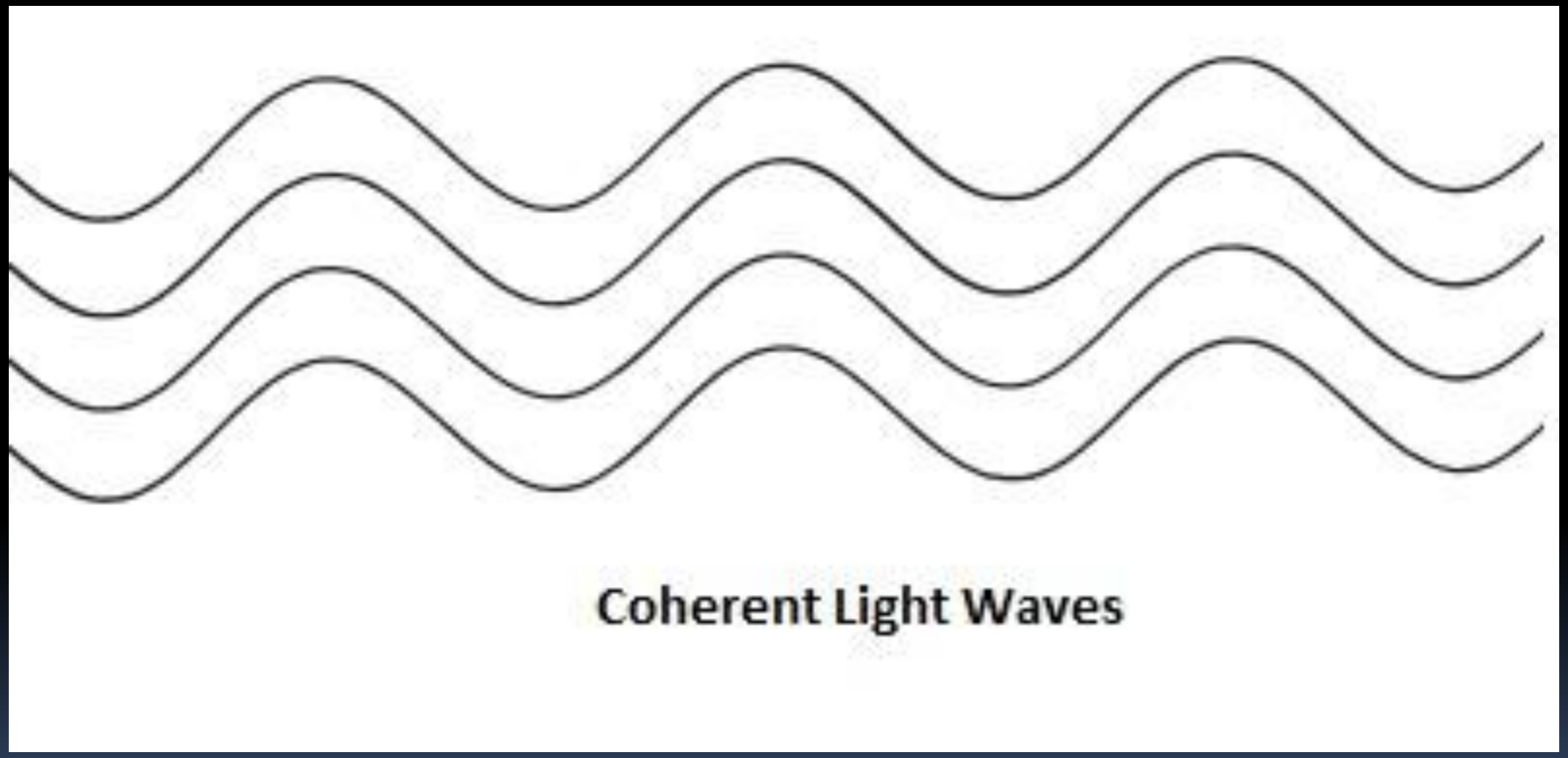
Background

- L.A.S.E.R.
  - Light Amplification by Stimulated Emission of Radiation
- First invented in 1960
- First report of caries removal in vivo 1985

Properties of all Lasers

- Stimulated photons by atoms creates the following light:
  - Coherent ~ all phases of electromagnetic wave are identical
  - Monochromatic ~ visible light of a narrow range of wavelengths
  - Collimated ~ light rays that have minimal divergence as they propagate (highly directional)

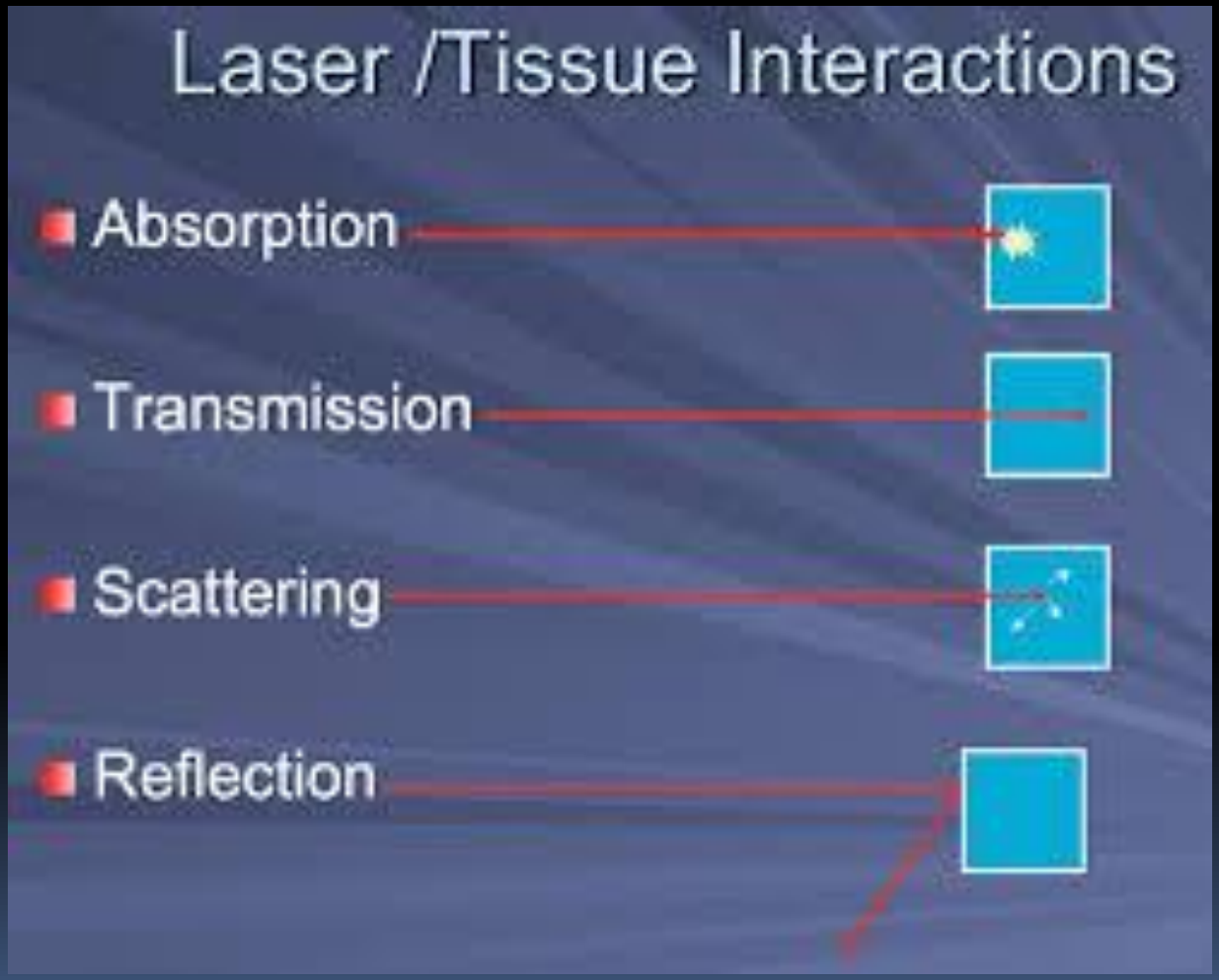
Coherent



Mechanism of Action

- Laser energy
  - Reflected
  - Scattered
  - Transmitted
  - Absorbed ~ Desired property of medical/dental lasers
- Water molecules, proteins, pigments and macromolecules are responsible for absorption ~ produces thermal reaction in tissue
- Absorption dependent on wavelength of laser

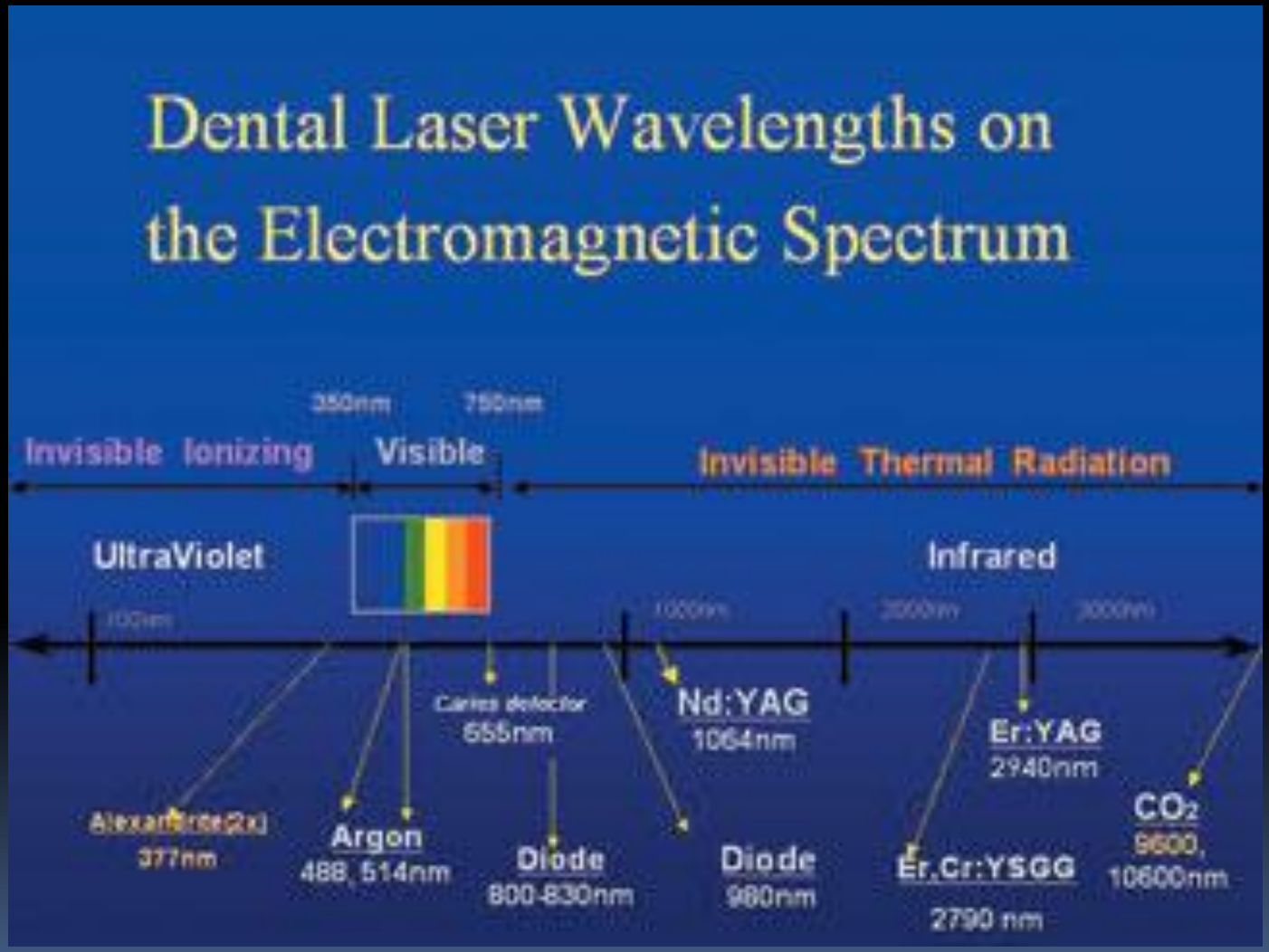
Light Energy



Laser Classes

- Class 1
  - Laser will not damage eyes i.e. CD Rom Player
- Class 2
  - Supermarket scanners
- Class 3
  - Can damage eyes if focused on
  - Laser pointers
- Class 4
  - Direct and reflected exposure can cause eye/skin damage
  - Fire Hazard
  - Dental/Medical Lasers fall into this class

Wavelength of Lasers



Laser Types

- Neodymium:yttrium-aluminum garnet (Nd:YAG)
- Carbon Dioxide (CO_2)
- Erbium:YAG (Er:YAG)
- Erbium, Chromium:Ytrrium (Er,Cr:YSGG)
- Argon

Laser Types

- Excimer Lasers 193-350 nm wavelength
  - Argon-Fluoride
  - Xenon-Chloride
- Indications
  - Hard tissue ablation
  - Calculus removal

Laser Types

- Gas Lasers
  - Argon 438-515 nm wavelength
  - Helium-Neon 637 nm wavelength
  - Carbon dioxide 10,600 nm wavelength
- Indications
  - Soft tissue surgery, cure composites, tooth whitening, subgingival curettage, removal of gingival melanin pigmentation

Laser Types

- Diode Lasers
  - 655-980 nm wavelength
- Indications
  - Caries and calculus removal
  - General surgery
  - Subgingival curettage
  - Root canal disinfection*

Laser Types

- Solid State Lasers
  - Nd:YAG 1064 nm wavelength (Periolase)
    - Soft Tissue Only
  - Er:YAG 2940 nm wavelength
  - Er:YSGG 2790 nm wavelength
  - Er,Cr:YSGG 2780 nm wavelength (Waterlase)
    - Hard and Soft Tissue
- Indications
  - Selective ablation of plaque and calculus
  - Caries removal
  - Soft tissue surgery
  - Subgingival curettage
  - Osseous surgery
  - Scaling of root surfaces
  - Root canal disinfection*

Recommended Treatment

- Most widely accepted for
  - Gingivectomy
  - Frenectomy
  - Melanin pigmentation removal
  - Amalgam tattoo removal
- Less widely accepted for
  - Management of periodontitis

Surgical Literature

- Effects on Wound Healing
  - Increased coagulation
  - Reduced bacteremia
  - Decreased swelling
  - Decreased scarring
  - Increased patient acceptance

Literature

- Root surface modifications
  - Issue of altering root surface without damaging pulp/periodontium
  - Charring and melting noted with CO_2 at certain settings
  - Heat induced cracking with CO_2
  - Cavitation defects with Nd:YAG
  - Nd:YAG may remove smear layer at lower settings

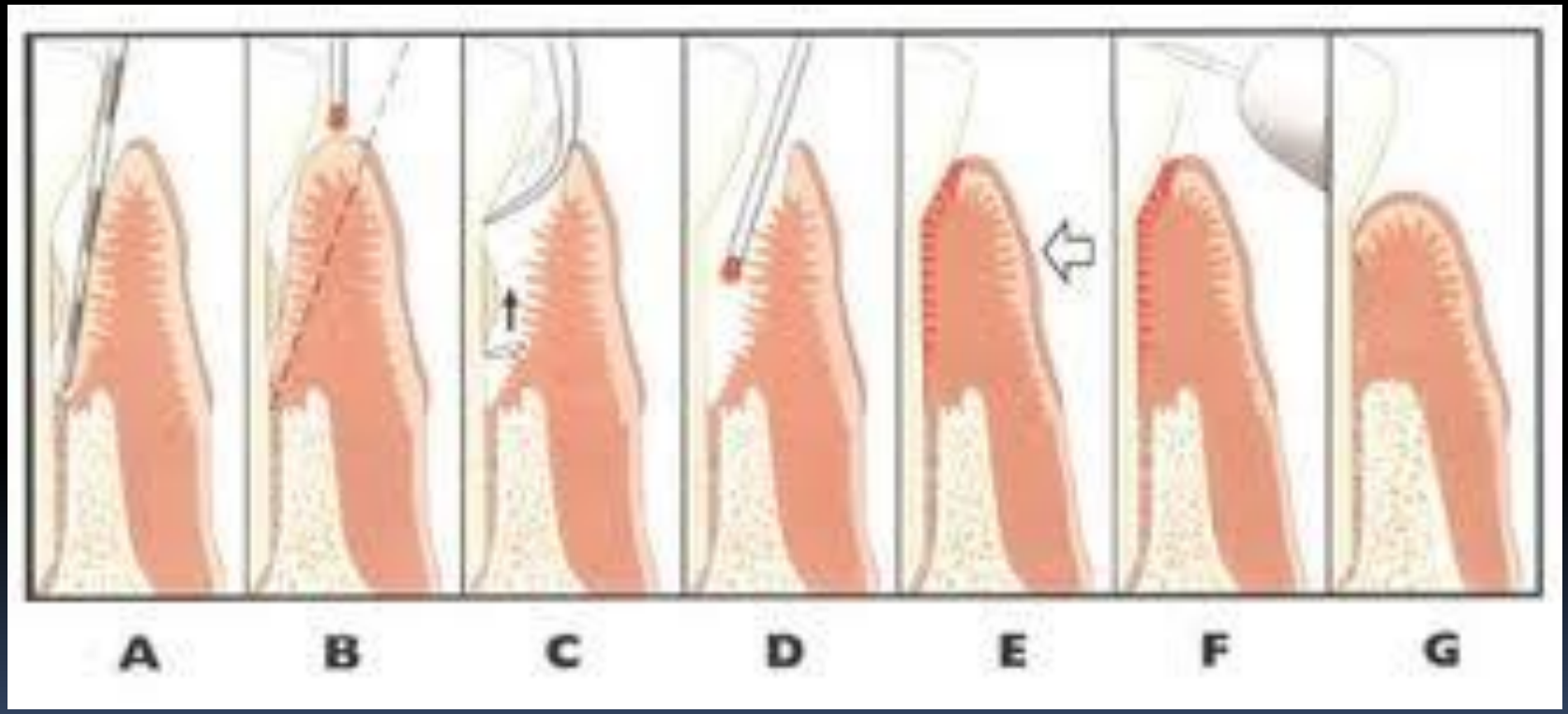
Literature

- Bacteria/Calculus
  - Limited evidence showing reduction in bacteria with laser over traditional therapy
    - Marketing point of companies "Laser sterilizes the pocket"
  - Microbial rebound noted with laser treatment
  - Nd:YAG may remove calculus at proper settings

Lasers and Periodontitis

- Laser treatment predicated on concept of subgingival curettage with regeneration of attachment apparatus
- LANAP – Laser assisted new attachment procedure
  - Periolase (Millenium)
- LANAP is a new version of an old technique (ENAP ~ excisional new attachment procedure)
- Bone is not altered

LANAP/ENAP



Literature

- Slot 2009
- Systematic review
  - Looked at 323 articles
  - 8 articles met criteria
  - Randomized human clinical trials
  - Looked at Nd:YAG alone or in combo with ScRP
  - Looked at bleeding/gingivitis/plaque levels

Literature

- Slot 2009
- Findings
  - Nd:YAG similar to ScRP in terms of inflammation and PD reduction
  - No additional benefits over ScRp
  - No evidence to support Nd:YAG laser is superior to traditional modalities of perio treatment

Literature

- Slot 2014
  - Systematic review
  - Looked at diode laser vs. traditional therapy
  - Screened 416 papers of which 9 selected

  - Combined effect of diode laser plus traditional therapy is no more effective than traditional therapy along (looked at PD and CAL)

Literature

- Schwartz 2008
  - Systematic review
  - 11 studies for review w/o meta-analysis
  - Looked at Er:YAG, CO_2, Nd:YAG vs mechanical debridement alone
  - Looked at short term (6 months) and long term (24 months) outcomes
  - Found no additional benefits of lasers vs. mechanical debridement alone
  - Some evidence for use of Er:YAG

Nebraska Study

- Nguyen 2015
  - Single masked, RCT, 22 patients with history of chronic periodontitis exhibiting sites with >/= 5mm PDs, patients enrolled in routine PMT program
  - 50 sites treated with ScRp and 50 sites treated with ScRp plus Diode laser
  - Outcomes assessed BOP, PD, CAL, IL-1Beta crevicular fluid
  - Results
    - Both modalities showed reduced BOP/PD/IL-1Beta but not s.s. different
    - CAL gains not s.s. different

Laser for Tx of Peri-implantitis

- Mailoa 2014
  - Systematic review/Meta Analysis
  - Looked at peri-implantitis treatment outcomes with lasers, saline, CHX, Tetracycline, CA
  - 7 human studies/2 animal studies
    - No s.s. difference in PD reduction/CAL/Bone fill regardless of modality used
    - Animal studies showed higher BIC on rough surface implants when compared to smooth implants with use of laser

AAP Position Statement 2011

- Regarding lasers for use of nonsurgical periodontal treatment
  - Subgingival curettage
    - No additional benefit with use of laser
    - Diseased pocket lining curettage not effective with either use of chemicals, curettes, or lasers
  - Reduction of Subgingival bacteria
    - Insufficient evidence to support s.s. reduction in bacterial load compared to ScRp
  - Scaling and Root Planing
    - Er:YAG lasers show greatest potential for subgingival root surface debridement
    - Most studies show minimal benefit when combined with ScRp

Literature

- Most literature presented by laser companies has been the following:
- 1) Company funded
- 2) Case reports
- 3) Performed by operators with vested interest

Conclusions

- Lasers show promise in soft tissue surgery, caries removal, pigmentation removal
- Limited evidence to support use of lasers for management of periodontal patients
- Marketing Strategies
  - No need for surgery
  - Cure for periodontal disease
- Cost vs. Benefit

Case #1

- 17 year old female
- Severe dental phobia
- Recently completed orthodontic care
- CC: “My teeth look small”

Clinical Photos

Clinical Photos

Treatment Plan?

Laser Crown Lengthening/Frenectomy

Laser

7 day PO care

1 week change

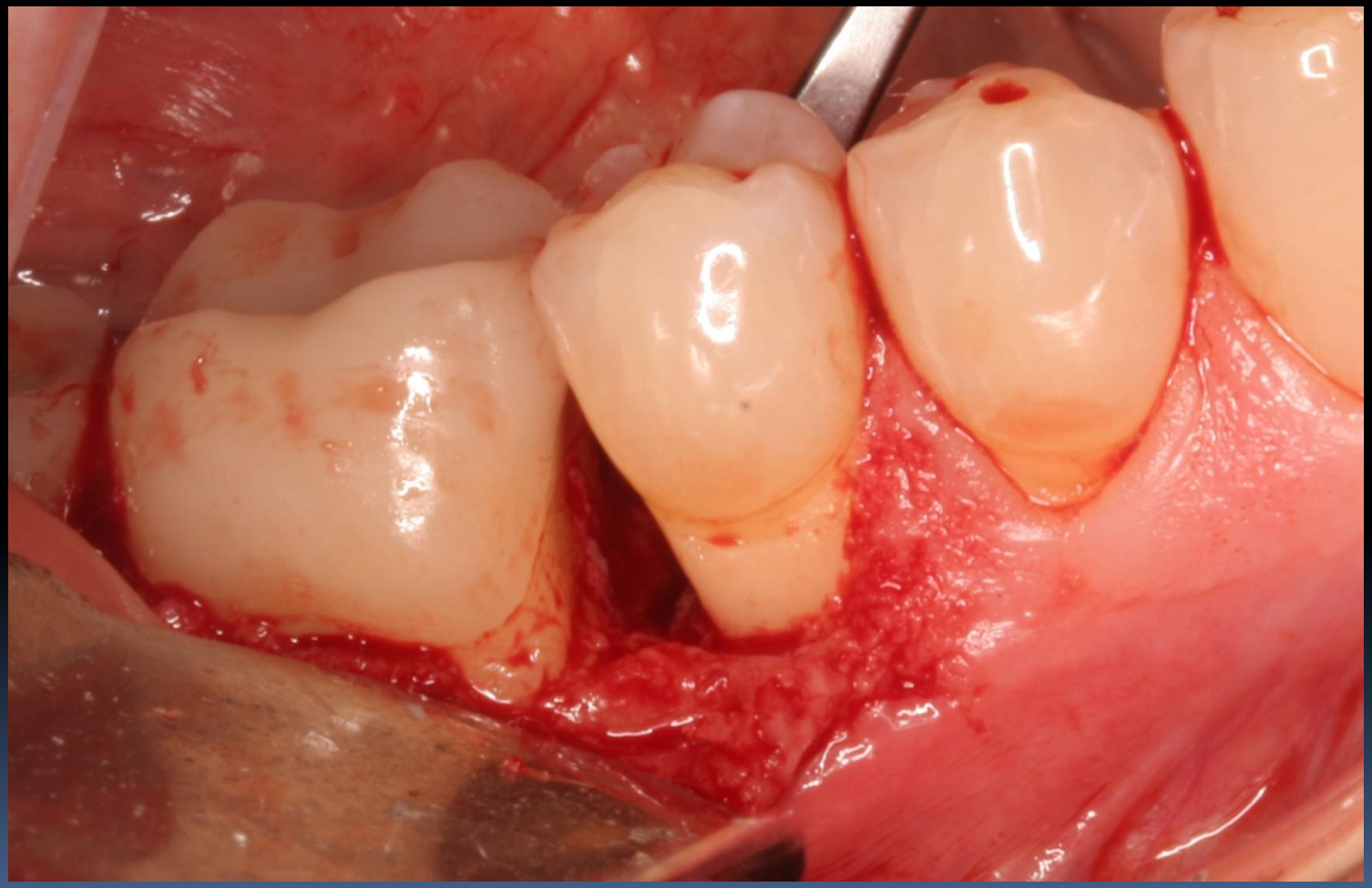
Case #2

- 65 year old male
- History of chronic periodontitis
- Openly stated he did not want traditional scalpel surgery

Radiograph

Buccal/Lingual #29 Preop

Surgical Exposure with Waterlase



Bone Graft

Postop