

Dr. Martin Trope - Dental Traumatology Update

Portals of Exit are also potential portals of inflammation. If traumatic injuries occur and the internal aspect of the cementum/precementum layer is penetrated, this will result in bone and root resorption. True internal resorptive lesions are very rare.

Root resorption requires two factors:

- (1) Protective layer damage (cementum/precementum)
- (2) Inflammatory Stimulus

The injury results in 2 phases

1. Destructive phase – Inflammatory Root Resorption and
2. Healing Phase – (can be favorable or unfavorable)

Trope believes that all destructive (lucent) root resorptions of dental origin are inflammatory root resorption. (This differs from Andreasen's more specific classic definition). This resorption is reversible. The first 24 hours are the most critical. All our efforts need to be focused on: (1) minimize inflammation (2) minimize acute inflammatory byproducts

Why is no resorption associated with SRCT resection? Trope believes there is a race between bone and inflammation. If sufficient bone is removed from around the resection, the bone is "distanced" from the resected root and there is less inflammatory stimulus- better healing without resorption. With bonded technology, in future we may be placing "dome type" retrofills that cover the entire resected surface as well as the canal prep.

When examining films for resorption we need to check both the lateral bone and the tooth for radiolucency. If both are present - this is a true inflammatory lesion.

Trauma – If necessary, a splint should be placed for no more than 7-10 days. (Longer splinting times can actually be detrimental to healing)

Horizontal Root Fractures- the most important this is to get the fragments as close to each other as possible. Many don't require endo treatment. If the Coronal portion goes non-vital – attempt to treat ONLY the coronal half. Do not attempt to "unite" by treating the apical section, it is probably vital and does not require treatment.

Intrusive injuries result in the most destructive forces on the PDL other than avulsion.

When to treat and when not to treat:

If recent injury with no signs of pulpal injury – wait and watch. Be careful with pulp tests – negative or false readings are common with traumatized teeth. If after 3 months the tooth is still not responsive, it probably needs endo. Sometimes after trauma apical radiolucencies (ie/ PDL thickening) can resolve and these teeth do not always require endo.

Cases that result in obliterated chambers will often turn yellow – these DO NOT need treatment unless they are aesthetically objectionable.

Osseous Replacement – A situation in which root is replaced by bone (no radiolucency) In that case we should remove the GP from the treated area and attempt to submerge the root. The tooth is hopeless and the emphasis should be on maintaining the root as a matrix for bone in the alveolus – we must get rid of the Cemento-enamel junction that is the stimulus for resorption.

Trope believes we must be much more aggressive at the time of emergency treatment. We must direct our attention to the cut down the factors that result in destructive phases.

Mouthguards – The literature hasn't shown conclusive proof that they work and that different types don't seem to matter. The best protection is offered by full-face helmet masks/cages.

Osseous Replacement Treatment

- (1) (1) Prevention (80% of these injuries occur within 100 m. of home or school. Most often it is maxillary central/lateral or mandibular incisors) Schools, homes, gyms should have a storage medium available.
- (2) (2) Limit additional damage (minimize dry time and have storage medium available)
- (3) (3) Limit initial inflammatory resorption response (drugs)
- (4) (4) Stimulate Cemental healing

In the case of intrusive injury– we should REMOVE THE PDL BEFORE REPLANTING.

Storage in water results in disruption and hydrolysis of the cells of the PDL and is only slightly better than dry storage. It is NOT a good method of storage.

Self-cleaning and education is more important than rigid splinting.

Emergency treatment: Adjunctive therapy:

1. Tetracycline (short term) – This Ab has anti-resorptive properties! It is 3x better than amoxicillin as an anti-resorptive agent and has the same antibacterial effect. Give 10-day supply. Although it has been shown to stain teeth, at the age of most injuries (8-10 years old) the only teeth that would be affected would be the 2nd or 3rd molars. (Not an aesthetic concern.)

In cases of severe injury – perform preventive endo on Day 0 and place Ledermix (Triamcinolone and Dexamethasone paste) (Recent dog studies showed significantly better healing than CaOH) It needs to be placed immediately (Day 0) for its anti-inflammatory effects.

2-hour avulsion/dry tooth

You will get osseous replacement- guaranteed. We need to try to slow the process.

Remove PDL completely. (It is mostly dead anyway) Acid etch the root surface for a few minutes with regular acid etch solution. You can also use NaOCL but it must be rinsed away. Then apply Emdogain enamel matrix protein to root surface. We will NOT reform the PDL but this treatment significantly slows the osseous replacement. At that point it is a cost/benefit decision. We need to think in terms of 5-year survival rather than lifetime.

In the case of the 40-minute avulsion – DO NOT use acid – Use Emdogain after washing the PDL.

Trauma Guidelines:

1. Evaluate the Trauma
2. Replace in socket
3. Limit the inflammation (by sometimes removing the remnant PDL if the tooth has been out of the mouth for a long time or is dry)
4. Splint 7-10 days if necessary
5. Tetracycline and NSAIDs for 10 days
6. Chlorhexidine rinses to keep area clean.

Now it is time to evaluate the pulp

In the case of intrusive severe luxation or a mature luxated tooth- after 7-10 days – NSRCT. We are treating a necrotic but NOT INFECTED pulp.

CaOH use

Place CaOH for 3 mo. if no lucency is present. If lucency is present – place for 3 months and wait for lucency to resolve. CaOH may be lost from canal space during that time but apex should

show bone growth and lucency should resolve. If it does – you can fill. This may take between 3-18 months. Each case is different.

External/Internal resorptive defects

Injury + Inflammatory stimulus -> Sulcular Infection

1. Cervical resorption
2. Invasive Cervical resorption
3. Extra canal Invasive resorption
4. Sub epithelial External Inflammatory resorption

Odontoblastic/predentin layer is still intact. Trope believes that Int./Ext root resorption is a “man made” phenomenon. ie/When internal resorption occurs – it works its way to cementum and rarely perforates – ie/ protected by precementum. When Ext. Resorption occurs, it works its way to predentin and rarely perforates the pulp.

The challenge is in the diagnosis ie/ Ext. root resorption is often radiographically misdiagnosed as Internal root resorption. True Internal resorptive lesions are rare.

Predisposing factors: Ortho, Trauma, intracoronal bleaching, Surgery, Intracoronal restorations, Idiopathic factors – the multitude of factors means that we really don't know why this happens. You need damage just below the attachment for this to occur.

Treatment Strategies: Depends on the direction of the resorption:

1. 1. If coronal– easier to treat
2. 2. If apical migration – can be a “nightmare” to treat.

Trope showed Heithersay's classification and said that CI 1&2 – treatable. For CI 3&4 Trope is treating with intentional replantation or leaving them alone (less than 10% success!)

True Internal resorption – the blood supply to resorptive tissue is the problem. Etiology is unknown – You need predentin damage and pulpal inflammation. Most occur on teeth that are heavily restored. Factors include Chemical and thermal factors during tooth preparation. (Turbines used in the early 60s w/o water) Problem is easily treated with conventional endodontic treatment using thermoplastic techniques.

Differential diagnosis of Root Resorption

Osseous Replacement – Ankylosis

1. Need Severe injury
2. Pulp usually non-vital
3. Metallic Percussion sound
4. Infraocclusion
5. Moth eaten appearance on X ray
6. NO adjacent bone resorption – no lucency of adjacent bone (as opposed to lucency of bone with active inflammatory resorption)

Ext. Inflammatory resorption related to Pulp Infection

- (1) (1) Severe injury – severed blood vessels
- (2) (2) Pulp definitely non-vital (If in doubt – wait)
- (3) (3) Radiolucency of root AND bone

Most internal ext. resorption is misdiagnosed ext. resorption. The best method of diagnosis is by radiographic means. If external – the lesion will “move” with angled x rays. Internal resorption doesn't “move”. Also if it is External root resorption – the outline of the pulp space can frequently be seen as an intact radio-opaque layer outlining the canal space. Multiple films need always be

taken. Adjacent bone loss is also a clue to determine whether external inflammatory factors are involved. Pink spots at the cervical area – mean nothing. It means that enamel is undermined by tissue – it can be caused either int. or ext. resorption.

If the case is strictly internal resorption – the canal can be dried by removing the pulp tissue. In many cases of external resorption– the canal will need to be treated BUT the external granulomatous tissue makes it difficult to dry the canal. This case cannot be treated by merely doing the endo – the external extra-canal factors must be dealt with if the resorption will continue. In rare cases, the pulp can be preserved and the tooth restored without endo.

END PART 1

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Peter Cancellier – The Ultrasonic Tip Parade

Peter's a firm believer in scope use. Ultrasonic instrumentation minimizes overextension of the access cavity that can be caused by use of burs. Ultrasonic tips allow for more accurate dentin removal and better visualization when combined with a scope.

Ultradent Seek Canal/Caries indicator is a good for locating canals
Bubble (NaOCl) Test used to ascertain whether an additional canal/tissue is present. If NaOCl bubbles after a canal has been prepared, chances are there is another canal present.
Peter prefers that assistant have her own scope ocular.
Recommends EIE mirrors for photography

Peter's study compared the efficiency of Sybron's MiniEndo, Satelec P5 and Spartan MTS-1 units when combined with a variety of manufacturer's tips.

Each tip was applied to root dentin in 10 x 1 second passes with different power levels. The dentin cuts were photographed with a Nikon 950 and MPEG2 videos were made with a Sony Mini video camera. Scores were given from 0 (tip fractured) to 4 (deep smooth cut). Peter gave us a work sheet that published the results indicating the tip brand and the unit it worked best with. New tips were NOT used with each unit.

Always use a wrench to tighten the tip. Peter suggests that you have your equipment service person hook up multiple devices in your cart/delivery system so that ONE foot pedal controls whatever device you select.

Peter suggests that water is important to preserve tip life. Rather than have the unit deliver the water, he has his assistant spray the field as necessary.

According to Dr. Cancellier, Tulsa bought out the company that had manufactured Spartan's Ultrasonic tips (the same company that manufactured Gary Carr's original tips) So they had to change the name because the CPR name was owned by Spartan. That is why Tulsa's tips are now known as the "ProUltra" line.

Troughing and Post Removal

For Finding 4th Canal

- Ø EIE Ball, CKT series, Sybron CT4 Tulsa ProUltra 2,3 Spartan CPR 2,3 Spartan Buc 1,2,2a, 3

Diamond coating on the instruments now allows for side and end cutting (axial walls)

Post Removal

- Ø EIE2 Ball and Pear, Sybron CT4 Tulsa ProUltra 1,2,3 Spartan CPR 1,2,3 Spartan Buc 1,2,2a, 3

Recommends Ruddle PRS and Gonon systems

Peter showed a case where excessive heat was generated by attempting to remove the post with 5 minutes of vibration. The bone sloughed and the tooth was lost. He suggests intermittent rather than continuous use. Ultrasonic use of as little as 10 continuous seconds can cause excessive heat. Water must be used constantly. Be careful with lower premolars, as they are most susceptible to the heat/sloughing problem.

EIE2 Ball Diamond

- Ø Rounded tip eliminates clefts and ditches in the pulp chamber floor. Cutting and refinement of line angles, smoothing access walls, cutting MB toughs

EIE2 CKT 1,2,3 (CKT1 = .30 mm dia. CKT2 = .40 mm CKT3 = .50/.60 mm dia.)

- Ø Smooth, clean flat troughing groove that facilitates canal location
- Ø Good for removing coronal obstructions, restorative materials, cements, posts etc. Can be used to remove caries or refine prep margins

NONE OF THESE TIPS BROKE DURING TESTING. EIE2 also has their own new TDO NSK Ultrasonic unit/

Obtura Spartan BUC1

At higher settings with the P5 you get more horizontal movement of the tip (waggle!)

Obtura Spartan Buc2 - the Planer (wide)

Cancellier didn't like it as much. At higher levels you need to use water to prevent tooth fracture.

Obtura Spartan Buc2a smaller version of #2- the Planer (wide -) similar to results with Buc 2

Obtura Spartan Buc 3 - the Digger

Very active tip, good for cutting apically into small canals, troughing around posts, water port built into shaft.

Spartan CPR tips have water ports; Tulsa ProUltra tips don't have them.

Spartan CPR2

- Ø For calcified canals, pulp stones, pulp chamber and isthmus tissue removal
- Ø Trepine around obstructions
- Ø Medium to high setting
- Ø 17 mm length

ProUltra 2 (looks similar to CPR2)

- Ø Scores slightly better than the CPR2

Sybron Slim Jim 4S

- Ø Tip broke in Satelec P5 and Sybron Mini-Endo but not in Spartan MTS-1

Sybron UTS4

- Ø Tip broke in all machines

Deep Troughing and Obstruction Removal

Remember that power settings are very important in getting efficiency and extending tip life

Obtura Spartan CPR4D

Tulsa ProUltra 4 - don't turn it up too high - it will break

Sybron MiniEndo Machine cuts very strongly; you may need to select tips that work at lower power settings. One manufacturer's tip may work better in a rival's machine.

EIE2 SP1 – a very skinny tip (spreader) but don't use at high settings EIE SP2 is smaller than SP2. (Sybron's SP2 is actually bigger than their SP1S ! Confusing nomenclature!)

Sybron SP3S – Cancellier suggests that creating a tracking groove is essential for doing retropreps with this bur and may benefit intracanal and pulpal floor preparations. The MiniEndo produced and deep and cut but wider. You do NOT want to use an SP3S in a P5 – high risk of breakage.

Tulsa ProUltra Titanium 6-8

ProUltra 7 –

- Ø The longer the tip the less control of the movement
- Ø If the tips wiggles and deforms. STOP
- Ø To determine power level, test longer tips on the pulpal floor before entering the canal
- Ø The walls of the canal DO NOT help confine the movement of the ends of the longer tips.

CPR 7 Titanium vs. ProUltra 7 Titanium - Spartan unit worked best with the CPR7/Pro Ultra 7

Ultrasonic Rules

- (1) (1) Use the shortest tip possible to reach the desired depth Otherwise: Breakage
- (2) (2) Have contact of the tip to tooth structure before activating the ultrasonic unit
- (3) (3) Use water whenever possible: Prolongs tip life, prevents blocking of orifice with dentin, prevents overheating of the tooth

Spartan	MiniEndo	Satelec P5
Buc 3	Buc 1	Buc 2
CPR2D	Buc 2a	Sybron SP3S
Sybron SJ4 Sybron SP1S	ProUltra 2	ProUltra 2 CPR2D
ProUltra 4	CPR4D	EIE2 Ball EIE2SJ4
ProUltra 7 CPR7		EIE2 SP1 EIE2 CT4

Findings/Generalizations

- Ø Controlled power needed with longer tips
- Ø Ideally, have all 3 units available
- Ø The longer the tip, the more movement at its end
- Ø If a tip end wiggles to the side, reduce power immediately
- Ø To determine best power level, test tips on the pulpal floor before entering the canal
- Ø Tips do not necessarily go best with the tip manufacturer's recommended ultrasonic unit
- Ø Overpowering a tip makes it:
 - ○ Do less work
 - ○ Take more time
 - ○ Overheat the tooth
 - ○ Fracture
- Ø Research has shown that there is no linear increase in tip displacement amplitude with increasing generator power setting. There can also be considerable variability in power output between different units manufactured by the same manufacturer. (Tomson et al 2003)

END PART 2

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Gilberto Dibelian - RaCe Instrumentation and Resilon

Dr. Dibelian went through a detailed description of the Brasseler RaCe system. I'm sure that many of us are familiar with it and I will skip to the Resilon section.

Resilon - Why did he change?

Debelian believed that this is a promising material.

Debelian reviewed the function of an endodontic filling material:

(1) Entomb existing bacteria not removed during cleaning

He quoted the results of the classic studies of Success by Culturing Engstrom 64, Zeldkow 63, Oliet & Sorin 69 Bystrom 87 and Sjogren 97. (Increased success with negative cultures at time of fill.)

(2) Prevent Coronal and Apical leakage

Quoted results of leakage studies, Swanson 87, Torabinejad 90, Khayat 93 and Trope et al 94 (All leaked to apex)

Do we get success because of or in spite of Gutta Percha? (Success studies : Tronstad 2000, Ray 1995)

(3) Strengthen the Root

What followed was basic review of the Resilon system as has been previously shown to us by Martin Trope. Please see my lecture notes of the April 2004 Schilder Symposium for a description of the properties of this material as described by Dr. Trope. He quoted Schipper's 2004 (as yet unpublished) research on dogs that showed when root filled teeth were directly challenged with bacteria placed in the access, there was a dramatic decrease in periapical inflammation when Resilon was used vs. GP/AH26.

Debelian creates an "Apical Box". His shapes are quite parallel and he uses lateral condensation. He apparently is not concerned about patency. Many lecturers like to show mostly non-vital cases that have many lateral canals and dramatic 6 month healing of LEOs. I must admit to some concern about the lack of demonstrable "anatomy" in Gilberto's cases. Very few of his cases showed canal fills in accessory or lateral areas. This may have been a reflection of the high numbers of vital cases that he showed, or it could be the result of the lack of hydraulics that occurs when using lateral condensation or the lack of irrigation due to the parallel shapes. In any case, although his results seem good, it is my opinion that the shapes are too conservative and I certainly do not agree with the lack of canal patency.

Cornelius H. Pameijer

Adhesives in Vital Pulp Capping and Resin Based Sealers

A "behind the scenes look at the research"

Pameijer and Stanley The disastrous effects of the "Total Etch" technique in vital pulp capping in primates. J. Dent 11:845-854 1998.

The question is: What do you do when you have a vital exposure?

The pulp is able to respond to irradiation with a typical inflammatory response. Dilated arteries at the apex do not compress the veins resulting in pulpal strangulation. (as has been speculated in the past).

If RDT (Remaining Dentin Thickness) is greater than 1 mm, the composition of the materials is less relevant. At RDT of .5 mm the chemical composition is important. The shorter the RDT the less the buffering capacity of the fluids in the dentinal tubules.

Pameijer says (Calxyl formula introduced in the 1930s) CaOH is a good material when used in very small appropriate amounts. Initial formulas of this were PH12 and caused pulp mummification. Later and current formulas of Dycal now have a PH of 9-11.

Dycal Formula - Catalyst - CaOH 53% Ethyltoluenesulfonamide 36% ZnO 9.7% Zn Stearate.3%

Base - Titanium Dioxide 42 %, 1,3 Butylene glycol disalicylate 41 % , Ca Tungstate 19% Ca Tinting agent .4%

A Secondary dentin bridge is formed against the mummified layer produced by the high PH. The initial 12 PH was reduced to 9-11 in order to minimize this mummification layer and maximize healthy pulp.

Early studies with a visible light cured material (Prisma VLC Dycal) were successful but shelf life was terrible and after 3-4 months it turned to spaghetti. It was removed from sale and replaced Ultrablend and Ultrablend plus which is stable up to two years.

Kanca's famous "Replacement of a fractured incisor fragment over pulpal exposure: a case report (Quintessence Int 1993 24:81-84) then caused a sensation. Everyone began to etch pulps because of this one report. Stanley reacted to this by publishing the article "Trashing the Dental Literature- Misleading the General Practitioners: A Point of View J Dent Res 1996; 75:1624-1626 (which Dr. Pameijer recommends that we read) The article reviewed the literature and outrageous claims and found that while this method began to be embraced wholeheartedly, he could find only 27 references that studied a total of 25 human teeth. The research was simply not credible.

Because of the popularity if the technique, manufacturers exerted pressure on research and Pameijer decided to look at this in a proper way.

The premise of the total etch technique: Bonding agents adequately seal the exposure so no inflammatory response can occur due to bacterial invasion. Therefore the technique depended entirely on preventing microleakage.

Questions that needed to be asked:

1. How long will the seal last?
2. What if the bonding agent hydrolyzes?
3. How effective is the bond when the exposure is surrounded by demineralized dentin?
4. How good is the bond to infected dentin around the exposure?
5. Does the material composition have an effect?

Pameijer animal research

Objective: To determine whether the "Total Etch" technique in pulp capping is a viable clinical procedure.

1. The pulps needed to remain vital over the three periods of observation 5,25 and 79-75 days (an ADA standard measurement system)
2. After 25 days a thin bridge (preferably complete) and after 75 days a complete bridge should be present.

Pameijer used Baboons for study

Method: Prepare CI V prep/exposure with #331 bur high speed with water. Pameijer says that only 5% of restorative dentists (worldwide) would restore lesions like this with rubber dam. Therefore contamination of the exposure was done by saliva soaked cotton pellet applied to the exposed site. 2% Chlorhexidine (Consepsis) was then applied to the area for 30 sec. 35% Phosphoric acid gel was applied to the dentin around the exposure for the purpose of establishing a hybrid layer to which the bonding layer is applied. A second 60 sec application of Consepsis was followed by air drying and application of dentin bonding primers and the restoration for 5 experimental groups:

He used 5 experimental sets: All Bond 2 (Bisco) Probond (Caulk) Permagen A&B (Ultradent) Ultrablend CaOH (Ultradent) and Dycal (CaOH) (Caulk)

Two controls were also used (no bonding): Dycal (Control) and Ultrablend CaOH (Control) (Controls had same etch protocol but tooth was etched and restored AFTER CaOH was placed over the exposure. The CaOH was protected from the etch by a thin layer of polycarboxylate cement.)

All materials used according to manufacturer recommendations.

Results: (Combined 25 day and 75 day results)

1. All Bond 2 - (13 teeth total) - 5 teeth non vital - 5 teeth with no attempt of bridge in remaining vital space - (ie/ could go either way-) Total Bridges - 0
2. Probond -(14 teeth total) 4 teeth nonvital - 8 teeth with no attempt of bridge in remaining vital space (ie/ could go either way-), 2 teeth with bridge formed
3. PermaGen - (13 teeth total) - 9 teeth non vital -- 2 teeth with no attempt of bridge in remaining vital space- 1 tooth with bridge formation
4. Ultrablend --(14 teeth total) - 5 of 7 teeth non vital -- 2 teeth with no attempt of bridge in remaining vital space- 7 c (50% success)
5. Dycal --- (14 teeth total)- 1 tooth non vital -- 1 teeth with no attempt of bridge in remaining vital space- 12 teeth with bridge formation (86% success)
6. CONTROL - Dycal - 0 nonvital teeth 1 teeth with no attempt of bridge in remaining vital space, 13 teeth with bridge formation
7. CONTROL - Ultrablend - 1 nonvital teeth 1 teeth with no attempt of bridge in remaining vital space, 12 teeth with bridge formation

Summary Total Etch Technique experiment results (25 day and 75 day results combined)

1. Of 68 total teeth in the Total Etch experiment -> 24 teeth (36%) went Non-Vital and 22 (35%) formed bridges. (The remaining were in the "uncertain" category.)
2. Of 40 teeth in the 3 Dentin bonding Total Etch systems 45 % became non-vital with 25% forming bridges
3. Of 28 teeth in the CaOH +Total Etch system - 21% became non-vital with 67% forming bridges
4. Of the 28 Control Teeth (No Etch) 3% became non-vital while 89% formed bridges

Conclusion

1. At 75 days the two control groups produced 85% bridge formation (Ultrablend) and 92% bridge formation (Dycal).
2. At 75 days the 3 bonding systems combined produced 25% bridge formation, 45% had necrotic pulps
3. In spite of newer trends the use of CaOH gives the practitioner a reasonable chance of maintaining pulp vitality and the formation of a bridge. (9 of 10 cases can be successful)

Pameijer suggests the following treatment protocol for treating pulp exposures:

1. After exposure, rinse and dry
2. Apply Consepis for 60 sec. Or more
3. Dry Consepis, rinsing is optional
4. Apply a SMALL AMOUNT of CaOH to exposure - use a minimal amount
5. If base is necessary, use light cured GI
6. Etch with 35% PAG, rinse and dry
7. Restore with dentin bonding system/composite resin of your choice

Why use CaOH for this?

1. Bacteriostatic properties when used in s PROPERLY SEALED environment
2. PH =approx. 9. Basic properties have stimulating effect on pulp.
3. Produces the most predictable outcome of all materials available
4. Light cured versions are insoluble in acids and CAN be used in adhesive dentistry

Pameijer says that study of Human pulp response to direct pulp capping performed by Pereira et al (Am Dent J 2000:13; 139) used dry CaOH powder that, when mixed with serum, produces a higher PH than his animal study protocol. Even still, they had 80% bridge formation.

He has tested many different substances using the Baboon models- Epi pellets, Benzalkonium Chloride 10%, Ca Lactate 10,20,30%, BaOH 19%, Total Etch with 5.25% NaOCL (which he recommends), MgOH 10%, Glass Ionomers.

When Ultrablend was used on CONTAMINATED pulps, most teeth became non-vital - NOT because of microleakage, but because the initial bacterial insult was too great. Pameijer is currently working on a PERFECT haemostatic agent followed by total etch with PQ1, study in progress.

Modified Bioglass (using smaller than normal glass particles) - Results showed incorporation of glass particles into dentin bridge but the material is not light cure and must be applied in a "sandy mix". It is difficult to work with. Clark, Pameijer et al (J Dent Res IADR Issue 78 Abs #910, 1999) and Am J Dent 2001 14;227-232

MTA - Very successful as a pulp capping material. But hard to sell to restorative dentists because it is not user friendly. He admits that his experiments (clean CI V exposures in Baboons with a nice "well" for the repair material) don't represent the average exposure in clinical practice. Serum from pulp mixes with MTA and is then covered by composite.

A New Light cured MTA is being developed -It has tested well in primates. You heard it here first! (Editor's note: Now THAT would be an AWESOME material - MTA that could be cured with light! Instant perf repairs, retros, apexifications! No waiting for next appt. to check for proper set!! Cool!)

Pameijer's Human studies (U of Md. Balt.) MTA vs. Dycal

48 patients - 24 with Dycal Advanced and 24 with MTA.

Preop Xrays, hot.cold and EPT tests. 3rd molar exposures

2% Chlorhexidine rinse

1-week post op telephone interview

Pre extraction post op X-rays, hot. Cold and EPT tests

Extraction after about 3 mos.

Histological examination

Results: MTA performed better than Dycal. Bridge formation more regular.

Pameijer says we should ask 7 questions when listening to a speaker:

1. How many cases have you done/
2. How many years have you used the technique?
3. Who are some other researchers/clinicians that have used the technique?
4. Assess their credibility?
5. Has research been done on your technique?
6. Are there publications on the subject?
7. Are there animal experiments confirming the technique?"

Dr. Pameijer closed this part of his presentation with this paragraph:

“For the benefit and the well being of the patient and with the objective to provide optimum patient care we have to do the science first before making recommendations based on limited or anecdotal clinical observations.” (CH Pameijer 2000)

During the question and answer period after this section, Pameijer made clear that this method was reserved for mechanical exposures and that all carious exposures go directly to conventional endodontic treatment immediately (with the exception of those cases with an immature apex.)

Biocompatibility and/or Efficacy testing of Endodontic Root Canal Sealers

Required tests for manufacturers:

Ø In Vitro toxicity tests

Ø Leakage tests (Pameijer uses electrochemical leakage tests designed by Tony von Fraunhofer. Leakage values are based on magnitude of current. Tests are Continuous, Reproducible, Non-destructive, and Quantitative.) They give him an idea of how good the system is before conducting other tests.

Ø Subhuman primate trials - This is where we begin to evaluate potential tissue responses to Root Canal Treatment

Ø Clinical trials in humans

ADA test specifications for root canal sealers are very vague. Ie/ tests are usually done in a “clean” environment (vital teeth). Pameijer wanted to also test sealers in an infected environment. He opened a primate tooth, extirpated pulp, etched the tooth and left it open for a month to generate a periapical area.

He then used standard tx protocol - Rubber dam, surface disinfectant, WL, C&S with Protapers/Profiles, 5.25 % NaOC/EDTA/2%CHX

Histological Parameters examined:

Root fill location (short/long) Cement extruded? Necrotic tissue at apex? Adaptation of material? Inflammation (0-4 degrees A/C/M) hyperemia, Root resorption? Bone reaction? Ligament hyperemia? Marrow fibrosis? Bone marrow inflammation?

Baboons canals are difficult to work on and hard to get films with. Clinical films are compared with the parameters above and presented in table/chart form. Good endo goes down in inflammatory response (in degrees) with time. Histology is then compared with this charted data. Dr. Pameijer showed several slides of degrees of inflammation associated with different filling positions, extruded material, flush fills, short fills etc.

SEM studies were performed using:

1. Dry
2. Moist and
3. Wet Dentin

For example, Pameijer’s studies showed that primer should NOT be used with Ultradent’s Endorez because the Endorez’s hydrophilicity has such potential to penetrate tubules that it contraindicated the use of a bonding agent and that adaptation was less when it was used. This differs from Resilon where it has a self-etching primer. With all these bonding agents - you MUST have moist dentin - Not wet and not dry - moist!

Do final flush - put paper point in canal quickly - do not remove all moisture. Alcohol drying ADVERSELY affects the bond with RESILON.

His conclusion: “Irrespective of in vitro and in vivo tests that are done to test a new material prior to marketing, success is ultimately determined by the practitioner once the material has been marketed.”

Clinical and radiographical evaluation of a resin based root canal sealer. Zmener and Pameijer

(Am J Dent 2004 17:19-22) His studies in this area are currently sitting at 24 months. Dr. Pameijer emphasized that much longer time periods of 5-6 years need to be studied before we can assess whether these materials are successful.

End part 3

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