

Resin Modified Glass Ionomer



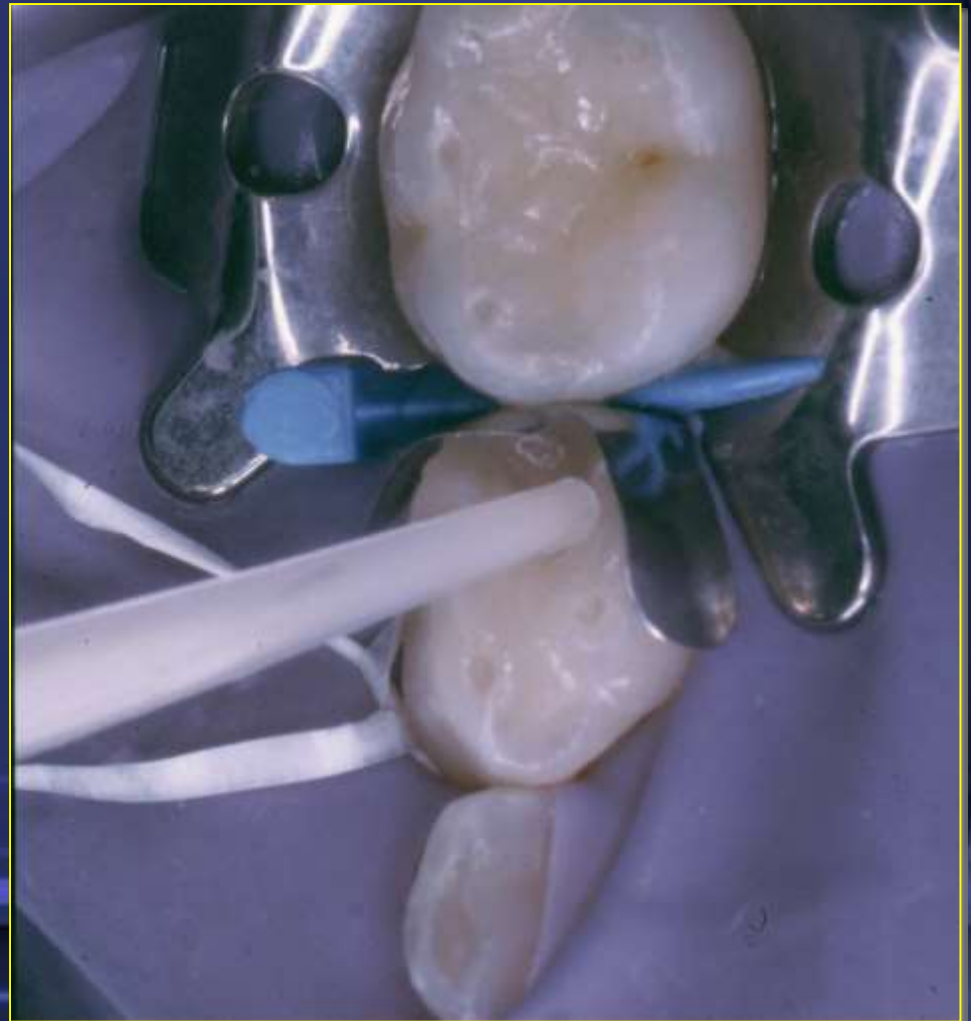
When one tugs at a single thing in nature, he finds it attached to the rest of the world.

- [John Muir](#)

Injection of RMGI

- Rinse etchant
- Matte finish enamel
- Gloss finish dentin

Fuji II LC



Physical properties RMGI



- Compressive strength- (1 day)
220 MPa
- Depth of cure- 20 seconds (A2)-
3.8 mm
- Fluoride release- > 500
ug/cm²/year

Brush with bonding agent

Bonding agent
smoothes RMGI and
leaves adhesive
surface for
composite resin



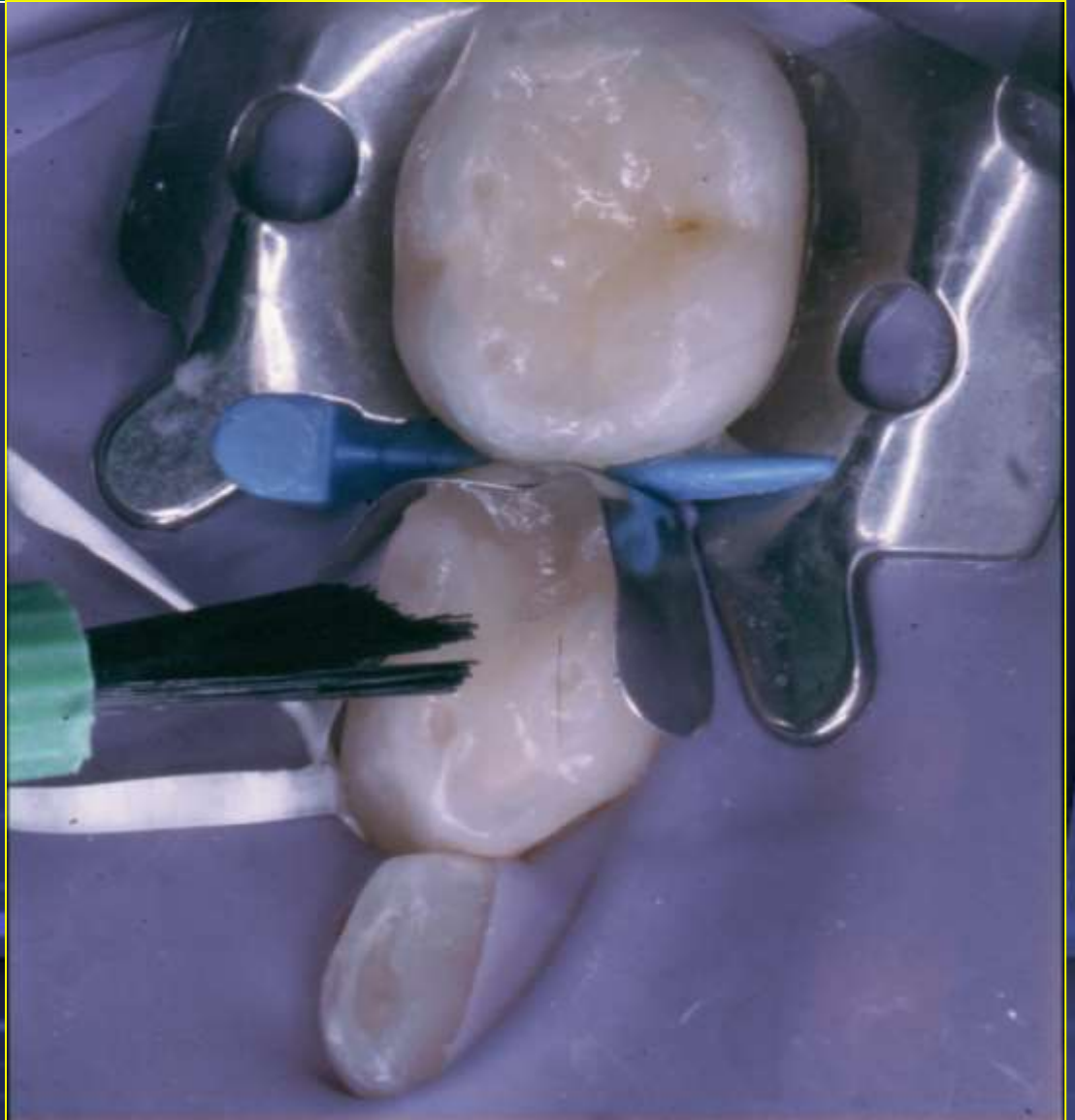
Bonding Agents

- Any bonding agent- good way to use up old third generation materials, PLEASE insure no acetone or alcohol is left on brush!



Apply bonding agent to RMGI

- Place RMGI increment 1 mm short of margins
- Smooth with bonding agent



Buccal lingual light cure

- Sectional matrix
- Ref: Carole Wilson et al
- Dennison et al



Restorative Care

- IADR

Presentation # 3128

3128 Flexural Strength and Modulus of Interface Between Composite and RMGI

M.L. CANNON, Grove Medical Center, Long Grove, IL, USA, and [R. JURADO](#), Northwestern University, Chicago, IL, USA

Objectives: The popularity of the "Open Sandwich" technique is due to its' clinical success and relative ease. However, clinical studies have demonstrated a low percentage of failures resulting from "delamination" of the microhybrid composite occlusal component from the resin modified glass ionomer base component. The failures clinically appear to originate at the marginal ridge of the restorations due to flexing at the composite RMGI interface. This study measured the flexural strength and modulus at the interface of eight different restoration groups. **Methods:** Ten cylinders each of eight different sets, approximately 2mm by 12 mm, were prepared: Group A; AeliteLS (Bisco)/PhotacFil(3M/Espe) without adhesive, Group B;StarFlow (Danville) /Bisco RMGI without adhesive, Group C; AeliteLS/Bisco RMGI without adhesive, Group D; AeliteLS/ PhotacFil with DE Bond (Bisco), Group E; AeliteLS/FujiII LC (GC America) with DE Bond, Group F; AeliteLS/FujiII LC with OneStep (Bisco) adhesive, Group G; AeliteLS PhotacFil with One Step adhesive and Group H; UniFil Flow/FujiII LC with UniFil Bond adhesive (GC America). Each sample was hydrated in de-ionized water for 24 hours before testing. Exact measurements of each sample were obtained before testing with a universal "Q"TESTER (MTS). **Results:** Group C had significantly higher flexural strength (ANOVA analysis Df 7 P=0.000)than the other groups. Otherwise,the addition of an adhesive improved the interfacial bond. Microscopic examination of the fractured samples revealed that voids contributed to the fracture of certain groups (non adhesive) of samples. **Conclusion:** The failure at the interface is related to incompatible materials or inappropriate technique in use for adhering composite to the RMGI base, resulting in delamination of "Open Sandwich" restorations.

Eight different sets of RMGI/adhesive/composite

Application of Occlusal Component



Flowable composite will need to be approximately one mm thick

Minimally Invasive Dentistry

Flowable composites



osites

Ready Mixed Flowable Fill
A Cost-Effective Solution For Your Fill Problems



Finished restoration

- Sectional matrix removed
- Wedge removed
- Flash removed with carver
- Power cure 600 milliwatts plus



Restorative Care for Children

- IADR

Presentation #3359

3359 In Vitro Microleakage Analysis of the Incremental Fill and Open Sandwich Techniques

J. HIESTER¹, [B. JANTRA-YOUNG](#)¹, M. CANNON, and R. JURADO^{1, 1} Northwestern University, Chicago, IL, USA

Objectives: The purpose of this study was to compare the microleakage of the "open sandwich" techniques with the incremental fill technique for composite restorations. In the "open sandwich" technique, the gingival portion of the restoration is composed of resin modified glass ionomer reportedly to reduce microleakage. **Materials and Method:** Forty premolars each received two standardized preparations and then were restored by four different methods; Group 1- control group, etched (15s), primed (One Step, Bisco), incrementally filled with composite (Pyramid, Bisco) and sealed with flowable composite (Aeliteflo LV, Bisco), Group 2- same as Group 1 except base placed after primer (Fuji II LC GC), Group 3- same as Group 2 except no primer, Group 4- same as Group 1 except no etching nor primer placed, instead the preparation was coated with a GI bonding liner(K-14, GC). All samples were thermocycled (3000 cycles) and stained with silver nitrate (50%) before sectioning and then ranked 1 through 4 for microleakage. **Results:** Paired t-Tests analysis confirmed that Group 1 leaked less than Groups 2-4. Group 4 leaked less than 2 and 3. **Conclusion:** "Open sandwich" techniques do not reduce microleakage more than the incrementally filled composite restorative technique.

Rubber dam removed

- Little polishing required
- Adjust occlusion as necessary



Restorative Care for Children

A Clinical Study of the “Open Sandwich” Technique in Pediatric Dental Practice

Mark L. Cannon, DDS, MS

ABSTRACT

Purpose: This study evaluated the clinical efficacy of the “open sandwich” restoration for pediatric dental practice.

Methods: These pediatric dentists used a standardized preparation and restorative technique to place the restoration. The prepared tooth was etched with a phosphoric acid etching agent and rinsed. A resin modified glass ionomer (Fuji II LC or Phosac-BD) was placed short of the margins and then light cured. The resin modified glass ionomer was covered with an occlusal layer of a microhybrid flowable composite (Adiello or Flow-it). The same preparation for the experimental restoration was used for the control conventional amalgam (Tyrin) restorations. The restorations were evaluated at 6-month intervals and ranked with a modified United States Public Health Survey (USPHS) scale as follows: Alpha: No discernible marginal opening or stain; Beta: Slight opening of margin discernible with dental explorer, but without stain; Charlie: Open margin and stain; Delta: Recurrent caries or restoration failure. Restoration failures were categorized according to etiology: pulpal necrosis, bruxism, marginal leakage, intrinsic fracture, or adhesive failure.

Results: All recalled experimental restorations, except 8, were rated as either Alpha or Beta. Six failed due to intrinsic fracture and 2 due to pulpal necrosis. Fifteen restorations had delamination of the flowable composite from the resin modified glass ionomer. The use of the “open sandwich” technique compared favorably with a similar study using adhesive amalgam restorations.

Conclusions: The “open sandwich” technique can be successfully used in a pediatric dental practice. (*J Dent Child.* 2003;70:66-70)

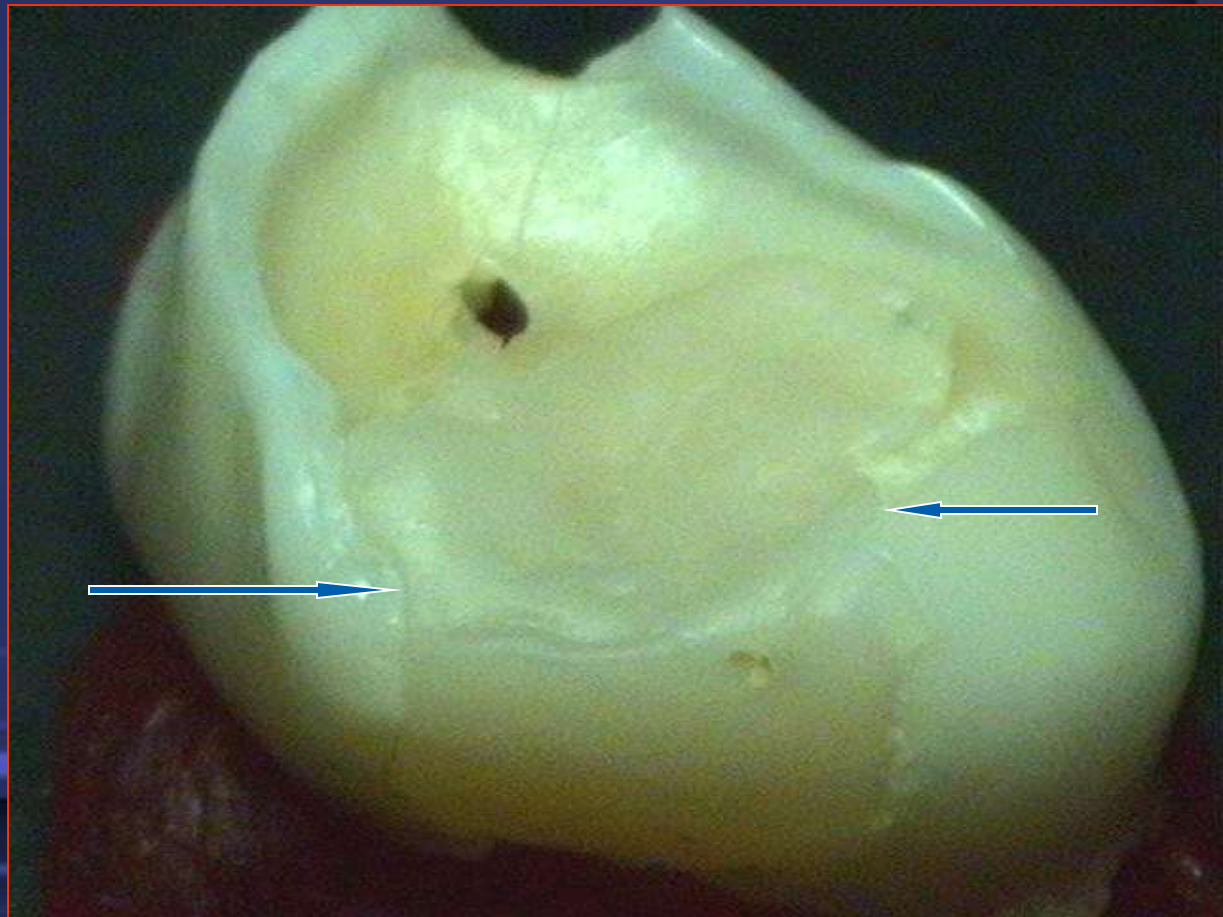
KEYWORDS: RESIN MODIFIED GLASS IONOMER, OPEN SANDWICH RESTORATION, STRATIFIED RESTORATION

- **Reference:**
- Journal of Dentistry for Children
- 2003

Retrieval

BisCover

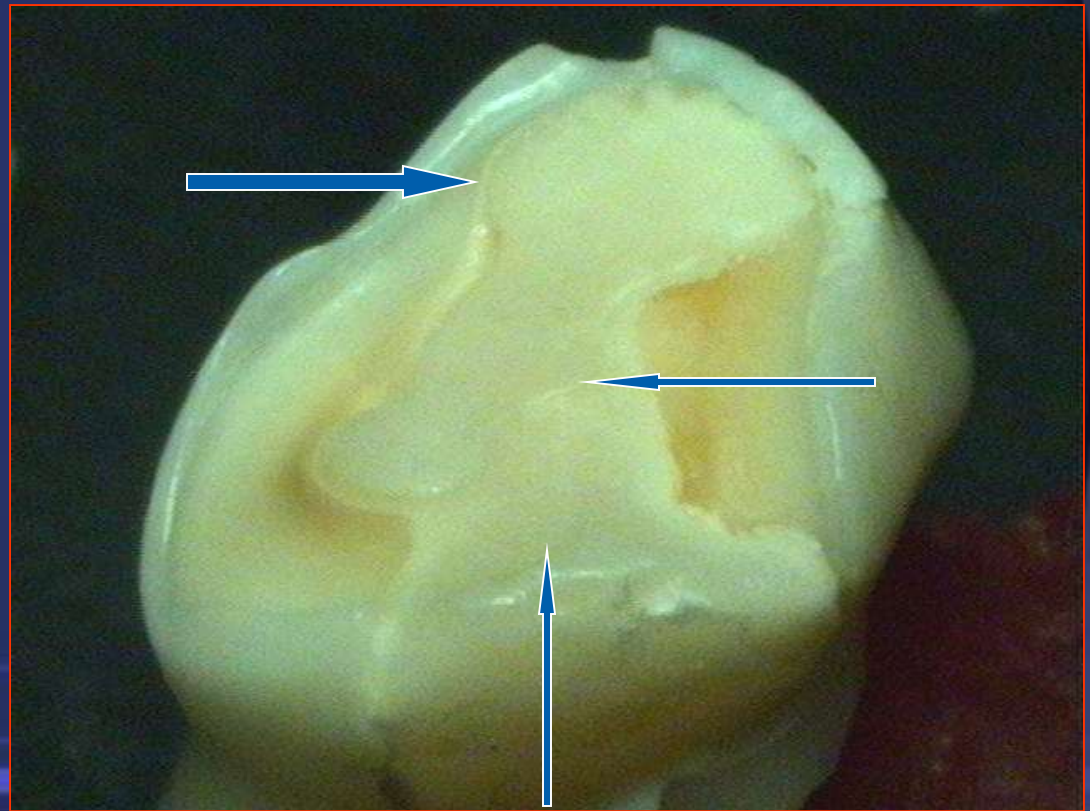
- Severe bruxer with low shrink composite
- Note pulp exposure
- Note excellent margins



Minimally Invasive Dentistry

BisCover

- Same patient, other side with open sandwich restoration
- Note flowable composite
- Note RMGI and wear

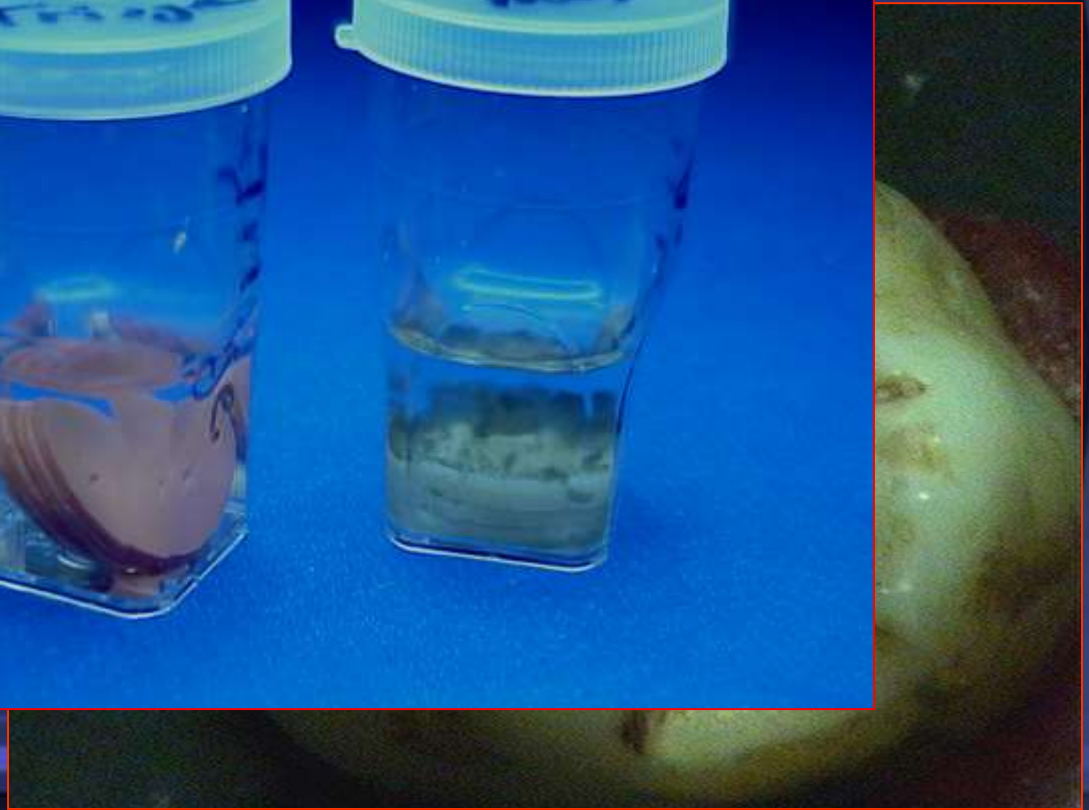


- RMGI, note wear and staining
- Exposed margins

Vitremer



Retrieval



Retrieved Molar- occlusal view

- Beta perhaps even Alfa ranking



Retrieved molar- distal view

- Charlie or even Delta gingival ranking

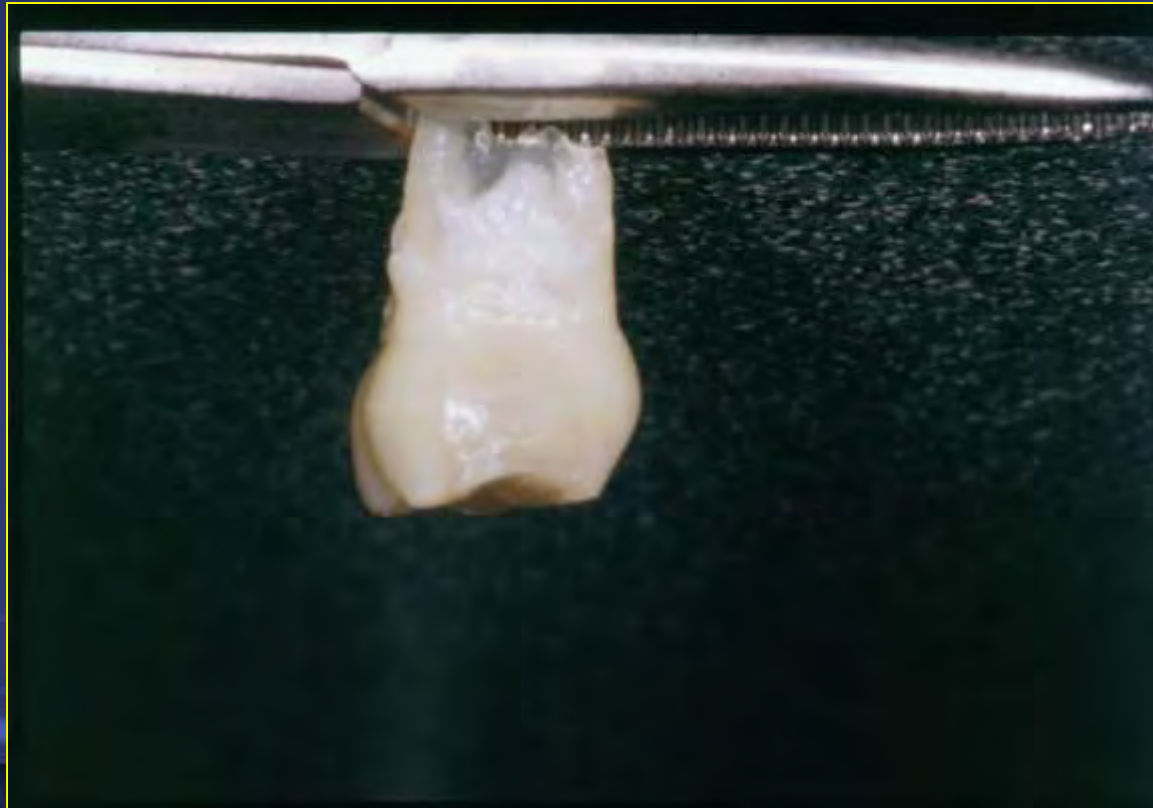


Minimally Invasive Dentistry

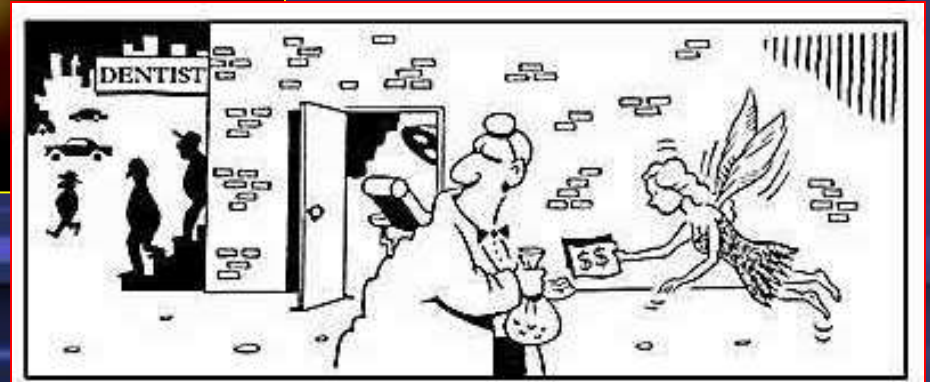
Are the Margins Sealed?



Retrieved molar- gingival margins



Retrieved molar- 10X magnification



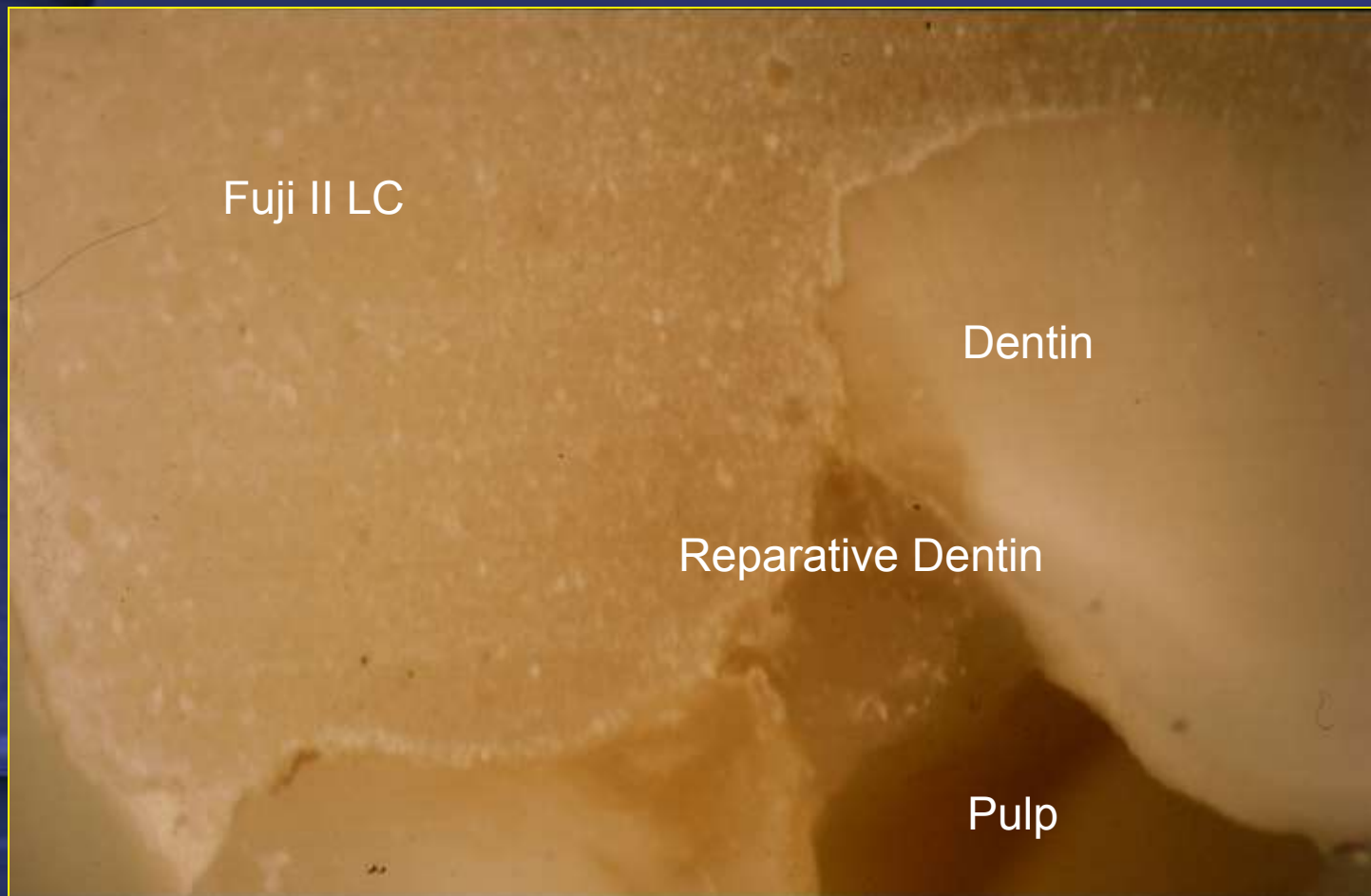
Marginal fluoride release



Sectioned molars 10X magnification



Pulp response- reparative dentin



Retrieved Molars Study



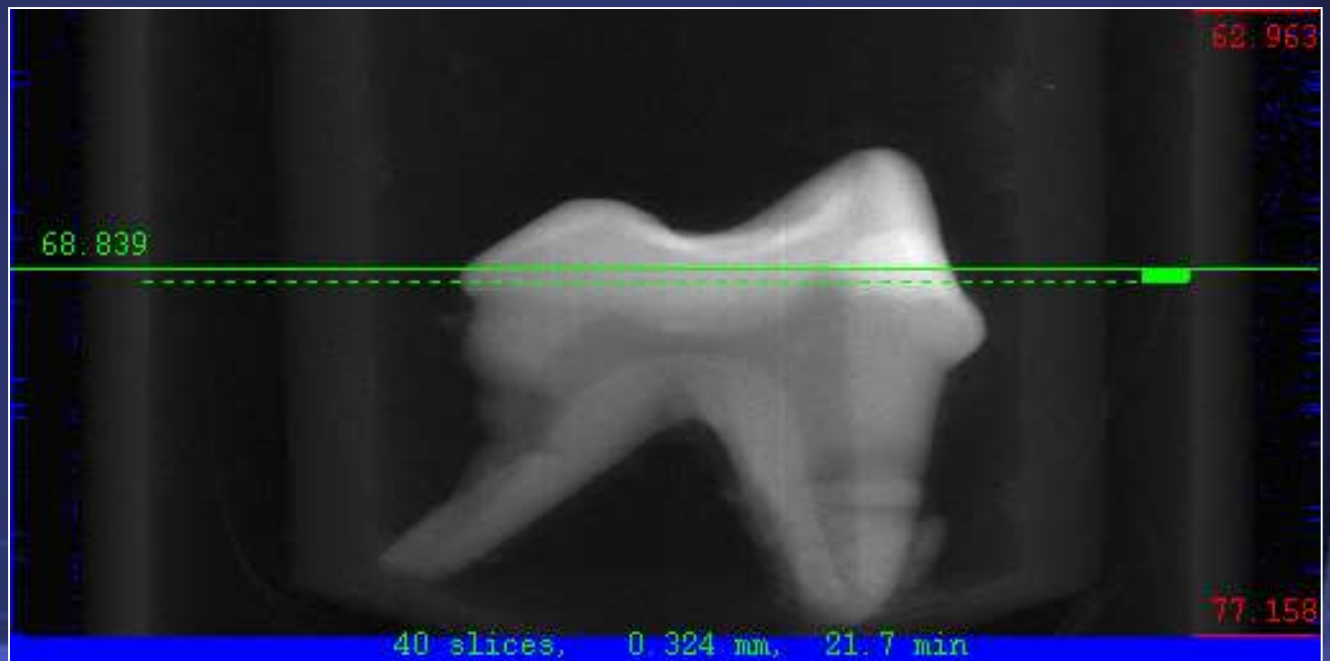
Retrieved Molars Study



40X magnification

micro CT

“Scout view” of pulp capping and RMGI



Current Research

Family

Keith, Andrea, Christopher, Michelle and Ryan Cannon



Anterior Esthetics

Acrylic Resin Crowns



Dentistry courtesy of Dr. Elizabeth Ralstrom

Anterior Esthetics

Early Childhood Caries

Pre-operative photograph



Anterior Esthetics

Rubber dam clamp 212



Exposes more tooth

Anterior Esthetics

Reduce incisals all at once



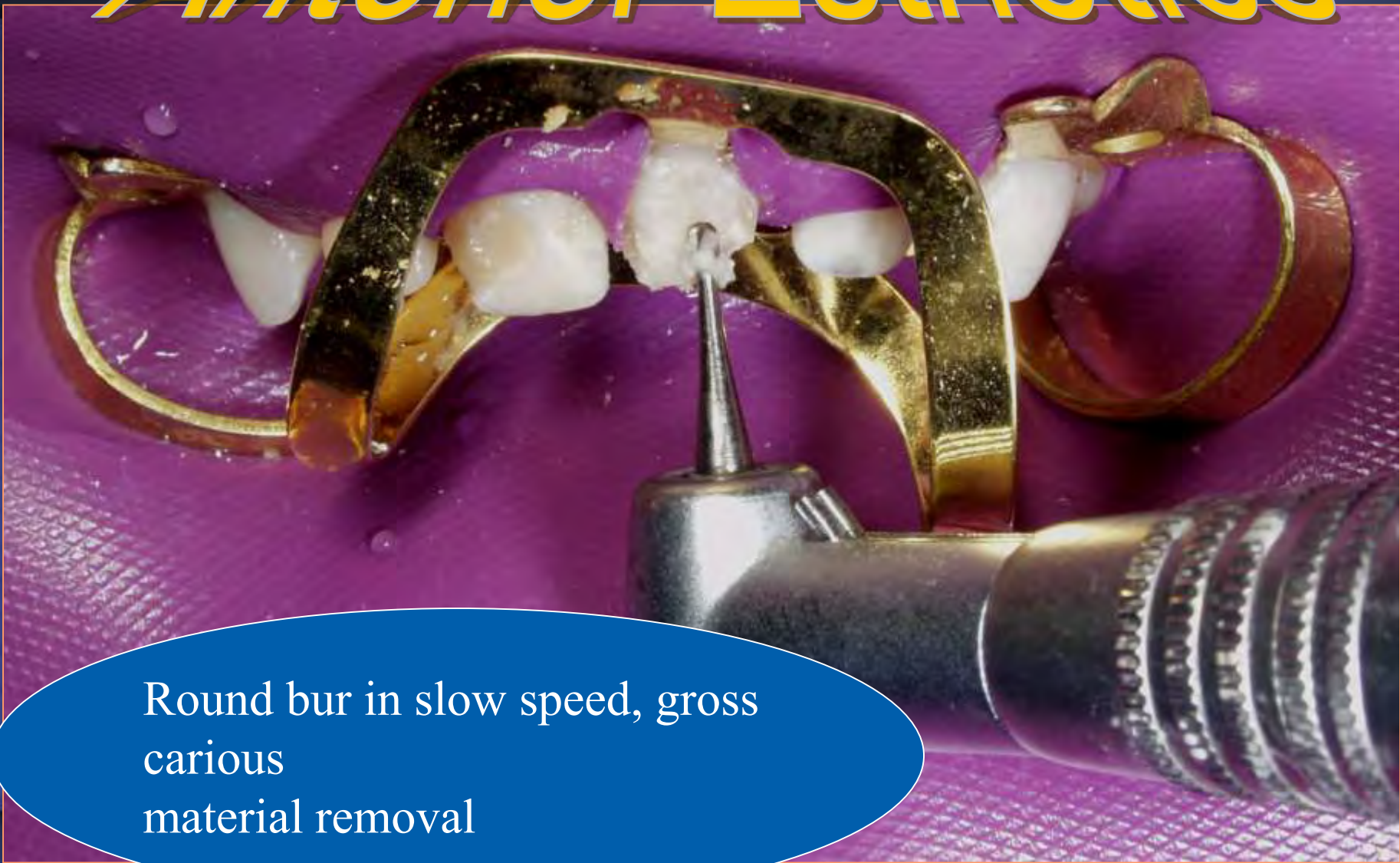
Flame shaped diamond reduces incisal

Anterior Esthetics

Interproximal reduction



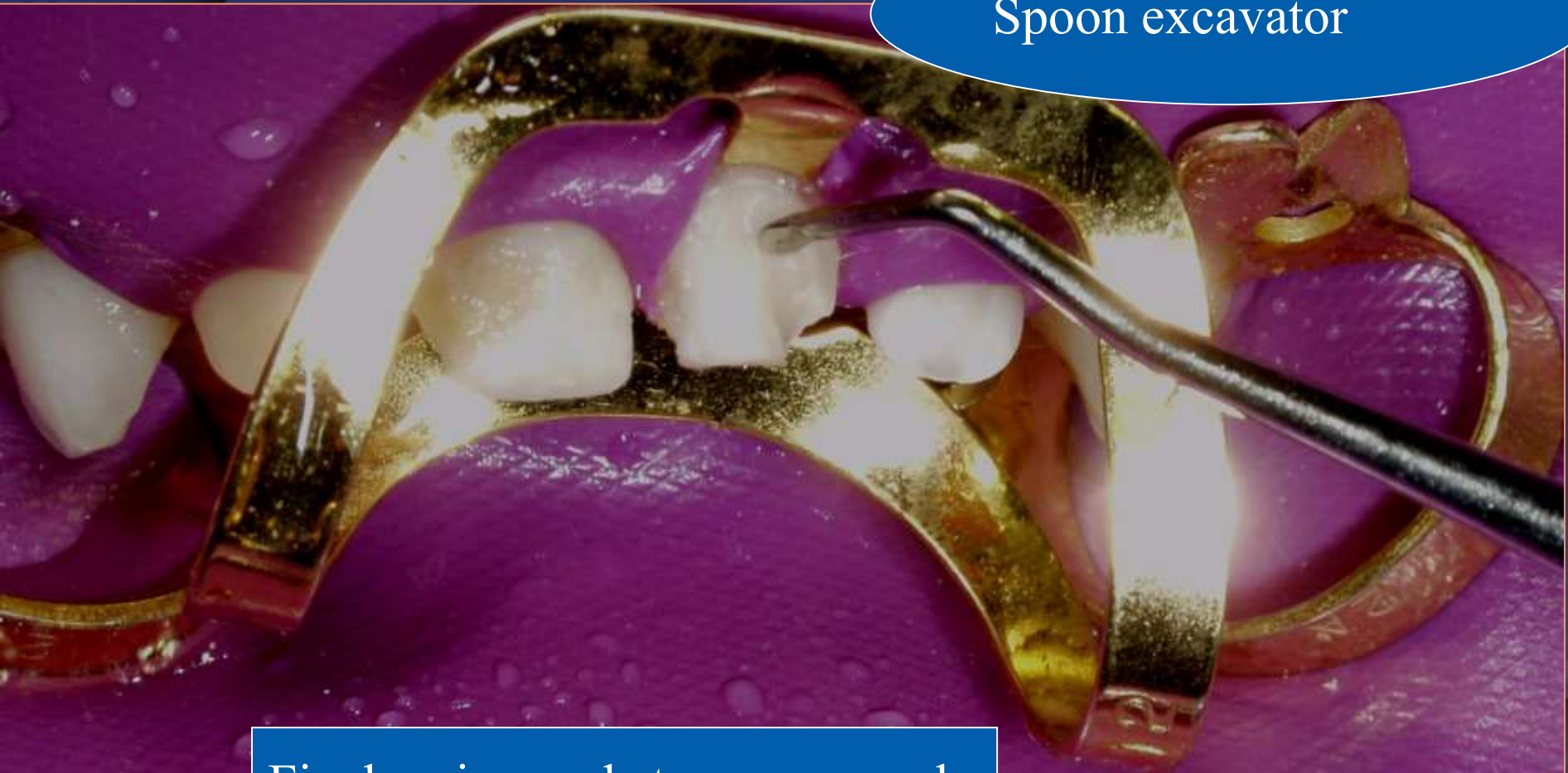
Anterior Esthetics

A close-up photograph of a dental procedure on a wax model of upper anterior teeth. A dental handpiece with a round bur is being used to remove gross carious material from a central incisor. The wax model is mounted in a gold-colored metal arch. The background is a textured purple surface. A blue oval text box is overlaid in the bottom left corner.

Round bur in slow speed, gross
carious
material removal

Anterior Esthetics

Spoon excavator



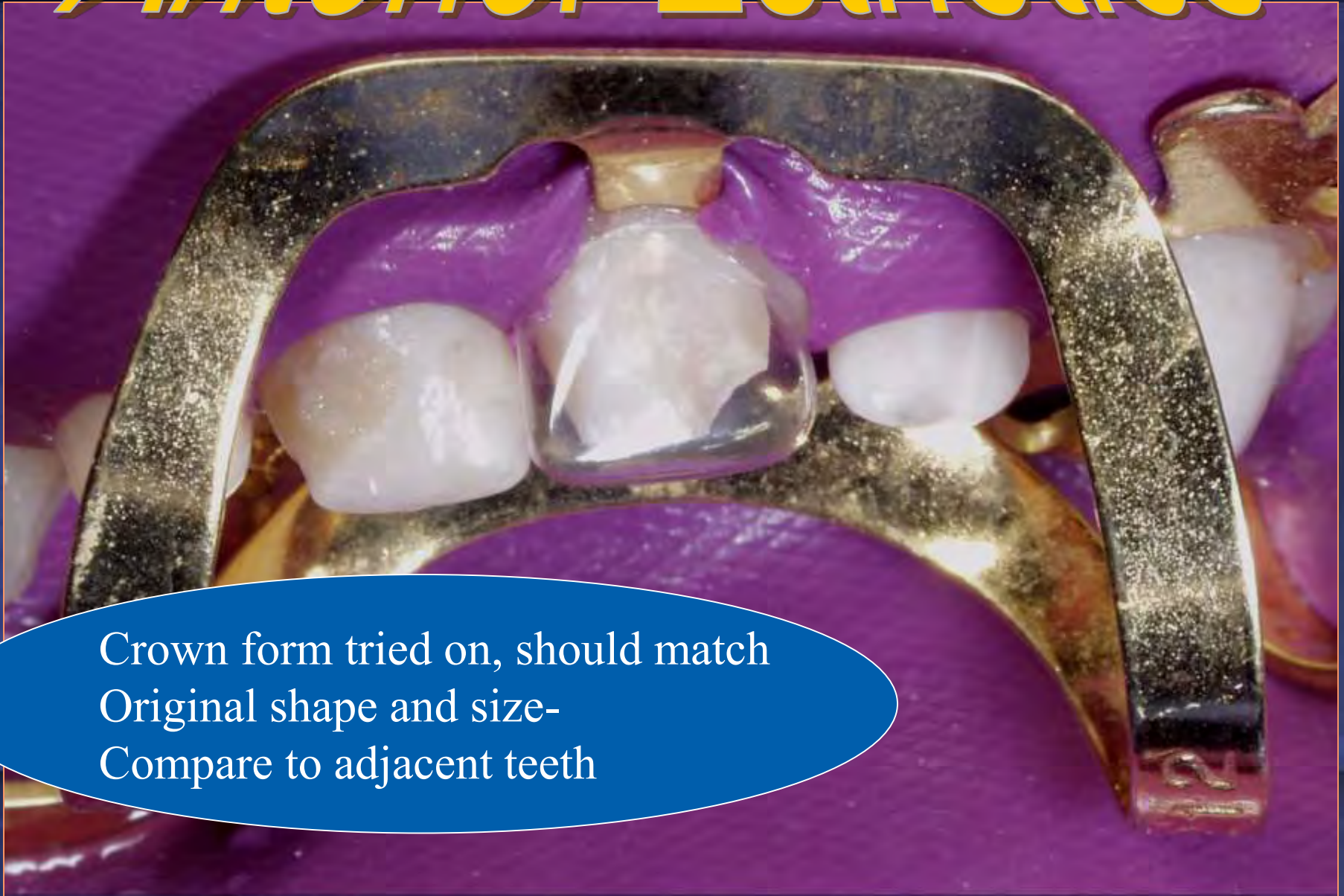
Final carious substance removal

Anterior Esthetics

A close-up photograph of a dental procedure. A pair of metal dental scissors is being used to trim a clear, curved dental crown. The crown is held in place by a metal clamp. The background is a blurred image of a person's face, focusing on the mouth area.

Curved crown and collar
Scissors trim crown
forms

Anterior Esthetics



Crown form tried on, should match
Original shape and size-
Compare to adjacent teeth

Anterior Esthetics

Crown form vented from
inside with explorer tine



Anterior Esthetics



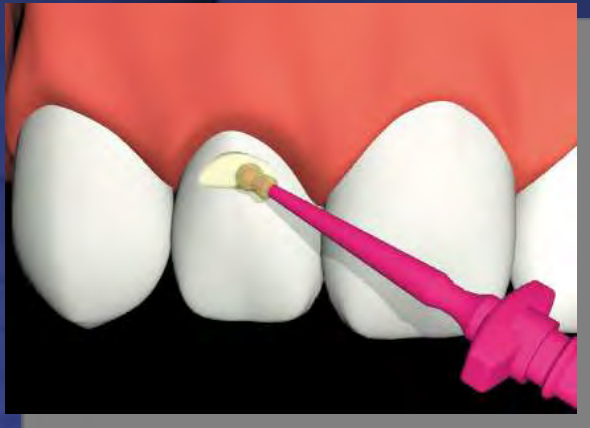
G Bond application

G-



G-BOND Technique Chart

Application



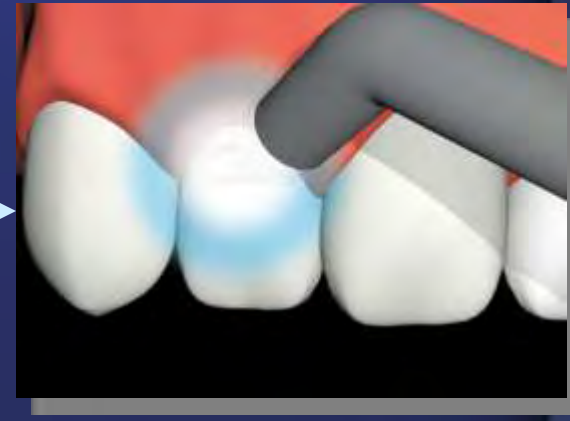
Apply G-BOND to the whole cavity and wait for 10 secs.

Air Dry



Dry thoroughly with maximum air pressure 10 secs. from the air syringe.

Light Cure



Light Cure for 10 secs. by visible light irradiation.

Anterior Esthetics



Light cure at 600 milliwatts for
10 seconds

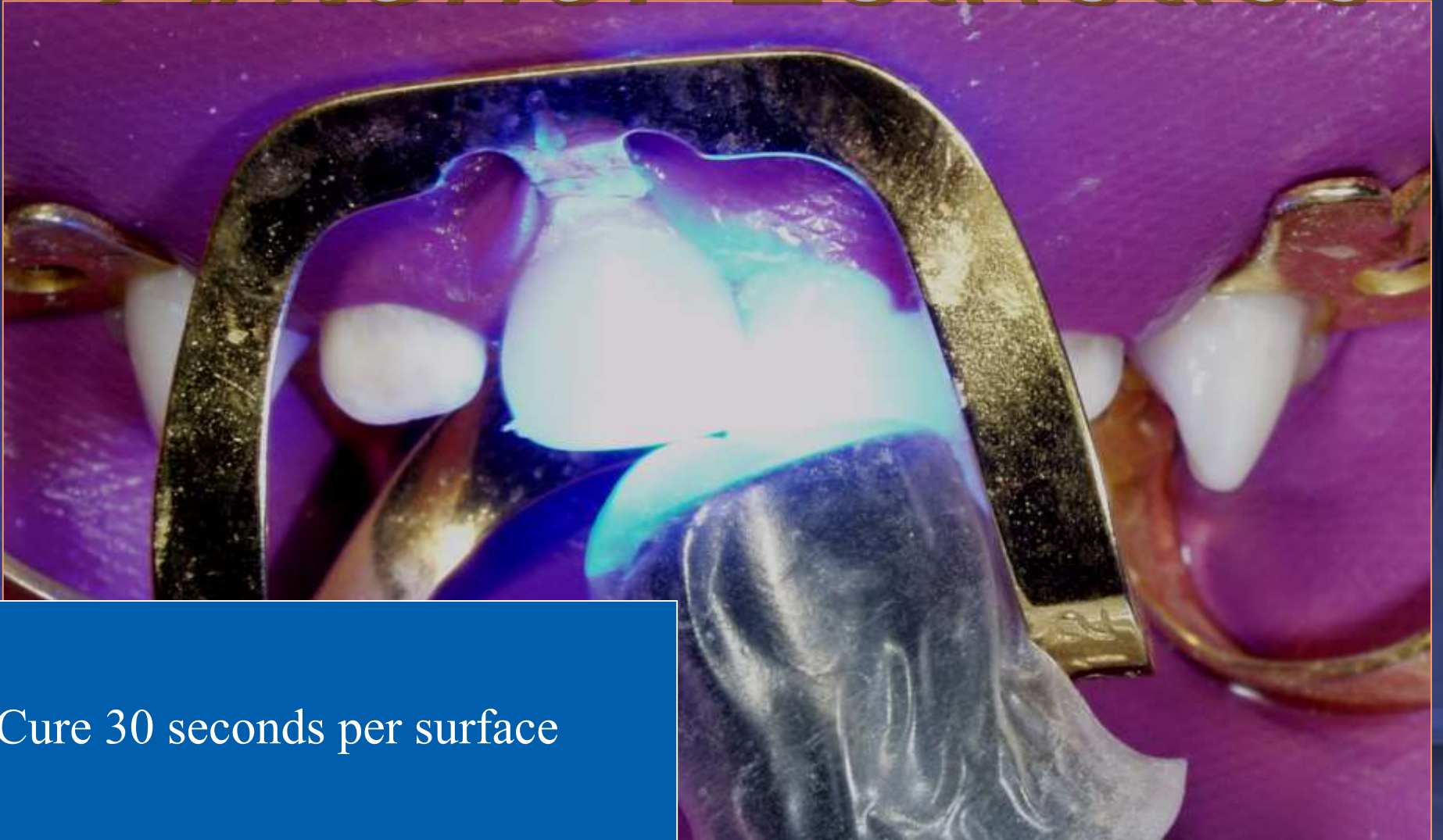
Anterior Esthetics



Crown filled with Gradia and Seated, excess removed with Composite instrument

Pulse cured on buccal, lingual and incisal

Anterior Esthetics



Anterior Esthetics



Crown forms seated and light cured

Anterior Esthetics



Polishing disks, first reduce incisal

Anterior Esthetics



Polish corners

Anterior Esthetics



Rubber dam left on for polishing

96% success rate, 4% failure due to trauma

Anterior Esthetics

Rubber dam removed, composite
Crowns on lower lateral incisors
And upper central incisors



Anterior Esthetics



Recall- follow up

Anterior Esthetics

Case Two

Trauma- needs urgent treatment

Case Two



Pre-operative view



Anterior Esthetics

Case Two

Disk does bevel without discomfort

Bevel fractured edges



Case Two



Anterior Esthetics

Case Two

Celluloid crown form
trimmed and fitted



Pay attention to your work



Case Two

Plan shades, see
if crown form
allows for layers



Anterior Esthetics

Case Two



Inside shade try-in to block shine through

Pop off and etch!

Anterior Esthetics

Case Two

Etch all
surfaces of
enamel for 30
seconds

Etch dentin for a
few seconds



Anterior Esthetics

Case Two

Apply two coats of adhesive resin!



Anterior Esthetics

Case Two



light cure at least 10 seconds

Anterior Esthetics

Case Two



Primed surface should not be air sensitive

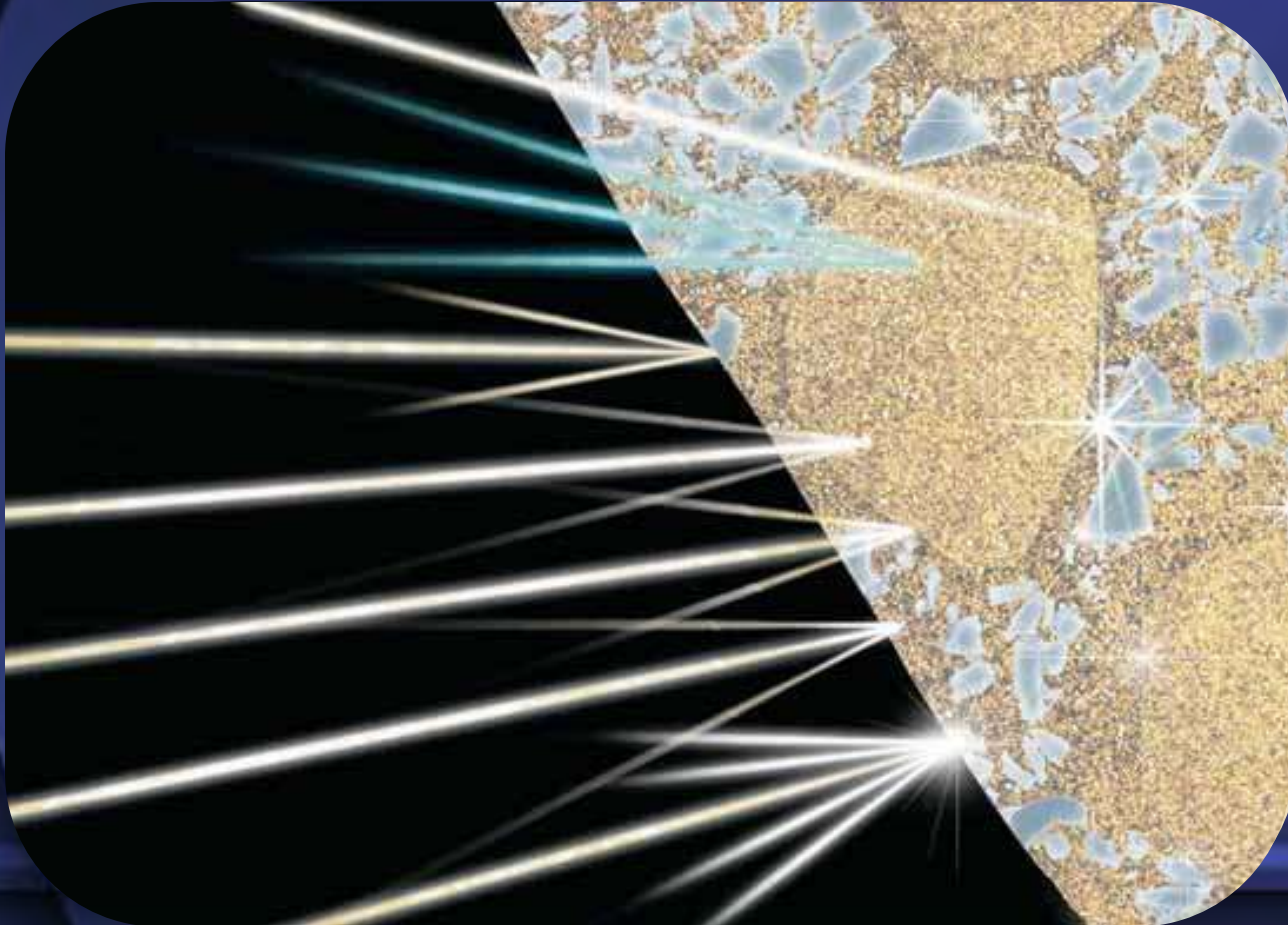
Case



1. Roll ball of incisal or translucent composite
2. Place in crown form
3. Roll ball of Inside Shade
4. Place on palatal
5. Roll ball of Body Shade or use enamel

- Reflection similar to tooth structure

GRADIA DIRECT



GRADIA DIRECT in comparison

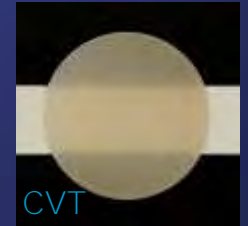
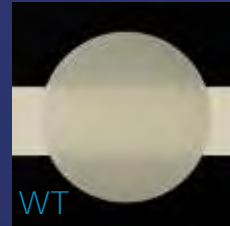
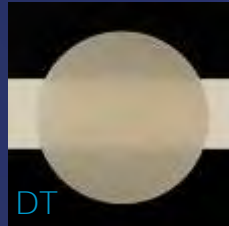
- Polishability



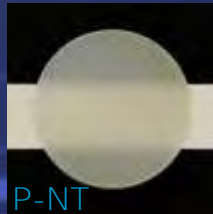
GRADIA DIRECT - Outside special shades

- Shade range

ANTERIOR



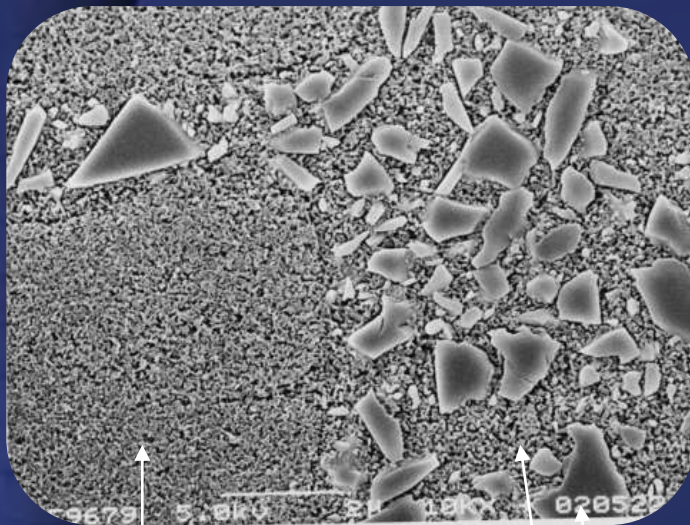
POSTERIOR



GRADIA DIRECT

- Anterior and Posterior version

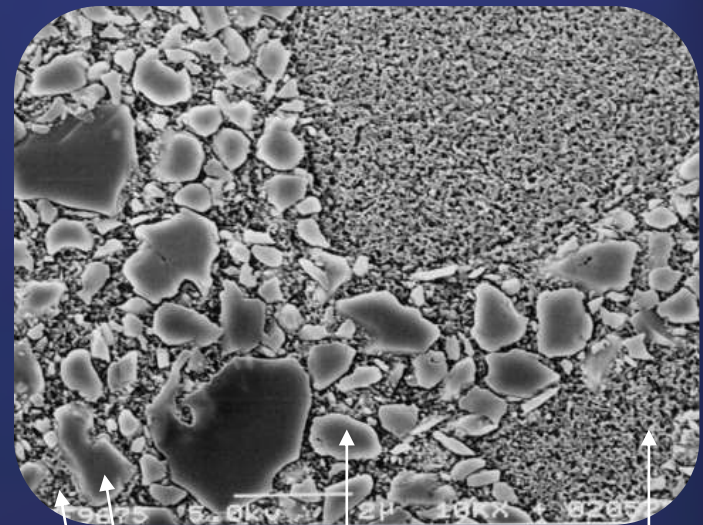
ANTERIOR



Prepolymerized filler

Silica*

POSTERIOR



FAI – silicate glass*

Silica*

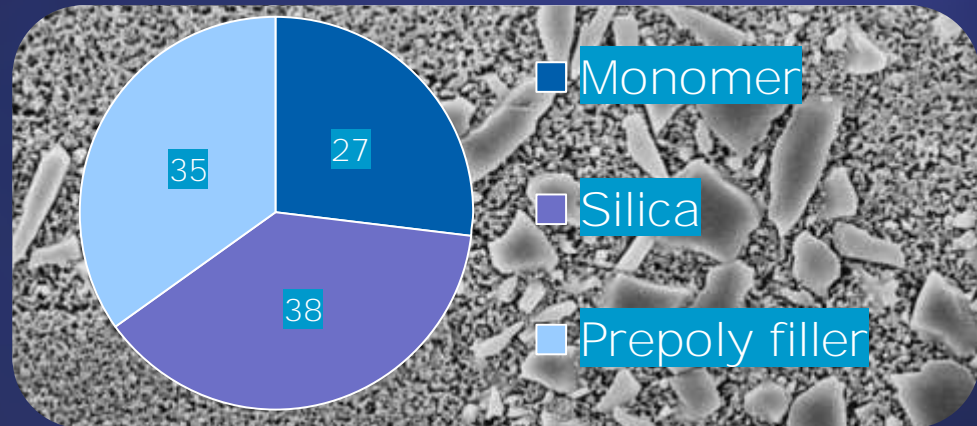
Prepolymerized filler

* Mean particle size 0.85 μ m

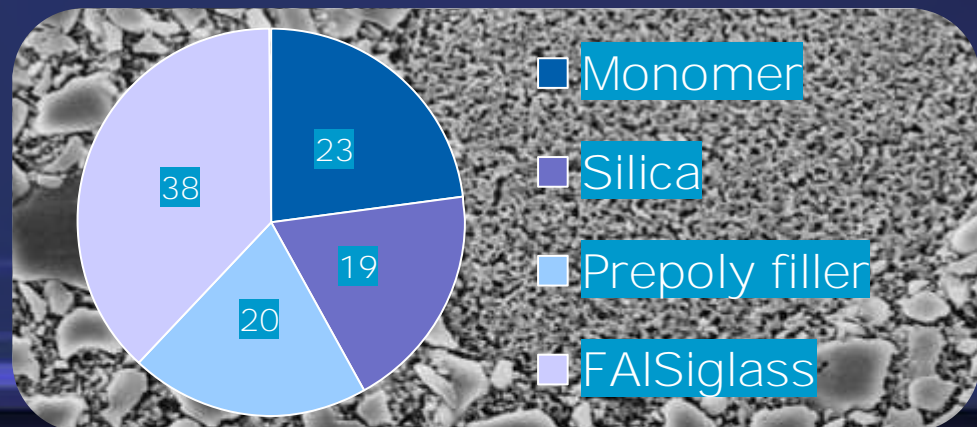
GRADIA DIRECT

- Composition (weight %)

ANTERIOR



POSTERIOR



Anterior Esthetics

Case Two

Remove excess composite only- leave a thin margin to reduce polishing

Anterior Esthetics

Case Two

Light cure for 30 seconds
From buccal, lingual
And incisal

Anterior Esthetics

Case Two

Light cure for 30 seconds
From buccal, lingual
And incisal



Anterior Esthetics

Case Two

Remove crown
form and polish
with EC
Moore's disks,
mainly incisal
corners and
gingival margins



Case Two

Anterior Esthetics

32 flute carbide finishing
bur, football shaped



Newest Real TV

Funnyheck.com

WHO WANTS *To* MARRY A HOBBO



25 women looking for love...
1 guy we promised a sandwich...
The fun begins this fall on abc

Anterior Esthetics

Case Two



Finished Immediate Restoration

Anterior Esthetics

Case Two



Palatal view

A black and white photograph of the Chicago skyline, featuring numerous skyscrapers and the Willis Tower, set against a dramatic, cloudy sky. The image serves as the background for the entire slide.

Dental Diode Lasers: Research and Clinical Applications

**Mark Cannon DDS MS,
Associate Professor
Northwestern University
Attending Physician
Children's Memorial Hospital
Chicago, Illinois**

Dental Diode Lasers: Research and Clinical Applications

Pulpotomy therapy is one of the most important treatment techniques necessary for preservation of the primary dentition.
Laser treatment of pulpal tissue is now rapidly becoming commonplace.
This presentation discusses the current research, including animal studies performed at UNESP (Aracatuba, Brazil) and Northwestern University in addition to the clinical techniques and applications of the dental diode lasers.

Review of the Literature

J Clin Pediatr Dent. 2008 Fall;33(1):21-8.

Effects of antibacterial agents on dental pulps of monkeys mechanically exposed and contaminated.

Cannon M, Cernigliaro J, Vieira A, Percinoto C, Jurado R.

Northwestern University, Children's Medical Center, Chicago, USA. markcannon@northwestern.edu

Abstract

OBJECTIVE: The purpose of this study was to compare the effectiveness of antibacterial agents and mineral trioxide aggregate in the healing of bacterial contaminated primate pulps. **STUDY DESIGN:** The experiment required four adult male primates (*Cebus opella*). The experiment was performed under general anesthesia and the exposed pulps were exposed to cotton pellets soaked in a bacterial mixture consisting of microorganisms normally found in human pulp. **Controls:** The experiment was performed in the Endodontic Clinic of UNESP. Following bacterial inoculation (30 minute exposure), the pulpal tissue was immediately treated with either sterile saline, Cipro HC Otic solution (12), diluted Buckley's formecresol solution (12), or ZOE Otic solution (12) for 5 minutes. After removal of the pellet, hemostasis was obtained and a ZOE base applied to the DFC treated pulps and the non-treated controls (12). After hemostasis, the other exposed pulps were treated with Cipro HC and MTA. The pulpal bases were all covered with a RMGI (Fuji II LC). The tissue samples were collected at one day, two days, one week and over four weeks (34 days). **RESULTS:** Following bacterial exposure, the pulps were stained and histologically graded. After histologic analysis, presence of neutrophilic infiltrate and areas of hemorrhage with hyperemia were observed. The depth of the neutrophilic infiltrate depended on the agent or material used. The pulpal tissue treated with Otic suspensions demonstrated significantly less inflammation (Kruskal-Wallis non parametric analysis, $H = 9.595$ with 4 degrees of freedom; $P = 0.0223$) than the other controls. The pulpal tissue treated with MTA was more organized in the MTA treated group than the ZOE group (Kruskal-Wallis non parametric analysis, $H = 11.231$ with 1 degree of freedom; $P = 0.0004$). **CONCLUSIONS:** Otic suspensions and MTA are effective in treating bacterial infected pulps and stimulate the production of a hard tissue bridge over the site of the exposure.

Review of the Literature

1: Pesqui Odontol Bras, 2006 Jul-Sep;20(3):219-25.

Biological response of pulps submitted to different capping materials.

Briso AL, Rahal V, Mestrener SR, Dezan Junior E.

Department of Restorative Dentistry, School of Dentistry of Aracatuba, State University of Sao Paulo.

Pulp capping is a procedure that comprises adequate protection of the pulp tissue exposed to the oral environment, aiming at the preservation of its vitality and functions. This study evaluated the response of the dental pulps of dog teeth to capping with mineral trioxide aggregate (MTA) or calcium hydroxide P.A. For that purpose, 37 teeth were divided into two groups, according to the capping material employed. Two dogs were anesthetized and, after placement of a rubber dam, their pulps were exposed in a standardized manner and protected with the experimental capping materials. The cavities were then sealed with resin-modified glass ionomer cement and restored with composite resin. After sixty days, the animals were killed and the teeth were processed in order to be analyzed with optical microscopy. It was observed that MTA presented a lower cellular response compared to calcium hydroxide, presenting a lower occurrence of inflammatory infiltrates.

MTA better than CH

Ledermix or formocresol showed cellular infiltration extending to greater than two-thirds of the pulp (P < 0.01). Comparative studies with berbamine, a natural analog of tetrandrine, showed that it was less inflammatory than formocresol and Ledermix, and had a lower inflammatory response than the and formocresol. These results suggest that tetrandrine may have value as a pulpotomy medicament.

Anti-inflammatory works

Assessment of a novel alternative to conventional formocresol-zinc oxide eugenol pulpotomy for the treatment of pulpally involved human primary teeth: diode laser-mineral trioxide aggregate pulpotomy.

Saltzman B, Sigal M, Clokie C, Rukavina J, Titley K, Kulkarni GV.

Faculty of Dentistry, University of Toronto, 124 Edward Street, Toronto, Ontario, Canada.

OBJECTIVE: The purpose of this study was to investigate whether a diode laser pulpotomy with mineral trioxide aggregate (MTA) sealing could be an acceptable alternative to the conventional formocresol pulpotomy and zinc oxide eugenol (ZOE) sealing in human primary teeth. **METHODS:** A randomized, single-blind, split-mouth study was used with a sample of 16 children aged from 3 to 8 years (mean age=5.10 years). A total of 26 pairs of teeth from these 16 patients were selected based on clinical and radiographic criteria. One tooth from each pair was randomly assigned to either the laser-MTA pulpotomy group or the formocresol-ZOE pulpotomy group. All teeth were followed up clinically and radiographically at 2.3, 5.2, 9.5 and 15.7 months. All extracted failures were sectioned and photographed to assess possible reasons for this. **RESULTS:** A total of seven laser-MTA-treated teeth were deemed to be radiographic failures (mean time until failure=9.1 months) compared to three formocresol-ZOE treated teeth (mean time until failure=12.5 months). These results were not significant using the Fisher's Exact Test. Six teeth in the laser-MTA group and five teeth in the formocresol-ZOE failures exhibited clinical and/or periapical radiolucencies with or without pathologic root resorption. One of the laser-MTA failures displayed premature root resorption and is being observed for exfoliation. Analysis of photographs of teeth prior to extraction revealed errors in clinical technique in addition to expected signs of disease such as the presence of granulation tissue and areas of pathologic root resorption. **CONCLUSIONS:** The laser-MTA pulpotomy showed reduced radiographic success rates compared to the formocresol-ZOE pulpotomy at 15.7 months; however, these results were not statistically significant. Improved success rates among a larger patient sample and a longer follow-up period would be required for the laser-MTA pulpotomy to be considered a routine alternative to the conventional formocresol-ZOE procedure. Meticulous restorative techniques must be followed to ensure the success of laser-MTA pulpotomies.

**Diode laser MTA equivalent
To FC-ZOE**

agar plates. **RESULTS:** The number of bacteria was significantly reduced in experimental groups in comparison with the control group. Diode laser was determined to be more effective than NaOCl in reducing bacterial counts on root canal walls. **CONCLUSIONS:** Diode laser irradiation and 5.25% NaOCl application provided a significant antibacterial effect in vitro, in contaminating primary molar root caries.

Decrease bacteria in primary molars

CO2 and diode lasers decrease bacteria

of adhered *S. sanguinis* or *P. gingivalis*. To cite this article: Hauser-Gerspach I, Stübinger S, Nuyken O. CO₂ and diode laser effects on bacterial adhesion to zirconia and titanium surfaces: an in vitro study comparing zirconia to titanium. Clin. Oral Impl. Res. xx, 2010; 000-000.

Review of the Literature

☐ 1: [J Clin Laser Med Surg](#). 1996 Feb;14(1):37-42.

Effects of the argon laser on primary tooth pulpotomies in swine.

[Wilkerson MK](#), [Hill SD](#), [Arcoria CJ](#).

Baylor College of Dentistry, Dallas, Texas 75266-0677, USA.

This study evaluated the clinical, radiographic, and histologic effects of the HGM PC Oralase argon laser on vital pulps of swine teeth. Pulpotomies were performed in vivo on 42 primary teeth from three young pigs and observed for 7 or 60 days. For each time period nine experimental teeth received an argon laser dose of 1 W, 2 sec (24.88 J/cm²), and nine experimental teeth received a dose of 2 W, 2 sec (49.74 J/cm²). Controls consisted of three teeth for each time period and did not receive exposure from the argon laser. There were no significant differences noted between the two energy densities with respect to clinical, radiographic, or histological parameters for either time period. All soft tissues remained normal and all teeth exhibited normal mobility at weekly assessments. Other than physiologic root resorption, there were no differences in pre- and postoperative radiographs in the 7 day sample; calcifications coinciding to dentinal bridges were visible in 6 of the 13 teeth at 60 days. The histologic findings were consistent with the exception of teeth which had early restoration loss with resultant bacterial contamination, all other pulps appeared to retain their vitality and capability of normal pulpal healing. Use of the argon laser at the parameters described in this study did not appear to be detrimental to pulpal tissues.

Our Purpose



- The purpose of this animal study was to compare the effectiveness of an experimental antibacterial and hemostatic formulation to that of diode laser irradiation by histological examination in the healing of porcine pulpotomized molars.

IACUC Approved

Study Design:



- The experiment required **three young swine** (*Sus scrofa domestica*, Yorkshire) with **36 teeth prepared** with occlusal penetrations into the pulpal tissues. The preparations were performed under general anesthesia and the exposed pulps were exposed using high speed instrumentation with rubber dam isolation and a disinfected field.
- Following instrumentation, the coronal pulpal tissue was amputated and immediately **treated with either:**
 - **ferric sulfate and chlorhexidine semi-gel (12) for approximately 2 minutes**
 - **diluted Buckley formocresol solution (12) for 5 minutes**
 - **laser irradiation with a diode laser (12) for approximately 2 minutes**
- Hemostasis was obtained and a IRM base applied to the treated pulps (36). The pulpal bases were all covered with a RMGI (Fuji II LC).

Treatment Groups

- Buckley's Solution diluted and 5 ml application on cotton
- Kavo Gentleray Diode Laser 3 watt pulsed 100ms 2 mins.
- 20% Ferric Sulfate/1.2% Chlorhexidine Mix- (experimental) for 2 minutes



Treatment under General Anesthesia at
Northwestern University :

Center for Comparative Medicine



Study Design, cont.



Northwestern Center for Advanced Surgical Education
Feinberg School of Medicine Department of Surgery



- The tissue samples were collected via animal sacrifice
- This was a **N**orthwestern study
- **N**orthwestern study
- The tissue samples were collected via animal sacrifice. The animals were sacrificed after N-CASE was performed. The teeth were then placed in a decalcification solution for 24 hours.



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Histology:

- **The 36 samples** were evaluated by the University Department of Histology for histological evaluation using light and fluorescence microscopes. The evaluation included the use of special staining materials and techniques. The samples were assigned identification numbers and were evaluated at both **63X** and **250X** magnification.
- **The histological analysis** included the following parameters: **necrosis**, **hard tissue bridging**, **presence of giant cells**, **other calcifications**, **presence of giant cells**, **particles of capping agent**, and a **ranking of the inflammation**.
- The data was statistically analyzed with the assistance of a statistician unaware of the sample groups constituents.



Ranking for Inflammation:

- Inflammation

- 0- none or few inflammatory cells present
- 1- slight amount of inflammation
- 2- moderate inflammation
- 3- severe inflammation, micro abscesses
- 4- necrosis or abscess formation



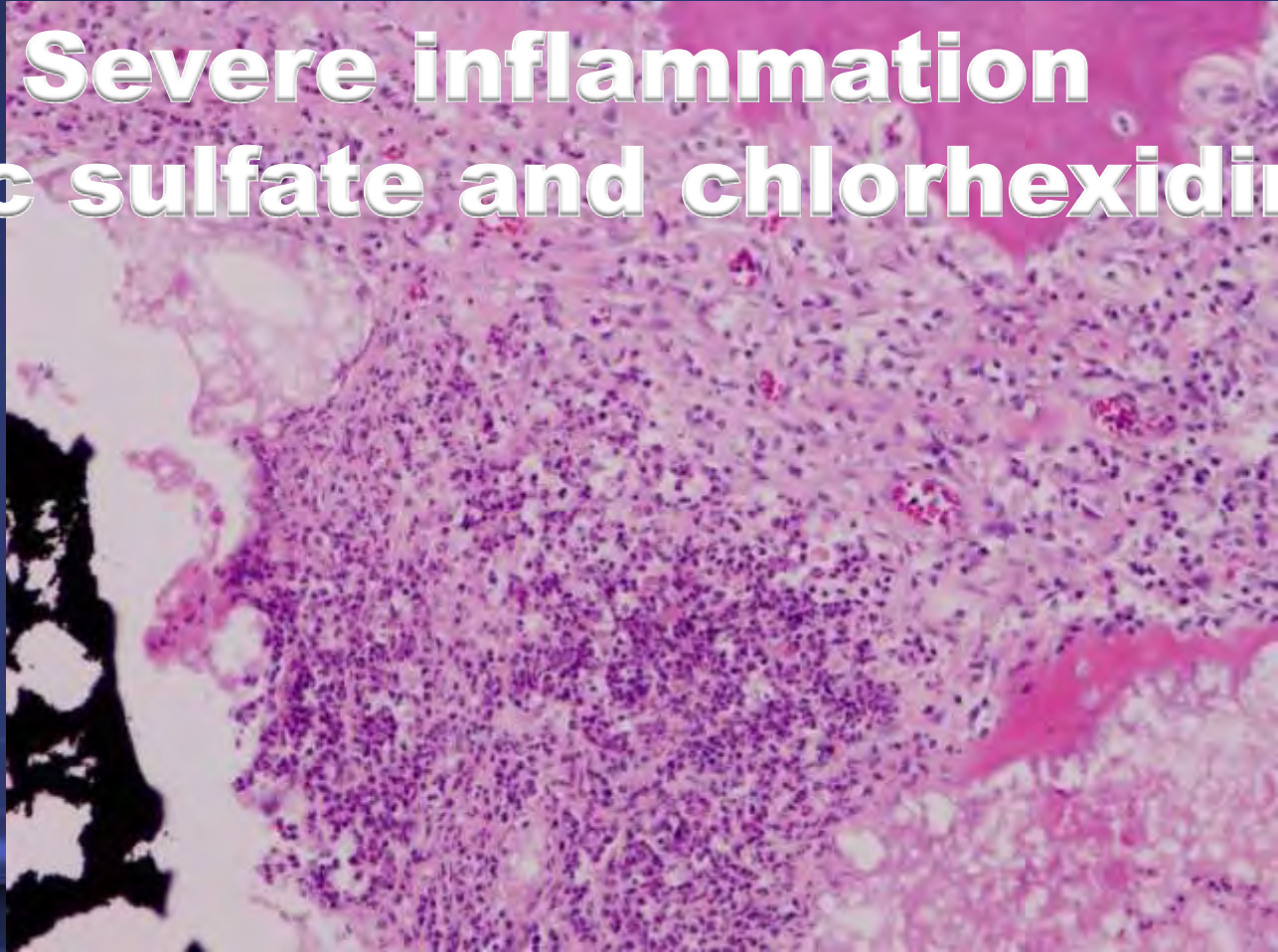
Ranking for Inflammation:

**Mild inflammation
- Laser**



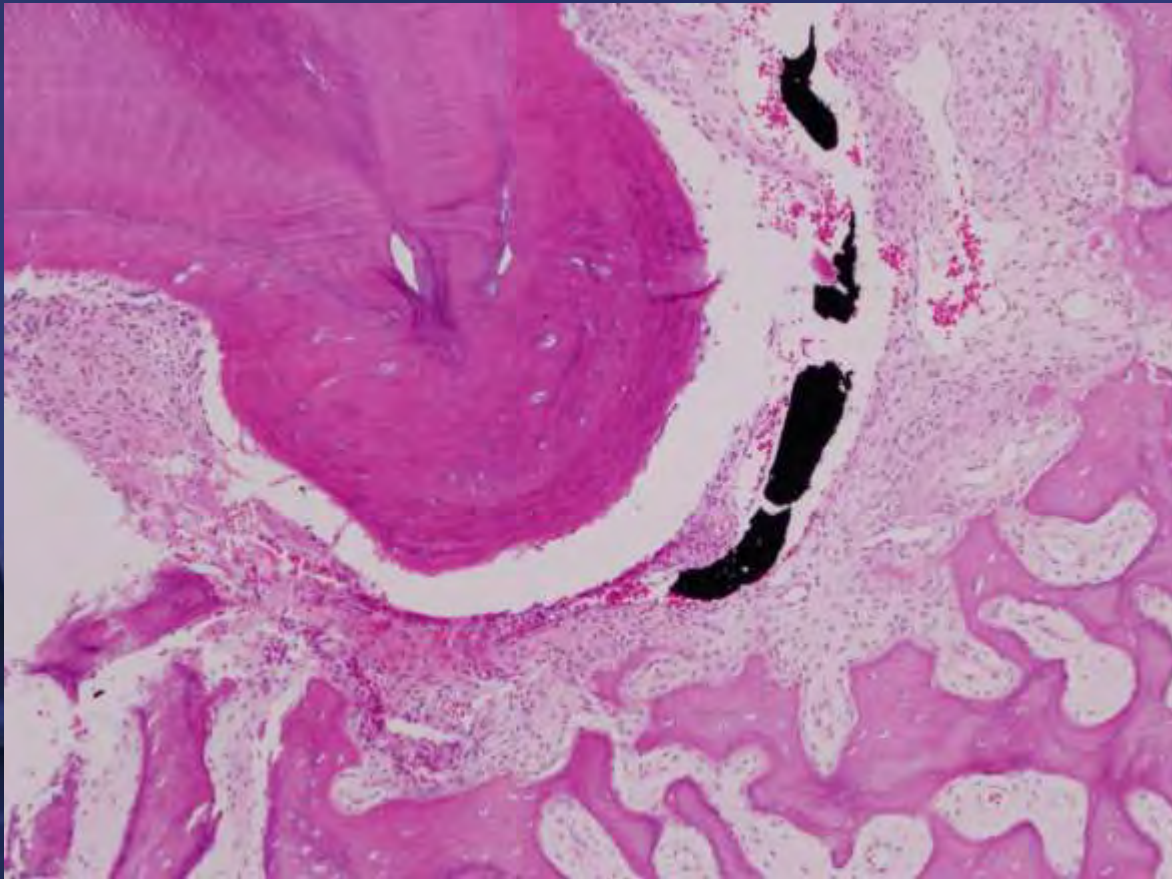
Ranking for Inflammation:

Severe inflammation
Ferric sulfate and chlorhexidine



Ranking for Inflammation:

“Ferric sulfate” and “iron?” deposits



Results: Non-parametric Independent – Kruskal-Wallis Test

Group	N	Rank Sum	Mean Rank
Laser	12	136.5	11.38
Formo	12	235.0	19.58
Ferric	12	294.5	24.54

p= 0.0072

The treatment groups were statistically significant.

Discussion



Ferric sulfate and chlorhexidine group

- The mixture of 20% ferric sulfate and 1.2% chlorhexidine did not perform as well in pulpal application as was hypothesized.
- Perhaps there is an un-expected chemical reaction between the ferric sulfate and the chlorhexidine. It is possible that another anti-microbial medicament, such as, *benzyl ammonium chloride* would be an acceptable additive to ferric sulfate to provide anti-bacterial effectiveness and maintain the hemostatic feature.



Discussion



Ferric Sulfate and Chlorhexidine

Of great concern should be the apparent ferric sulfate compound deposits found by the pathologists in the radicular pulpal tissues. These deposits may or may not contribute to pulpotomy failure or success but the end result of less than acceptable healing would more or less indicate that the deposits do not contribute to healing but may be the result of increased inflammation or result in increased inflammation. Further studies are definitely indicated to determine the nature of the deposits, and their contribution, if any, to inflammation of the treated pulps.

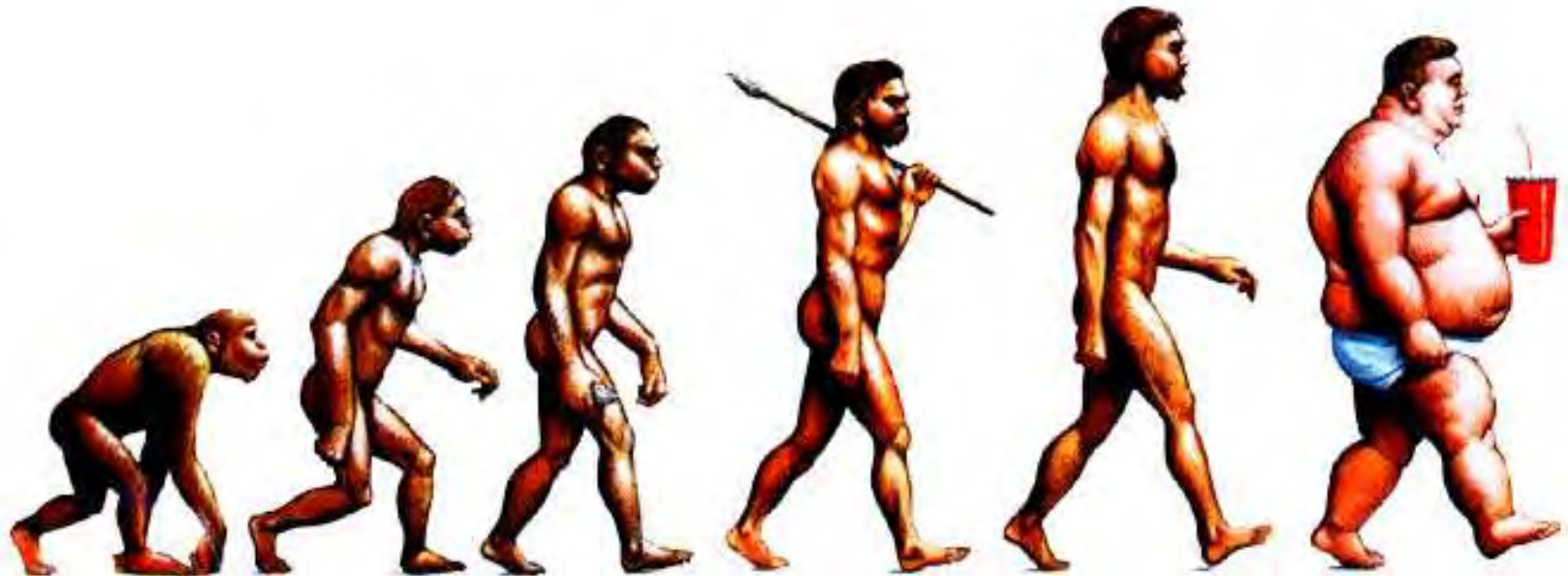
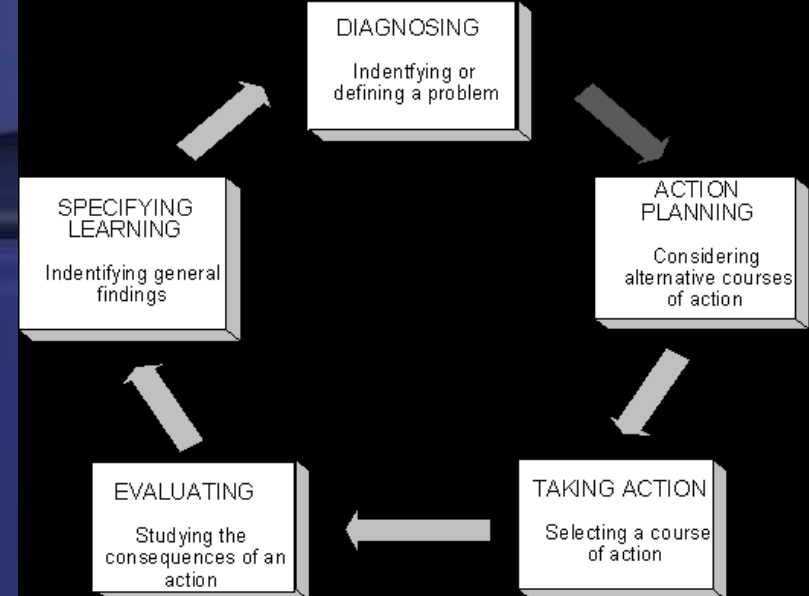
Discussion

Diode Laser Group



- Laser treatment of pulpal tissue is rapidly becoming commonplace as the diode laser units are now extremely economical and found in many dental offices. The diode laser has been advocated for treatment of anything from aphthous ulcers to periodontal disease. It is now utilized by dental hygienists rather routinely and for soft tissue surgery by dentists, both specialists and general dentists. **All of the diode laser units have a pulpotomy setting, but the rationale for these settings is unclear.** The setting advocated for the KaVo Gentle Ray was apparently sufficiently correct to allow for successful pulpal treatment. Ideally, animal and clinical studies should be performed to determine the exact settings for achieving the most histologically kind treatment of the involved pulp.

Discussion



and controlled, clinical studies.

Effects of Alternative Pulpotomy Techniques on Swine Pulp

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Early Response of Mechanically Exposed Dental Pulp of Swine to Antibacterial-Hemostatic Agents or Diode Laser Irradiation

Cannon M. * / Wagner C. ** / Thobaben JZ. *** / Jurado R. **** / Solt D. *****

Objectives: The purpose of this study was to compare the effectiveness of an antibacterial and hemostatic agent to diode laser irradiation in the healing of mechanically exposed porcine pulps. **Materials and Method:** The experiment required three adult swine (*Sus scrofa domestica*, Yorkshire) with 36 teeth prepared with occlusal penetrations into the pulpal tissues. The preparations were performed under general anesthesia and the pulps were exposed using high speed instrumentation with rubber dam isolation and a disinfectant field. Following instrumentation the coronal pulpal tissue was amputated and immediately treated with ferric sulfate and chlorhexidine semi-gel (12), diluted Buckley's formocresol solution (12) for 5 minutes or laser irradiation with a diode laser (12). After treatment, hemostasis was obtained and a ZOE base applied to the treated pulps (36). The pulpal bases were all covered with a RMGI (Fuji II LC). The tissue samples were collected at 4 weeks (28 days). Following fixation, the samples were de-mineralized, sectioned, stained and histologically graded with a scale of 0-4. **Results:** The treatment groups were statistically different with the Laser Treated Group demonstrating the least inflammation. **Conclusion:** Pulpotomy treatment with the KaVo Gentle Ray Diode Laser demonstrated significantly less inflammation than the other two pulpal therapy modalities. The ferric sulfate and chlorhexidine mixture demonstrated the greatest inflammation as histologically graded. Also, the histological sections of pulpotomized swine teeth treated with the ferric sulfate and chlorhexidine mixture presented with black pigmented areas in the pulp and surrounding tissue. The formocresol group (clinical standard) and the diode laser group did not present with the black precipitate.

Keywords: pulp exposures, pulp response, bacteria, swine
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Granules", apparently precipitates, from the Ferric Sulfate in the radicular pulpal tissues. The Formocresol Group had moderate inflammation consistent with previously published research.

Laser Clinical Pulpotomy Technique

Pulpal Extirpation
Hemostasis
Debridement
Decontamination

