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
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 2mms by 12 mms, 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 OneStep 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.
Application of Occlusal Component

Flowable composite will need to be approximately one mm thick.
Flowable composites
Sectional matrix removed
Wedge removed
Flash removed with carver
Power cure 600 milliwatts plus
Restorative Care for Children

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

J. Hiestero, B. Jantra Young, M. Cannon, and R. Jurado, 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 (Aeliteflow 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

Reference:
Journal of Dentistry for Children
2003

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: Three pediatric dentists used a standardized preparation and restorative technique to place the restorations. The prepared tooth was etched with phosphoric acid and rinsed. A thin modified glass ionomer (Fuji II LC or Prime-Fil) was placed short of the margin and then light cured. The thin modified glass ionomer was covered with an occlusal layer of a microhybrid flowable composite (Adaptic or Flow-it). The same preparation for the experimental restoration was used for the control conventional amalgam (Tylenol) 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, extraction, marginal leakage, intrinsic fracture, or adhesive failure.

Results: All recalled experimental restorations, except 8, were used as either Alpha or Beta. Six failed due to intrinsic fracture and 2 due to pulpal necrosis. Fifteen restorations had delaminating of the flowable composite from the thin 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;70:65-70)

Keywords: Glass ionomer, open sandwich restoration, stratified restoration
• Severe bruxer with low shrink composite
• Note pulp exposure
• Note excellent margins
• Same patient, other side with open sandwich restoration
• Note flowable composite
• Note RMGI and wear
• RMGI, note wear and staining
• Exposed margins
Retrieved Molar- occlusal view

• Beta perhaps even Alfa ranking
Retrieved molar - distal view

• Charlie or even Delta gingival ranking
Are the Margins Sealed?
Retrieved molar- gingival margins
Retrieve molar - 10X magnification
Marginal fluoride release
Sectioned molars 10X magnification
Pulp response - reparative dentin

Fuji II LC

Dentin

Reparative Dentin

Pulp
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
Pre-operative photograph
Exposes more tooth
Flame shaped diamond reduces incisal
Interproximal reduction
Round bur in slow speed, gross carious material removal
Anterior Esthetics

Spoon excavator

Final carious substance removal
Curved crown and collar
Scissors trim crown forms
Crown form tried on, should match
Original shape and size-
Compare to adjacent teeth
Crown form vented from inside with explorer tine
G Bond application
LIGHT CURED SELF-ETCHING ONE COMPONENT ADHESIVE
Apply G-BOND to the whole cavity and wait for **10 secs**.

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

Light Cure for **10 secs** by visible light irradiation.
Light cure at 600 milliwatts for 10 seconds
Crown filled with Gradia and Seated, excess removed with Composite instrument.

Pulse cured on buccal, lingual and incisal.
Cure 30 seconds per surface
Crown forms seated and light cured
Polishing disks, first reduce incisal
Polish corners
Rubber dam left on for polishing

96% success rate, 4% failure due to trauma
Rubber dam removed, composite Crowns on lower lateral incisors And upper central incisors
Recall - follow up
Case Two

Trauma needs urgent treatment
Case Two

Pre-operative view
Case Two

Disk does bevel without discomfort

Bevel fractured edges
Case Two

1-2mm bevel

1-2mm bevel
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!
Case Two

Etch all surfaces of enamel for 30 seconds

Etch dentin for a few seconds
Case Two

Apply two coats of adhesive resin!
Anterior Esthetics

Case Two

light cure at least 10 seconds
Case Two

Primed surface should not be air sensitive
Case

1. Roll ball of incisal or transluscent 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 in comparison

- **Polishability**

<table>
<thead>
<tr>
<th>Material</th>
<th>Polishability (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRADIA Posterior</td>
<td>0.4</td>
</tr>
<tr>
<td>GRADIA Anterior</td>
<td>0.3</td>
</tr>
<tr>
<td>A110</td>
<td>0.5</td>
</tr>
<tr>
<td>Heliomolar</td>
<td>0.6</td>
</tr>
<tr>
<td>Miris</td>
<td>0.7</td>
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<tr>
<td>Herculite XRV</td>
<td>0.8</td>
</tr>
<tr>
<td>EsthetX</td>
<td>0.9</td>
</tr>
<tr>
<td>PrismaTPH</td>
<td>1.0</td>
</tr>
<tr>
<td>Tetric Ceram</td>
<td>0.8</td>
</tr>
<tr>
<td>Supreme Trans</td>
<td>0.6</td>
</tr>
<tr>
<td>Supreme Body</td>
<td>0.4</td>
</tr>
<tr>
<td>Z 100</td>
<td>0.5</td>
</tr>
</tbody>
</table>

- Cured against a mylar strip
- Diamond bur, GC
- Silicone polisher, Compomaster, Shofu
- Soflex Superfine, 3M
GRADIA DIRECT - Outside special shades

• Shade range

ANTERIOR

NT
DT
WT
GT
CVT

POSTERIOR

P-NT
P-WT
GRADIA DIRECT

- Anterior and Posterior version

ANTERIOR

PREPOLYMERIZED FILLER

SILICA*

POSTERIOR

PREPOLYMERIZED FILLER

SILICA*

FAI – SILICATE GLASS*

* Mean particle size 0.85 µm
GRADIA DIRECT

• Composition (weight %)

ANTERIOR

- Monomer: 35%
- Silica: 38%
- Prepoly filler: 27%

POSTERIOR

- Monomer: 38%
- Silica: 23%
- Prepoly filler: 19%
- FAISiglass: 20%
Case Two

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

Light cure for 30 seconds
From buccal, lingual
And incisal
Case Two

Light cure for 30 seconds
From buccal, lingual
And incisal
Case Two

Remove crown form and polish with EC Moore’s disks, mainly incisal corners and gingival margins.
Case Two

32 flute carbide finishing bur, football shaped
Newest Real TV

WHO WANTS TO MARRY A HOBO

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

Anterior Esthetics

Finished Immediate Restoration
Case Two

Palatal view
Dental Diode Lasers: Research and Clinical Applications

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

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). In each animal, four teeth (one maxillary and one mandibular) were used. The teeth were 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 tissue. RESULTS: From 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 formecresol solution (12), or MTA (12). 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 teeth were treated with either saline or MTA (12). The pulpal bases were all covered with a RMGI (Fuji II LC). The tissue samples were collected at one day, one week, one week and over four weeks (34 days). RESULTS: Following histologic analysis, the tissue samples were scored for inflammatory cell infiltration, necrosis, and demineralization. The inflammatory 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 = 9.59; 3 degrees of freedom; P = 0.0223) than the other groups. 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

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 better tissue response, presenting a lower occurrence of inflammation and 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 effective than MTA in preventing inflammation and cellular infiltration into the pulp. These results suggest that tetrandrine may have value as a pulpotomy medicament.

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 Chi-squared test. Since laser-MTA-treated teeth and formocresol-ZOE failures exhibited focal ovoid or peripical radiolucency swellings or without pathologic root resorption. One of the laser-MTA failures displayed premature root resorption and is being observed for exfoliation. Analysis of radiographs post-extraction revealed the failure of clinical technique in addition to expected growth of root calcium 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

Decrease bacteria in primary molars
CO2 and diode lasers decrease bacteria

To cite this article: Hauser-Gerspach I, Stübing L, Köcher R, Rothermundt KS, von Arx T. Agar plate adherence of S. sanguinis and P. gingivalis: an in vitro study comparing zirconia to titanium. Clin. Oral Impl. Res. xx, 2010; 000-
Review of the Literature

Laser Studies

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 and radiographic parameters for either time period. All soft tissues remained attached and no abnormal 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 groups treated with the 60 J/cm² dose. Histologic results correlated well with radiographs. 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.
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.
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 minute application on cotton
- Kavo Gentleray Diode 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.

The tissue samples were collected at 4 weeks (28 days) via animal sacrifice. This was a No Loss study done in conjunction with the Northwestern Medical School Department of Surgery.

Northwestern Center for Advanced Surgical Education

The tissue samples were collected during animal sacrifice. The animals were given an overdose of general anesthesia after N-CASE procedures and the teeth removal. The teeth were then placed in 10% formalin for 48 hours. Decalcification was done by placing the tissue blocks into formic acid-sodium citrate solution.
Histology:

- The 36 samples were received by Northwestern University Department of Pathology for an independent histological evaluation utilizing Leitz Dialux 20 microscopes. The evaluators were unaware of the materials and technique utilized as all the samples were assigned identification by number only. The samples were evaluated at both 63X and 160X magnification.

- The histological analysis consisted of the following parameters: necrosis, hyperemia, quantity and quality of hard tissue bridging, presence of odontoblastic-like 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
Mild inflammation - Laser
Ranking for Inflammation:

Severe inflammation
Ferric sulfate and chlorhexidine
Ranking for Inflammation:

“Ferric sulfate” and “iron?” deposits
Results: Non-parametric Independent – Kruskall-Wallis Test

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Rank Sum</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser</td>
<td>12</td>
<td>136.5</td>
<td>11.38</td>
</tr>
<tr>
<td>Formo</td>
<td>12</td>
<td>235.0</td>
<td>19.58</td>
</tr>
<tr>
<td>Ferric</td>
<td>12</td>
<td>294.5</td>
<td>24.54</td>
</tr>
</tbody>
</table>

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 unexpected 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.
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.
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 apthous 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

As with all treatment modalities, the pulpotomy technique will progress through an unending state of evolution, with slow and inevitable improvement. Animal studies with more biologic medicaments, and pulp capping materials may provide significant advancements, provided that the results are replicated in large, well-designed and controlled clinical studies.
Effects of Alternative Pulpotomy Techniques on Swine Pulps
Mark Cannon DDS, John Z Thobaben DMD*, Cameron Wagner DMD*, Ray Jurado DDS
Northwestern University, Children’s Medical Center, Chicago USA

The Diode Laser Group demonstrated significantly better pulpal healing and less inflammation than the other two groups. The Ferric Sulfate Group also presented with “Black Granules”, apparently precipitates, from the Ferric Sulfate in the radicular pulpal tissues. The Formocresol Group had moderate inflammation consistent with previously published research.

Early Response of Mechanically Exposed Dental Pulps 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 pulp tissues. The preparations were performed under general anesthesia and the 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 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 (Fujifilm 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 pulpotomy 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
Laser Clinical Pulpotomy Technique

Pulpal Extirpation
Hemostasis
Debridement
Decontamination