Delta Dental of Oklahoma is committed to providing affordable dental care to the 1.5 million Oklahomans who have no access to employer-sponsored benefits!

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With YOUR participation and OUR non-profit business model, we can join together to provide an affordable, insurance free program that offers virtually every Oklahoman vital access to quality dental care.

Questions about enrolling in our Patient Direct(TM) network? Please contact Terri Green with our Professional Relations Department at 405-607-2142 (within the OKC metro) or 800-522-0188, ext 142 (toll free).

Patient Direct™ from Delta Dental of Oklahoma: It’s a whole new way to look at dental!
SNAPSHOTS

The very first outlined strategy under the Access to Care objective included in the ODA Strategic Plan is to “Conduct CE courses and publish articles on the topic of restorative dentistry for pediatric patients”. Your Editorial Board answered that call and is proud to present this special issue of the ODA Journal, focused on pediatric dentistry and designed to give us all a refresher on this very important patient population. Of particular interest, is the DVD of 1.5 hrs of CE included with your Journal if you are an ODA member, as a benefit of your membership. Non-ODA members can take the CE course online at www.okda.org. A heartfelt “thanks” to Dr. Kevin Haney from the OU College of Dentistry for his time and expertise! We hope you enjoy and greatly benefit from this special issue!

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EDITOR’S MESSAGE
Raymond Cohlmia, DDS

I have seen the future, and the future is now. I am not sure who said those words, but indeed, the future is now. This issue of our ODA Journal approaches a turning point in our rich history of advances for our membership and readers. From our last issue, the history-rich ODA Commemorative Centennial Journal (which we hope you enjoyed!), we now follow with the introduction of our latest ODA membership benefit, our DVD Continuing Educational Series!

Enclosed, you will find a DVD which contains the very first of our Continuing Education Series. Our strategic goal is to produce one per year for the first two years and then two per year thereafter. This video production is about 1 1/2 hours long and features Dr. Kevin Haney of the Department of Pediatric Dentistry at our own University of Oklahoma College of Dentistry. Dr. Haney has been with OUCOD for many years and has become a key player in the pediatric dentistry arena across the nation. We owe our undying thanks to him for his contribution in making this video; without him, it simply would not have been possible working under our budget and time constraints. We also thank the College of Dentistry for interrupting their academically-filled schedule to allow us to film this production. As an aside, if you haven’t seen our dental school lately, it would be well worth a trip to see all the recent additions, improvements, and changes that have been made or are in the works now. Even for those that graduated as few as five or six years ago, you too would be amazed at the remarkable things that have happened since then. So stop by, get a tour, and be proud of one of the finest dental institutions in the nation.

Now back to the issue at hand, this particular educational video contains two sections about pedo treatment in your practice: an informative refresher course and an initiative to expand the services currently offered to your patients. We certainly hope that you benefit from our first in this series.

As with all new programs, there will be questions, comments, and requests; we truly want to hear them! The ODA Journal staff and editorial board work hard to meet your needs and hopefully along the way, introduce you to some new information, ways of communication, and educational pathways that don’t necessarily travel down that “old traditional path.”

This program, along with others that will be produced, is also scheduled to be placed on our website to allow for wider access to others. Our goal is to create a source of practice knowledge available on our website, complete with index data for you to retrieve this information in the easiest way possible. How many times have you read a journal or continuing education section of a publication and wanted to refer back to it for a refresher? Then you try to find which of the 30-40 journals now on your desk it was in. (As I write this, I count over 50 journals on my desk. As if I am going to be able to locate the one that had a particular feature I just thought of!). The bottom line; if it’s on the website complete with indexing, you’ll be able to throw away those journals and find what you need in just a few minutes. Welcome to the age of information retrieval! Here at the Oklahoma Dental Association, we’re excited, even eager, about the future and hope that you are as well.

One hundred years ago, in 1907, master plates and stamp printing presses created journals one at a time, usually overseen by a “master printer”. Information was present but not readily accessible to practitioners across the state (let alone across the nation). That was their “new” world. Now it’s 2007, and information within the state, and around the world, is readily accessible with the touch of a button. One hundred years later, it’s OUR “new” world.
OCTOBER

OCT 1-2 – ADA Annual Session - San Francisco

OCT 5 – ODF Mobile Dental Unit - Jackson Middle School - Okla. City

OCT 9 – TCDS Evening Meeting - 5:30 PM - Renaissance Hotel

OCT 9 – OCDS Board Meeting - 6:00 PM - ODA

OCT 10 – Children’s Oral Health Coalition Meeting - 10:00 AM - ODA

OCT 11 – OCDS Spouse Night

OCT 12 – ODF Mobile Dental Unit - Iowa Tribe - Perkins

OCT 12 – NW District Meeting - 8:30 AM - Ponca City Country Club

OCT 15 – Retired Dentists’ Luncheon - 11:30 AM - ODA

OCT 17 – OUCOD Faculty Appreciation Lunch - 12:00 PM - OUCOD Rm. 540

OCT 19 – ODF Mobile Dental Unit - Durant Public Schools

OCT 19 – ODA Journal Editorial Board Meeting - 8:00 AM - ODA

OCT 20 – ODF Mobile Dental Unit - Serve One Another Community Clinic - Ada

OCT 25 – TCDS New Dentist Party

OCT 26 – ODA Risk Management Seminar - 8:30 AM - Tulsa - DoubleTree Warren Place

NOVEMBER

NOV 2 – TCDS All Day CF - Renaissance Hotel

NOV 2 – ODA Board of Trustees Meeting “Mega Discussion” - 10:00 AM - ODA

NOV 2 – ODA CORD Caucus - 12:30 PM - ODA

NOV 2 – ODA Board of Trustees Meeting - 1:30 PM - ODA

NOV 4 – TCDS Dental Family Day Festival

NOV 8 – OCDS General Assembly - 5:30 PM - Homebuilders

NOV 9 – OCDS CE with Dr. Dan Fisher - 8:30 AM - Homebuilders

NOV 9 – ODF Mobile Dental Unit - Muskogee Head Start

NOV 13 – TCDS Evening Meeting - 5:30 PM - Renaissance Hotel

NOV 14 – Children’s Oral Health Coalition Meeting - 10:00 AM - ODA

NOV 16 – ODF Mobile Dental Unit - Atoka Public Schools

NOV 16 – ODA Council on Membership and Member Services - 10:00 AM - ODA

NOV 16 – ODA Annual Meeting Planning Committee - 1:00 PM - ODA

NOV 19 – Retired Dentists’ Luncheon - 11:30 AM - ODA

NOV 22-23 – ODA Offices Closed for Thanksgiving
Oklahoma Dentists Now Eligible for Disaster Relief Funds

The Federal Emergency Management Agency (www.fema.gov) has officially announced the authorization to release federal disaster funds to help meet the recovery needs of residents/businesses in Oklahoma following the recent severe storms and flooding.

As part of the ADA Foundation’s Charitable Assistance Programs, the Foundation provides the following:

- grants up to $2,500 to dental professionals who have been affected by disasters to assist with personal immediate needs; and
- grants (no specified amount) to organizations which can provide dental services to affected areas.

To receive an application, please contact Nicole Smith at the ODA at 405-848-8873; or by email at nsmith@okda.org. Additional information including the Rules for each program can be found at http://adafoundation.org/ada/prod/adaf/prog_charitable_disaster.asp.

If you have any questions, please feel free to contact Rose Famularo at the ADA Foundation at 312-440-2763; or by e-mail at famularor@ada.org.

Interested in paying your 2008 dues in installments?

Approximately ¼ of our members pay their dues each year in installment payments. Installment payers begin paying their dues now, paying equal payments monthly, and making their final payment in December [please note that the final payment will include any increase in your 2008 ODA/ADA/Component dues]. Installment dues payments can be made by either check or credit card. For more information, or to arrange to pay your 2008 dues in installments, please contact Norma Kesting at the ODA at 405.848.8873; or by email at nkesting@okda.org.

ODA News You Can Use!

This month’s spotlight on your ODA’s endorsed company

DHL Express

As an ODA / ADA Member, you’re entitled to special pricing for DHL’s full suite of domestic and international shipping services, covering over 220 countries and territories around the globe. DHL offers member-only discounts on shipping services of up to 25% on:

- DHL Next Day (delivery by 10:30 a.m.);
- DHL Next Day (delivery by 12:00 p.m.);
- DHL Next Day (delivery by 3:00 p.m.);
- DHL 2nd Day;
- DHL Ground;
- DHL@Home;
- DHL.ShipReady; and

DHL also offers web-based tools to automate your shipping process.

To find out more about the DHL benefits, set up an account, or ask questions regarding your current account, contact the dedicated hotline at 1-800-MEMBERS (1-800-636-2377, 8am-7pm, ET); or log onto www.1800members.com/ada.
SODA POP AND YOUR TEETH
– what you should know...

Soda intake for today's kids is definitely on the rise! Soda consumption has almost tripled, from 22 gallons of cola per person a year in 1970, to 61 gallons per person a year in 2006. Kids are drinking sodas as a thirst-quencher and a caffeine kick. But sodas are also ruining their teeth! Kids are drinking the stuff from morning to night -- all through the school day. The result is a prevalence of cavities that dentists have not seen since pre-fluoride days. And, not only are sodas causing tooth decay, they are also putting kids at risk for obesity, diabetes and hyperactivity. And because soda is readily available through school vending machines, kids are getting sodas before school, between classes, during lunchtime -- anytime. The larger 16-ounce bottles are the biggest problem because this larger quantity allows kids to sip all day, literally dousing their teeth with pop -- bathing their teeth with sugar -- all day long. And the carbonation in soda also gradually breaks down the tooth’s enamel.

TIPS FOR PARENTS - TELL YOUR CHILD TO:
• Select pop cans over re-sealable bottles. This limits the consumption of the pop to one sitting rather than sipping bottles and re-sealing them over a longer period of time.
• Limit regular pop to one can per day.
• Consume sodas only during meals to limit the teeth’s exposure to sugar and acid.
• After finishing a soft drink, head to the water fountain. Either swallow the water or swish and spit it out. It takes the sugar off the teeth.
• Don’t brush your teeth after drinking pop. The acid in the sugar weakens the enamel and, when you subject the enamel to a nylon bristle brush with toothpaste, you run the risk of wearing away the enamel even faster.
• Drink sodas through a straw. This results in less direct contact with the teeth.
• Eat two or more servings of dairy foods per day.

DIET SODA DRINKERS BEWARE!
Any type of soft drink (even diet soda) hurts teeth due to the citric acid and/or phosphoric acid in the beverages. Acid in soft drinks, whether they contain sugar or not, is the primary cause of weakened tooth enamel. The acid literally attacks your teeth, and each “attack” lasts approximately 20 minutes! And the acid attack starts over again with every sip!

Many other popular soda alternatives -- such as energy drinks -- can be just as bad for kids’ dental and overall health. They don’t have as much sugar, but some kids drink so much, they have the same effect as soda pop.
THANK YOU!

2007 DENPAC DONORS
HELP is available!

A confidential, effective, compassionate approach to recovery and treatment for all healthcare professionals with drug and alcohol abuse and behavioral problems.

Call the 24-Hour Confidential Hotline at (405) 427-4391.

DENTIST DAY AT THE CAPITOL - FEBRUARY 6TH -

MARK YOUR CALENDARS!

9:00 – 11:30 a.m.
Alliance members meet at the ODA building to receive legislative gift kits and disbursement instructions. Transportation to the Capitol will be available that day and is sponsored by DENPAC.

1:00-2:30 p.m.
Come-and-go educational session and lunch at the ODA building to learn about legislative issues on the docket that may affect dentistry in Oklahoma. Lunch sponsored by DENPAC.

2:30 – 5:00 p.m.
Dentists and Alliance members meet with legislators. Schedule an appointment with your legislator to meet during this time. Park at the ODA building and ride the shuttle bus to the Capitol.

5:30 – 7:30 p.m.
ODA Legislative Reception at the ODA Building - Hors d’oeuvres and drinks provided.

Your participation is imperative! Over fifty legislators attended the 2007 Dentist Day at the Capitol reception and many districts were not represented by ODA members. The first question every Legislator asked was “Is there anyone here from my district?” That answer needs to be YES! A personal relationship with your State Representative and Senator is the most important step toward educating the legislature about our issues. Don’t sit back and assume others will be representing your district. YOU be the one!

DENTIST DAY AT THE CAPITOL – COMMITMENT FORM
Attend all the events that day, or attend only what your schedule allows.

☐ Yes! I will attend all of the day’s events
☐ Yes! I will attend only the educational session/lunch and meet with my legislators
☐ Yes! I will represent my district during the Legislative Reception, ($10/person)

Name ________________________________
Address ________________________________
City __________________ State __________ Zip _______

Phone __________________ Fax __________ Email __________________

Contact your Legislator to make an appointment:
House of Representatives 405-521-2711 or 800-522-8502
Senate 405-521-5692

Find your legislators online at www.okda.org!
Return this form to the ODA by fax 405-848-8875
Who: Many dentists across Oklahoma will take time from their practices to help underserved children who aren’t getting the oral health care they need. Will you join us?
What: Give Kids A Smile® is an annual one-day volunteer initiative to provide free educational, preventive and restorative services to children from low-income families.
When: February 6th -

Even if you participate in GKAS! every year, and do not need supplies or t-shirts, the ODA still wants to know about it! The ODA will send a press release to the hometown newspaper of every participating dentist and will list the names of all participating members in a future issue of the ODA Journal. Please take pictures of the activities that day and send them to us! Thank you for volunteering for Give Kids A Smile®

Who: Many dentists across Oklahoma will take time from their practices to help underserved children who aren’t getting the oral health care they need. Will you join us?
What: Give Kids A Smile® is an annual one-day volunteer initiative to provide free educational, preventive and restorative services to children from low-income families.
When: February 1, 2008

Why: To provide oral care to disadvantaged children and teach them how to take care of their teeth. It will also provide you an opportunity to educate the parents about the importance of regular visits to the dentist.
How: You can volunteer to participate in a number of ways:
1) Offer free educational, preventive and restorative services to children from low-income families in your practice on February 1, 2008.
2) Open your practice to allow other local dentists to provide services in your practice with you on February 1, 2008. We will direct volunteers to contact you.
3) Volunteer your services in another practice on February 1, 2008. We will put you together with dentists who are looking for help that day.
4) Make a donation to Give Kids A Smile® so other volunteer dentists will have help with the supplies they’ll need on February 1, 2008.

The ODA will have a limited number of toothbrushes and toothpaste, etc., available to help you and special Give Kids A Smile® t-shirts for the volunteers to wear that day. Return the form below by January 10, 2008 to have priority.
To volunteer please complete the short form below and return it to:
Give Kids A Smile®/Oklahoma Dental Association
317 NE 13th Street
Oklahoma City, OK  73104
Or fax to: 405.848.8875
To learn more please visit www.okda.org or call Lynn Means at the ODA at 848.8873 or 800.876.8890; or email lmeans@okda.org.

PLEASE TELL THE ODA WHAT YOU HAVE PLANNED!
Give Kids A Smile® Volunteer Form

List full names of all participating dentists: ____________________________________________

Name of your practice if different from above (for press release): ________________________________

Address  City  Zip
Phone  Fax  E-mail address

Please mark all that apply:  
☐ YES! I am planning to participate in GKAS! in my office. Here is what I have planned:

☐ Please send me some supplies. I realize the ODA’s inventory is limited.
☐ No, I do not need any supplies from the ODA.

☐ YES! I am planning to participate in GKAS! and would welcome a colleague from another office to participate in my office on February 1, 2008.

☐ YES! I want to participate in GKAS! and would like to volunteer in a colleague’s office.

☐ YES! I would like to make a donation to the ODA to assist in purchasing GKAS! supplies.

My check is enclosed. Make check payable to the ODA and send with this form.

TOTAL          $14,260

HURRICANE KATRINA RELIEF FUND DONORS

Brochures available for your patients!

CALL THE ODA TO PLACE YOUR ORDER TODAY!

Brochures available at the Oklahoma Dental Association.
CALL THE ODA TO PLACE YOUR ORDER TODAY!

Gary & Kathleen Adolph     $100
Mark Allen     $500
Jay Anderson      $200
Winn Ashmore      $100
Lee Beasley     $500
William Beeson      $500
Jerry Benson      $100
Fred Blythe      $200
Bright Smile Family Dentistry, P.C.   $500
Gary Britton      $100
Margaret Brock       $10
Mike Buchanan     $400
Craig Buntemeyer     $150
Stephen Chastain     $100
Robi Craig      $500
Christina DeAtley     $200
Gary Dennington     $500
Thai-An Doan               $1,000
Ronald Gilbert        $50
Mark Goodman      $300
James Hackler      $100
David Harrell      $250
Jeffrey Hill      $100
Robert Jarvis      $250
Krista Jones      $500
Peter Kierl               $1,000
Michael Kierl        $50
Herbert Klontz      $100
Pam Low      $250
Dennis Morehart     $100
Maurice Nickell      $200
Oral & Maxillofacial Associates             $1,000
Larry Patterson      $200
Alan Plaxico      $250
Steven Scott        $50
William Smith, Jr.     $500
Paul Sommer      $100
J. Michael Steffen              $1,000
Trena Stewart-Rankin     $100
Robert Utecht      $100
Ronald Vaughn     $100
Scott Waugh               $1,000
Robert Webb      $100
Dennis Weibel        $50
Thomas Weirich      $100
George Williams     $100
Robert Womble      $100
Christian Zylinski     $500

TOTAL          $14,260

HURRICANE KATRINA RELIEF FUND DONORS
ODA: How do you think volunteer work differs between rural and city districts?
KO: In rural districts, you are pulling leaders from a smaller group of people. If you don’t do it, it probably won’t get done. There isn’t the large structure that exists in Tulsa and Oklahoma counties.

ODA: What do you most love about dentistry?
KO: I really enjoy helping my fellow man. A healthy smile gives people a much better attitude.

ODA: What goals do you have for your district in the next five years?
KO: I’d really like to recruit more dentists to western Oklahoma. I think that the Dental Loan Repayment Act will help with that. Mobilizing the rural districts to get the word out that rural areas are a great place to practice will help as well.

ODA: Who or what encouraged you to get involved in organized dentistry on the state level?
KO: Dr. Keith Keeter was the one who got me involved on the state level. He thought it was something I should do and he encouraged me to take the reigns of leadership for our district. He also said it was my turn, so here I am.

ODA: Tell us about your family. Is anyone else in the dental profession?
KO: My family is connected to dentistry. I have one uncle who is a retired dentist in Coeur d’Alene, Idaho. My daughter is also a senior at the University of Oklahoma.

ODA: Please list your favorite:
KO: • Movie – Forrest Gump
   • Television Show – Boston Legal
   • Music – Jim Brickman
   • Oklahoma Golf Course – golf? What’s that?
   • Sport (participate) – aviation
   • Sport (observe) – football
   • Professional Athlete – Lance Armstrong
   • Professional Team – Dallas Cowboys
   • US Vacation Destination – flying at Oshkosh, Wisconsin
   • International Vacation – I just got back from Machu Picchu in Peru
   • National Park – Yellowstone
   • Sports Car – Porsche 911, although I also still have my very first car...a ’66 GTO
   • Dream Ride – P-51 Mustang
   • Meal – steak
   • Ice Cream – vanilla
   • Dessert – pecan pie
   • Current Reads – I am currently re-reading Fate is the Hunter by Gann

PROFILE:
Dr. Kevin O’Halloran, Northwest District Trustee

Dr. Kevin O’Halloran graduated from the University of Oklahoma College of Dentistry in 1982 and has lived and practiced in Cordell, OK since that time. He enjoys a deep love for aviation and spends as much time in his plane as time allows. Dr. O’Halloran celebrates his birthday this month and will celebrate that day with his staff. He says, “I have not lost a staff member in over 13 years – only God knows how they put up with me!”.
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Southwest Dental Conference
January 17 - 19, 2008
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Sponsored by the
Dallas County Dental Society
Annual Meeting 2008
CE Preview

Michael A. Ignelzi, Jr., DDS, PhD

Dr. Ignelzi received his D.D.S., Certificate in Pediatric Dentistry and Ph.D. in Biochemistry and Biophysics from the University of North Carolina at Chapel Hill. He received his Certificate in Orthodontics and Dentofacial Orthopedics from the University of Michigan. Dr. Ignelzi is an Associate Professor in the Department of Orthodontics and Pediatric Dentistry at the University of Michigan where he teaches in the clinics, lectures, and treats patients in the dental faculty practice. He has published over 70 scientific articles, abstracts and book chapters and has made over 100 presentations to national and international audiences on a variety of pediatric dental topics. Dr. Ignelzi is the 2002 recipient of the Charles Craig Award, a national teaching award given by the dental honor society Omicron Kappa Upsilon. From 2000-2003, Dr. Ignelzi served as Chair of the American Academy of Pediatric Dentistry’s Council on Scientific Affairs. He has been quoted in several newspapers as well as Parents Magazine, Redbook, Prevention, and Contemporary Oral Hygiene. Dr. Ignelzi is a national media spokesperson for the American Academy of Pediatric Dentistry and is currently serving on the Editorial Board of the Journal of Pediatric Dentistry. He is a member of the American Academy of Pediatric Dentistry’s Bright Futures Early Childhood Expert Panel. Dr. Ignelzi is funded by the National Institutes of Health to study birth defects that affect the face and skull.

“What’s New in Pediatric Dentistry?”
Six (6) Hours of CE Available

Friday, May 16, 2008
8:00 am – 11:00 am and 2:00 pm – 5:00 pm
Lecture format: Audience participation will be encouraged
Recommended for dentists, specialists and hygienists

This entertaining and informative course features timely information for any practice that treats children. We offer practical information, based on sound science, so that you can provide the best care for your patients. We review the latest on glass ionomers as a base and restorative material, the infant and toddler visit, fluoride, caries risk assessment, and the most commonly encountered developmental anomalies and pathology in children. After attending the presentation, the participant should be able to:

- Use glass ionomers in specific clinical situations;
- Discuss the benefits of the infant and toddler visit;
- Complete a thorough infant and toddler exam;
- Incorporate contemporary caries risk assessment and recently released fluoride guidelines into your practice; and
- Diagnose the most commonly encountered anomalies and pathology seen in children and know the treatment options for these conditions.
In helping to promote the message of National Children’s Dental Health Month, Braum’s donates the printing of trayliners and posters displayed in their stores across the state each February. Even their Kid’s Meal prize has an oral health message that month! Braum’s also provides free ice cream to the statewide winners of the annual ODA Children’s Dental Health Month poster contest.

WOW! Thanks, Braum’s!
The Oklahoma Dental Association is proud to present our first of what will become the ODA Continuing Educational Seminar Series on DVD. This continuing educational opportunity is being provided to members of the ODA free of charge and is also available on the ODA website at www.okda.org. *The fee for non-members of the ODA to participate in this CE opportunity is $40.00.

This particular seminar presents two informative areas of pediatric dentistry for the general practitioner. The length of our [please see instructions below on how to receive credit]. The Pre/Post Tests found on page 27 & 38 are made available for you to be able to evaluate your level of knowledge and is to be utilized for self-evaluation only. Please do not return the test to the ODA.

On behalf of the Oklahoma Dental Association, we would like to personally thank **Dr. Kevin Haney of the Department of Pediatric Dentistry at the University of Oklahoma College of Dentistry. Without his insight, background, and generous time given, this video production would not have been possible.

We hope you enjoy this presentation and find it informative. Look for information regarding additional presentations in the ODA CE series in future issues of the ODA Journal.

- The ODA Journal Editorial Board and Staff

To:

Oklahoma Dental Association
317 NE 13th Street
Oklahoma City, OK 73104

*Non-ODA members, please include payment of $40.00, made payable to the Oklahoma Dental Association in order to receive CE credit.

For technical assistance, please contact Lynn Means at the ODA at (405)848-8873; or by email at lmeans@okda.org.

**Our presenter, Dr. Kevin Haney, may be contacted at (405)271-5579; or by email at kevin-haney@ouhsc.edu.
**A Practical Overview of Pediatric Restorative Dentistry**

By: Kevin L. Haney, DDS, MS, FACP

**Introduction**

The past 15 years have seen an explosion in the use of resin-based restorative materials in primary teeth. The use of amalgam and stainless steel crowns has decreased. Both anecdotal and scientific reports have demonstrated a philosophical change in the restorative management of dental caries. Has this been an appropriate change? Considering the extent of restorative care delivered to children, are we making wise choices with the restorative materials we use? Further, are we appropriately informing the parent of the risks of failures, the potential for success, and the options to treatment that informed consent mandates? To address these and many other questions, the American Academy of Pediatric Dentistry conducted a pediatric restorative material consensus conference in 2002. Sixteen articles addressing the noted questions were addressed and published in the September/October issue of Pediatric Dentistry, the primary scientific journal of the Academy.

The purpose of this article is to review these findings as well as the current materials recommendations for restoring primary teeth, the indications and contraindications of each material, and the expected success rate for using specific materials in specific situations. The following materials will be addressed: sealants, glass ionomers, resin-modified glass ionomers, compomers, composites, amalgam, and stainless steel crowns.

**Sealants**

There is no doubt that the appropriate use of sealants on permanent molars has decreased the caries incidence in children. Sealants have become a mainstay of the preventive efforts we use in children in the transitional dentition. When applied to the pit and fissure areas, a significant reduction in caries has been consistently documented. However, sealants do not confer any protection to the interproximal surfaces. Further, a higher risk for sealant failure is found in areas where isolation is consistently difficult to obtain. Grooves and pits approaching the gingival margin demonstrate higher failure rates than do occlusal sealants. As with all bonding techniques, isolation and moisture control are critical to the long-term success of the restoration.

Sealants are not contraindicated in the primary dentition (AAPD Guideline, 2007), and preventive application should be considered where deep pits and fissures exist. This condition occurs most frequently on primary second molars. Analysis of the individual risk factors as well as the ability of the child to tolerate the procedure should be considered before placement. If the interproximal surfaces of the primary molars cannot be clinically visualized, radiographic examination prior to sealant placement is encouraged to rule out the existence of interproximal caries.

Practitioners have regularly expressed concern that carious lesions may be sealed, thus leading to a situation in which the tooth is now in worse condition than before sealant placement. A tremendous volume of research has conclusively demonstrated that inadvertently sealed, small lesions arrest under an intact and maintained sealant. However, this presumes that the integrity of sealants are indeed evaluated and maintained on a periodic basis. With a failure rate demonstrated to be between 5-10% per year the philosophy that sealants are a “single application” restorative material is, perhaps, erroneous.

Several techniques have been advocated to enhance the retention of sealants (Blackwood, et al., 2002). Indeed, entire diagnostic and restorative systems have been developed with this goal in mind. Air abrasion systems have been advocated as one way of evaluating stained pits and fissures for caries, as well as for increasing the retention of sealants. However, appropriate tooth conditioning and moisture control continues to be the single most important factor in sealant retention (Simonsen, 2002).

Light-cure systems have revolutionized the placement of sealants by dramatically decreasing the amount of required chair time. What used to be a 20-25 minute procedure can now be successfully completed in half that time. Indeed, many providers would like to place sealants during the recall examination but have expressed concerns that topical fluoride placement will interfere with the bonding potential of sealants. Fiegal (2002) has reported, based upon an analysis of numerous bonding studies, that this philosophy is not correct. Sealants may be successfully placed following a topical fluoride application.

**Dentin Bonding Agents**

Increasing the strength of the bond that occurs at the tooth—restoration interface has been a goal almost since esthetic restorations were first introduced. A tremendous amount of literature has been authored regarding specific bond strengths, chemistries, indications and contraindications to the appropriate use of dentin bonding agents. Studies in primary teeth have found that bond strengths are quite variable. There are several reasons for this. Changes in study design make consistent analysis of the literature very difficult. Also, variations between the primary and permanent tooth enamel and dentin may influence the bond strengths that can be achieved. Last, primary teeth do not have the same longevity as permanent teeth. Long-term studies of success are, by virtue of the fact that primary teeth are being evaluated, difficult to interpret.

Questions occasionally arise as to the ability of bonding agents to work on primary tooth dentin. Regional variations in dentin structure are more commonly found in primary teeth than in permanent teeth. The placement of sealants may interfere with the bonding potential of sealants, thus leading to a situation in which the tooth is now in worse condition than before sealant placement.
in permanent teeth (Swift, 2002). There is no doubt, however, that bonding to primary enamel and dentin does occur. Agostini et al. (2001) demonstrated this quite clearly utilizing a variety of dentin bonding agents. An interesting finding from their study was that the more acidic a primer was, the less bonding to dentin occurred although all materials tested in their study were equally effective at bonding to enamel. In a study testing the differences in bond strengths achievable between primary and permanent tooth dentin, Soares et al. (2005) demonstrated no significant difference in mean bond strengths. Clearly these and other research studies indicate that bonding to primary teeth is achievable and reliably so.

**Amalgam**

Amalgam still possesses the longest track record of the restorative materials for primary teeth. It is relatively inexpensive and is the most forgiving in terms of moisture contamination. Concerns regarding toxicity were somewhat allayed with the publication in medical literature that the low toxicity potential for amalgam and composite restorations should not be a factor in restoration choice (Bellinger, 2006).

Two specific issues, both anatomic in nature, must be considered when using amalgam in children. First, the physical requirements of amalgam dictate that a sufficient bulk of amalgam be present in order to adequately withstand the forces of occlusion. Second, the broad, flat interproximal contacts of primary molars often dictate that class II preparation outlines extend beyond the ideal. In such cases, large interproximal boxes with narrow occlusal isthmuses have been shown to fail at a greater rate. In a series of classic articles, Levering and Messer (1988) showed that class II amalgams placed in the primary teeth of children less than five years of age had a significantly higher failure rate than those placed in older children while class I amalgam restorations demonstrated good longevity. In their studies, stainless steel crowns demonstrated significantly better longevity than class II amalgams, especially when placed in children less than four years of age (Messer and Levering, 1988). As a consequence of these findings and clinical experience, some pediatric dentists and public health programs resort to stainless steel crowns for the majority of class II restorations of primary molars: a survey of North American dental schools. Ped Dent 23(5): 25-27.

**Esthetic Bonded Materials**

Society increasingly demands optimum esthetics. Parents increasingly demand “invisible” fillings for their children. Of the esthetic materials available to achieve these demands, careful attention must be given to both the physical properties of the chosen material.

**Glass Ionomer and Resin-modified Glass Ionomers**

Theoretically, glass ionomer could be considered the ideal restoration for primary teeth. The material possesses a coefficient of thermal expansion that is nearly equivalent to the primary tooth, has the ability to release fluoride, and chemically bonds to the primary tooth. Unfortunately, a weak compressive strength in both the light-cure and non light-cure versions limits its use to small non-load bearing areas such as class III and V lesions, in microrestorative occlusal restorations of primary molars and in the ART technique (Berg, 2002).

Resin-modified glass ionomer materials have attempted to address the strength issue; however, a clear advantage of this material over amalgam, compomer, and composite has not been clearly established. Being a more dense material, many practitioners favor its superior handling properties compared to unmodified glass ionomer. Another advantage repeatedly cited is its tolerance of minor moisture contamination while still maintaining a relatively high degree of success, as well as being light curable (Berg, 2002).

**Compomers and Composites**

Compomers attempt to combine the best properties of glass ionomers (i.e. self-bonding and fluoride releasing) with the additional compressive strength and finishability of composite materials. Compomers demonstrate good serviceability and low failure rate as a restoration for primary posterior teeth (Gross, et al., 2001). And while a bonding protocol can be used to effectively increase the bond strength, the requirement is not as absolute as it is with the use of traditional composite materials (Garcia-Gadoy and Donly, 2002). Where strength is required, a bonded composite is the only resin-based material that possesses the ability to be used in all situations.

**Summary**

Given the available choices in restorative materials, the practitioner must carefully consider each case individually. Size of the lesion, expected life span, and need for preventive considerations all play a factor in the appropriate choice of materials to restore the primary dentition.

**References:**


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**A Practical Overview of Pediatric Restorative Dentistry**

*Dr. Kevin L. Haney*

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**Topics**

- Sealants
- Amalgams, Composites, Glass Ionomers and Compomers
- Bonding Agents
- Pulp Therapy

---

**Sealants**

“Sealants are effective caries-preventive agents to the extent they remain bonded to teeth... Even under the best of circumstances, sealants fail. Therefore, dentistry (as well as third-party systems) must accept that sealants need vigilant recall and proper preventive maintenance.”

*Robert J. Feigal, DDS, PhD*

---

**Sealants**

- I don’t seal because....
- When to seal?
- What to seal?
- Choice of material?
- How do we judge success?

---

**Sealants**

- Reasons given to not place sealants
  - ...they fail and have to be replaced
  - ...insurance won’t pay to replace them
  - ...they’ll get lesions and then the parents are upset.
  - ...I don’t believe in sealing grooves that might have lesions
  - ....

---

There is extreme variation in how caries is clinically “defined.” The clinical experience of the dentists plays a large role in how and when they themselves will individually provide treatment.

---

**Sealants**

- Virtually 100% effective in eliminating occlusal caries when fully retained.
- “Full” retention usually doesn’t occur over a long period
- Fifteen year retention rate is about 50%

---

**Sealants**

For sealants to remain effective, they must be maintained.
Sealant Success: Fact vs. Fiction

- **Fiction**
  - Easiest restoration that can be placed

- **Fact**
  - Sealants are technically demanding regarding isolation. Small mouths, movement, poor behavior, etc... all impact the success of sealants

Sealant Success: Fiction vs. Fact

- **Fiction**
  - Sealants stop caries from forming on teeth

- **Fact**
  - Non-sealed areas have the same risk of developing caries as any non-sealed tooth.
  - Progression of active incipient lesions is halted under an intact, maintained sealant.

Sealants: Fiction vs. Fact

- **Fiction**
  - Sealants last forever

- **Fact**
  - Sealant failure occurs at a rate of approximately 5-10% per year in some studies. Long term studies show a failure rate of approximately 50% at 15 years

Sealants

- **Insurance won’t pay…**
  - True - insurance typically doesn’t pay for touch ups.
  - Provider or parent eats the cost of early failures.

- **Class II Services (75%)**
  - Limited benefit for children
  - “Sealants are a benefit for persons through age thirteen (13), limited to permanent first and second molar teeth free of caries and restorations on the occlusal surfaces. Sealants are a benefit once per tooth in a sixty (60) consecutive month period.”

Sealants

- **Just can’t get some areas sealed**
  - Buccal pits and lingual grooves have a significantly higher failure rate than occlusals (BPs due to proximity of gingiva, and DLG’s due to gingiva and location). Appr. 50% failure rate in these areas.

- **Air abrade?**
  - Fiction
    - Air abrasion or enamoplasty of the grooves decreases leakage and increases retention of the sealant.

  - **Fact**
    - There is no statistically significant difference among prophy/etch, enamoplasty etch, or air abrade/etch on microleakage. Retention studies seem to be fairly equivocal regarding preparation styles.

    - The single most critical factor regarding microleakage (and retention) is appropriate acid etching (20-30 seconds) with 35% phosphoric acid.

Sealants

- **When to seal**
  - Most effective if tooth is sealed within 2 years of eruption.

  - However, significant differences on how people define “erupted.” Sealants placed on early erupting molars more likely to fail.

  - When to seal
    - Most effective if tooth is sealed within 2 years of eruption.

  - However, significant differences on how people define “erupted.” Sealants placed on early erupting molars more likely to fail.

Sealants

- **Seal as soon as eruption allows you to assure moisture control.**

- The child with no history of caries will probably not realize a great benefit from sealants.

- The child with a high caries rate (IP and SF) also will not realize a great benefit from sealants as caries will probably form in non-sealed areas.

- Evaluate patient risk: caries history, fluoride status, fissure anatomy, and plaque load.

- Premolar sealants may not be covered by insurance plans.

- Recall, recall, recall….
Sealants

- Wide variety to choose from:
  - Unfilled resins
  - Filled resins
  - Fluoride releasing
  - Non-fluoride releasing
  - Change colors when cured

Advantages / Disadvantages

Unfilled Sealants (i.e. Delton)

- Advantages
  - Usually translucent and allow you to see through the sealant
    - Cost is less
    - Staining in the grooves?
    - Dislodgment?

- Disadvantages
  - More quickly worn into occlusion - usually within 48 hours.
  - Tend to be yellow - not as esthetic
  - Not able to withstand occlusal forces - may need another material underneath if the grooves have been opened

Filled Sealants (i.e. Ultrascan XT)

- Advantages
  - Usually opaque - better color match with the tooth
  - Much stronger than the unfilled resin, so they tend to resist occlusal better
  - Can be used as a definitive restoration in some small lesions

- Disadvantages
  - Most need to have occlusion adjusted after placement
  - Can’t see through them - harder to detect caries if it occurs, under the sealant
  - Cost more

Fluoride releasing, or not?

- No real definitive literature showing the benefit, one way or the other, of using a fluoride releasing sealant

- On the other hand, there does not seem to be in problems associated with it either.

While on fluoride…

- Sealants following a prophylaxis:
  “For years there existed an opinion that a recent fluoride exposure, such as in-office fluoride treatment, would interfere with the etching pattern and, therefore, the retention of the sealants. This opinion is not correct. It has been dispelled in several reports using sealant bonding and orthodontic bracket bonding to test the hypothesis. Therefore, sealant application can be planned to follow fluoride treatment during the same office appointment if desired.”

Light Cure?

- Light cure sealants have one key advantage: TIME!!!
  - Moisture control - much easier to keep the child’s tooth dry for the length of time it takes to light cure, than for the time it takes a traditional auto-cure material to set up.

Material

- Ultra-seal XT is a filled sealant whose indications are for traditional sealants, micro-restorative, and as a light cured cavity liner.

Preventive Resin Restorations

- Conservative removal of the carious lesion without “extension for prevention”
- Should be no radiographic evidence of caries
- Usually limited to pits - if your preparation dictates that all fissures are involved, re-consider your choice of restoration (failure of sealant???)
- Depending upon the size of the preparation, the tooth can be restored with composite, compomer, glass ionomer, and then sealed, or a filled sealant is used alone.

More than any other, the PRR/PGI is a restoration of honesty - can you remove all of the caries and maintain a conservative preparation?
Dentin Bonding Agents

DBA’s

- Studies are quite variable regarding effectiveness / strength on primary teeth – suggests variations in study design may be accountable
- Variations between primary and permanent tooth enamel and dentin
- Not a great many studies out there to begin with

“...you never know what you are bonding too!” - Ed Swift, DDS

Findings were interesting

- Clearfil SE Bond had the highest dentin bond strength, yet was the least acidic.
- Prompt-L Pop and Etch and Prime 3.0 had the lowest bond strengths, yet were the most acidic.
- It's possible that the action of the acid on the primary dentin eliminated the potential for bond.
- All were effective on primary enamel

Clinical Factors affecting DBA’s

- Isolation
- Use mechanical retention
- Don’t desiccate the dentin
- Follow the instructions exactly
- Etc...
- And you may still not get what you think!

Restorative Materials

Amalgam

- Still the gold standard
  - Longest track record
  - Very few studies greater than 3 years old on the primary dentition for esthetic restorations
- Relatively inexpensive
- Most forgiving


- Tested bond strengths in vitro:
  - Clearfil SE Bond
  - Prompt L-Pop
  - Etch and Prime 3.0
  - Prime and Bond, NT (control)
Amalgam has problems

- Messer and Levering showed a significant failure rate in class II amalgams in children under 5 years of age.
- Can’t be as conservative – requires a bigger preparation to achieve the structural requirements of amalgam
- Media and public demands

Do I still do amalgam???

- Yes --- nothing I’ve read convinces me that amalgam is a bad material.
- In a child, amalgam is probably the most forgiving material that I can use, short of placing a crown.
- However, if the parent requests and I can keep the area dry, I will do posterior composites.

Glass Ionomer Restorations

- Chemically bonds to the tooth structure
- Similar coefficient of thermal expansion to the tooth which means that it expands and contracts at about the same rate as the tooth
- Fluoride releasing
  - Ex: Fuji IX

Glass Ionomers

- True Glass Ionomer (GI) Materials i.e. Fuji IX
- Resin Modified Glass Ionomers i.e. Fuji II LC

Compomers

- Resin composites (majority) with glass ionomer groups which react with saliva after placement and curing to release fluoride
- Less fluoride release than true glass ionomers
- Depending on the material, may not require etching of dentin/enamel.

Composites

- Strongest of the esthetic restorations
- Most esthetically pleasing
- No inherent bonding – must use a bonding system
- No fluoride release

Examples of Materials

<table>
<thead>
<tr>
<th>Examples</th>
<th>Glass Ionomers</th>
<th>RM Glass Ionomers</th>
<th>Compomers</th>
<th>Composites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuji IX</td>
<td>Fuji IIX</td>
<td>Ketac-Molar</td>
<td>Dyraect</td>
<td>TPH Prodigy</td>
</tr>
<tr>
<td>Ketac</td>
<td>Fuji II LC</td>
<td>Hytac Applicap</td>
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<tr>
<td>Fuji II</td>
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<td>Fuji II</td>
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<td>Fuji IX</td>
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</tbody>
</table>

Review of Studies and Comparable Failure Rates for Materials
### Preparation / Material Usage

<table>
<thead>
<tr>
<th>Class I or II</th>
<th>Primary Teeth (small)</th>
<th>Permanent Teeth (small)</th>
<th>Primary Teeth (small)</th>
<th>Permanent Teeth (small)</th>
<th>All situations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class III</td>
<td>Primary Teeth</td>
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<td>Primary Teeth (small)</td>
<td>Permanent Teeth (small)</td>
<td>All situations</td>
</tr>
<tr>
<td>Class IV</td>
<td>Primary Teeth (small)</td>
<td>Permanent Teeth (small)</td>
<td>Primary Teeth (small)</td>
<td>Permanent Teeth (small)</td>
<td>All situations</td>
</tr>
<tr>
<td>Class V</td>
<td>Primary and permanent teeth</td>
<td>Permanent teeth (small)</td>
<td>Primary and permanent teeth</td>
<td>Permanent teeth (small)</td>
<td>All situations</td>
</tr>
</tbody>
</table>

### Pulp Therapy in the Primary Dentition

- **Current Materials**
  - Formocresol
  - Ferric Sulfate
  - Mineral Trioxide Aggregate
  - Etc...

- **Formocresol**
  - The gold standard
  - Majority of pediatric dentists still use it
  - 70-99% success rate depending upon the study
  - Does cause chronic inflammation of the pulp structures apical to the amputation

  The cotton pellet should be squeezed dry before application.

- **Formo studies**
  - Series of articles in late 70's and early 80's demonstrated that formocresol escapes the canals of dogs in very low amounts and enters the peripheral circulation.
  - There was no conclusive evidence to demonstrate any long term sequelae from this escape.
  - Other pulp agents available at that time also escaped the canal into the circulation and did not show as good of clinical success.
  - 1:5 dilution has been found to be equally effective as full strength

- **Ferric Sulfate (Astringident)**
  - Commonly used in practice to control hemorrhage
  - Comparable success rates to formocresol
  - Great hemostatic agent
    - Is that hemorrhage telling you something?
  - Unknown mechanism of action - we aren’t sure why this works

- **MTA**
  - Very new to pediatric dentists - very few reports of its use in the literature and virtually no long term studies
    - Similar strength and set properties to IRM but not as toxic
    - Tends to promote hard tissue formation

  Real expensive - cost vs. benefit???

- **Pulp Points**
  - The success of a pulp therapy is more related to accurate diagnosis than the material
  - Choice of final restoration also affects the prognosis (amal vs. ssc)
  - It seems that all the materials wind up having comparable success rates - probably not the technique, but the diagnosis
  - Problems with the studies - usually small sample sizes and not long term.
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1. Regarding dentin bonding agents, the more acidic a self-etching primer is, the higher the bond strength is to primary tooth dentin. 
   T or F

2. According to cross sectional studies regarding posterior restorations in primary teeth, which material has the least probability of long-term survival in class II restorations?
   a) amalgam
   b) glass ionomer
   c) compomers
   d) composites

3. The strongest material currently available for posterior esthetic restorations is:
   a) resin-modified glass ionomers
   b) glass ionomers
   c) compomers
   d) composites

4. Which of the following materials does not “self-bond” to the tooth?
   a) resin-modified glass ionomers
   b) glass ionomers
   c) compomers
   d) composites

5. According to the American Academy of Pediatric Dentistry, sealants are contraindicated for use on primary molars. 
   T or F

6. Which of the following statements most accurately describes what happens to caries that is inadvertently sealed?
   a) continues to progress in size
   b) arrests and remineralizes
   c) arrests under a maintained sealant

7. The estimated failure rate of seal of sealants is:
   a) 0-5% per year
   b) 5 -10% per year
   c) 10 - 15% per year
   d) 15 - 20% per year

8. Which of the following variables contributes most to sealant failure?
   a) moisture contamination
   b) inadequate etching of the cuspal inclines
   c) fluoride application immediately prior to sealant placement

9. Air abrasion enhances sealant retention even in the absence of tooth etching. Appropriate tooth conditioning and moisture control are the most important factors in sealant retention.
   a) both statements are true
   b) both statements are false
   c) the first statement is true; the second statement is false
   d) the first statement is false; the second statement is true

10. Dentin bonding to primary tooth dentin is:
    a) less predictable than bonding to permanent tooth dentin
    b) more predictable than bonding to permanent tooth dentin
    c) enhanced, due to less regional variation in primary tooth dentin

11. In general, the more acidic a primer is, the greater the bond strength will be to primary dentin. 
    T or F

12. Which two factors must be taken into account when placing amalgam restorations in primary teeth?
    a) toxicity and moisture control
    b) toxicity and physical requirements of the amalgam
    c) physical requirements and moisture control
    d) physical requirements and preparation outline

13. Which of the following is most commonly cited as a reason for amalgam failure in class II restorations of primary teeth?
    a) fracture of the amalgam at the isthmus
    b) recurrent caries
    c) lack of appropriate fluoridation in the community

14. Which of the following materials is theoretically the best restorative material for primary teeth?
    a) resin-modified glass ionomers
    b) glass ionomers
    c) compomers
    d) composites

15. Which following material currently available for posterior esthetic restorations most nearly approaches natural tooth in its coefficient of thermal expansion?
    a) resin-modified glass ionomers
    b) glass ionomers
    c) compomers
    d) composites

16. Which of the following materials is not routinely recommended as a restorative material for class II lesions of primary molars?
    a) resin-modified glass ionomers
    b) glass ionomers
    c) compomers
    d) composites

17. Glass ionomers, resin-modified glass ionomers, and compomers all have the ability to self-bond to primary teeth. 
    T or F

18. What primary advantages do resin-modified glass ionomer materials have over conventional glass ionomer resins?
    a) greater fluoride release
    b) greater compressive strength
    c) the ability to self-bond

19. What primary advantages do compomer restorative materials have over resin-modified glass ionomers?
    a) greater fluoride release
    b) greater compressive strength
    c) the ability to self-bond

20. Compomers can self-bond to primary molars. Compomers can be used in all restorative situations on primary molars. 
    a) both statements are true
    b) both statements are false
    c) the first statement is true; the second statement is false
    d) the first statement is false; the second statement is true
Current Trends in Primary Tooth Pulp Therapy

Intended audience: dentists and dental specialists

In this course, the dentist will receive a review of:

► indications and contraindications for primary tooth pulp therapy;
► pulpotomy technique;
► formocresol pulpotomy;
► ferric sulfate pulpotomy;
► other medicaments for pulpotomies; and
► indirect pulp treatment for the primary tooth.

By: Kevin L. Haney, DDS, MS, FACD

Introduction

A challenging aspect of providing restorative care to children is determining the pulpal status of primary teeth with significant carious involvement. Providing an accurate assessment prior to initiating treatment is dependent upon several subjective and objective clinical variables. Symptomology varies among patients and subjective clinical signs, while more diagnostic in general, are not always easy to determine. Difficulties in exposing, developing, and interpreting radiographs may lead to inaccurate diagnoses and subsequent failure to provide accurate treatment. Age-related behavior and communication skills often impede a proper dialogue between the patient and the provider. Children may not accurately represent the nature of the pain they suffer or may not be old enough to communicate effectively. In some cases, the provider may fail to ask if a tooth has been symptomatic. Unfortunately, the assumption is commonly made that if a child doesn’t complain and there are no radiographic or clinical findings, then the pulp of the primary tooth in question is healthy. In fact, the disease process may have already progressed to the point that either a pulpectomy or extraction is required.

A variety of pulp therapy techniques and materials have been introduced through the years as alternatives to the traditional formocresol technique. Many of these techniques have little but anecdotal evidence to support their use. In the truest sense of evidence-based care, there is a paucity of scientific evidence to support the use of these techniques other than their continued use. According to Farooq et al. (2000) and Vij et al. (2004), primary teeth receiving indirect pulp therapy and restoration with a stainless steel crown demonstrated long-term clinical success and normal exfoliation at rates equivalent to and in some cases exceeding the success rate of the traditional formocresol technique.

Traditionally, pulpotomies have been the treatment of choice for those cases demonstrating reversible pulpsitis in which access into the pulp chamber has occurred. The goal of the pulpotomy technique is to surgically amputate the coronal pulp while leaving healthy vital pulp tissue at the chamber orifice to the root. By definition, the site of amputation would therefore be at a level apical to the predicted extent of the pulpal disease. By maintaining the radicular and periapical vitality as normal as possible, proper development of the permanent dentition is maintained. However, when the disease process has progressed beyond the chamber and into the canals as evidenced by necrosis, persistent bleeding following radicular pulpal amputation, radiographic pathology, and/or soft tissue abnormality, a pulpotomy is contraindicated. In these cases treatment may take the form of pulpectomy or extraction as the presence of radicular and peri-radicular disease may affect the development of the permanent tooth.

Indications for pulp therapy

The classic indications for performing a pulpotomy are:

1. asymptomatic primary tooth with deep dentinal caries;
2. symptoms suggestive of reversible pulpsitis only (i.e. elicited dental pain such as brief, non-lingering pain to cold or food);
3. greater than 1/3 of the root remaining, radiographically, and
4. restorability. In most cases, the ideal candidate for the pulpotomy procedure is the primary tooth exhibiting only slight or no clinical carious entry into the pulp upon preparation. Bleeding within the chamber should easily be achieved with light pressure following amputation.

Forms of Pulp Therapy

Pulp therapy falls into two broad categories: vital and non-vital therapy. The distinction between the two procedures is what the dentist either diagnoses clinically prior to initiating treatment or intends to occur to the pulp following treatment. If the intent is to maintain some degree of pulpal vitality, with a goal of maintaining a healthier periapical environment for the developing permanent tooth bud, then vital pulp therapy should be performed. It is important to note that almost all forms of vital pulp therapy will cause a degree of non-vitality within the remaining pulp, assuming the pulp has been accessed. If a tooth has been diagnosed as irreversibly inflamed or necrotic, then non-vital pulp therapy is the only treatment that can be performed and elective devitalization of the tooth via pulpectomy, or extraction therapy, are the only treatment options which have a predictable outcome.

Two distinct forms of vital pulp therapy are available in the primary dentition: indirect pulp therapy and vital pulpotomy. In recent years, indirect pulp therapy has gained favor for managing those cases with deep dentinal caries and reversible symptoms. Two distinct forms of vital pulp therapy are available in the primary dentition: indirect pulp therapy and vital pulpotomy. In recent years, indirect pulp therapy has gained favor for managing those cases with deep dentinal caries and reversible symptoms. According to Farooq et al. (2000) and Vij et al. (2004), primary teeth receiving indirect pulp therapy and restoration with a stainless steel crown demonstrated long-term clinical success and normal exfoliation at rates equivalent to and in some cases exceeding the success rate of the traditional formocresol technique.
Conversely, abnormal mobility due to pathology or advanced physiologic resorption are contraindications for pulpotomy procedures and may, in fact, be indications for more aggressive treatment such as extraction. Primary teeth exhibiting clinical signs and symptoms such as (1) pain to percussion; (2) spontaneous pulpal pain; (3) soft tissue inflammation due to infection, (4) sulcular and/or sinus tract drainage, or (5) persistent intra-coronal bleeding following pulpal amputation are not candidates for pulpotomy procedures as these are all indications that the disease process has spread beyond the chamber and possibly the apex. In these cases, the treatment of choice is either pulpectomy or extraction.

The Pulpotomy Technique

Profound anesthesia and rubber dam isolation are mandatory for all pulp therapy techniques. Though many techniques and burs have been advocated for gaining entrance into the pulpal chamber, all techniques share in common the complete de-roofing of the chamber. The purpose for this is twofold: to adequately visualize the pulpal tissue and to easily gain access to the canal orifices. Failure to adequately visualize the chamber orifices and floor, especially in instances of significant hemorrhage, clinically increases the risk of inadvertent perforation of the chamber floor during excavation of the pulpal tissue. Amputation of the pulpal tissue at the canal orifice is most easily accomplished with a sharp, slow-speed #4 round bur or a sharp spoon excavator. High-speed amputation is not advised as sudden movement by the child can easily lead to perforation of the chamber floor.

Current literature agrees on the need to assess the pulp’s hemostatic ability prior to placement of any intra-pulpal medicaments. A healthy pulp should stop hemorrhaging on its own, or with the application of light pressure of a cotton pellet slightly moistened with water. Though this step is commonly skipped by virtue of the operator’s experience, it is an important aspect to evaluate. Difficulties in achieving hemostasis can occur due to poor amputation technique, inadequate instrumentation, or poor access visibility. In primary molars, pulp tissue often extends buccally toward the cervical bulge. Inadequate coronal access can render this area non-visible, frequently leaving remnants of tissue poorly amputated and freely bleeding. In these cases, judicious assessment of the access and careful debridement of this area may be all that is indicated to create a cleaner amputation that more readily ceases to bleed. A balance must exist between the increased need for clinical visibility during the amputation process and the goal to maintain restorability.

Intrapulpal Medicaments

The two most evaluated intrapulpal medicaments used for vital pulp therapy are formocresol and ferric sulfate. Formocresol has a history of use dating back to the 1930’s. Full-strength FC, often labeled as “Buckley’s” Formocresol is composed of 35% tricresol and 19% formaldehyde in a water and glycerin solution (Mathewson, 1996). For years, full-strength formocresol was used with an overall average success rate of approximately 85%. In the early 1970’s, research indicated that a 1/5 dilution (20% strength) achieved essentially the same clinical success while preserving the apical vitality of the primary tooth to a greater degree. Most current research that utilizes formocresol in the research protocol continues to advocate the use of the 1/5 dilution strength, even though other studies have shown that the majority of pediatric dentists continue to use the full-strength formulation in their own practices due to the difficulty encountered in making the appropriate dilution (Seale et al).

Formocresol is often called a “fixative” agent due to its preservative action on the coronal layers of the radicular pulp stumps. Histologically, formocresol creates a zone of vitality ranging from fixed, cellular debris immediately beneath the site of application to essentially normal vital pulp apically. In conjunction with the final restoration and pulpal base, this acciluar zone acts as a barrier to further apical contamination and disease, allowing the permanent tooth to continue developing in a normal manner. Empirical data have generally recommended that a five-minute application of a slightly moistened formocresol pellet yields the best success rate. Upon removal of the pellet and prior to placing a chamber fill, the pulp stumps should appear dark and non-hermorragic.

The use of formocresol has not been without controversy. Despite its ability to induce rapid cellular fixation, a classic study by Pashley et al. (1983) showed that formocresol is absorbed by the pulpal vasculature and rapidly re-distributed throughout the body in small amounts prior to the adjacent pulpal microvasculature system being shut down. Further, this study found histologic changes in the kidney and liver of the study animals that were consistent with indications of early tissue injury. Though no long-term consequences were demonstrated (indeed, they speculated that cellular healing would be expected), the authors were careful to state in their discussion that because of the study design and high doses of formocresol utilized, no clinical implications should be derived. They did, however, make the recommendation that alternatives to formocresol be evaluated.

Finding an intra-pulpal medicament that has an equivalent success rate with less toxicity has been challenging. Gluteraldehyde was briefly advocated as a substitute. Its high molecular weight and size decreased systemic absorption significantly (Myers, et al. 1986). However, Lloyd, et al. (1988) demonstrated in an animal model that a longer application time was required for gluteraldehyde to achieve histologic success, also postulating that the concentration of the gluteraldehyde was a factor. Ranly (1984) discussed the fact that gluteraldehyde is less stable during storage, was most effective if kept refrigerated, and the breakdown by-products of un-refrigerated mixtures were less clinically active. In the end, despite gluteraldehyde’s apparent equivalency to the formocresol technique, questions regarding the length of application time and appropriate concentration did not appear to support its ease of use in the clinic.

Ferric sulfate was first evaluated as an intrapulpal medicament in the mid to late 1980’s. Having long been used as a hemostatic agent during cord-packing procedures for fixed prosthodontic procedures, ferric sulfate’s ability to induce rapid intra-pulpal hemostasis while maintaining histologic cellular integrity was felt to be advantageous. FS is not absorbed or redistributed from the pulpal microcirculation due to its relatively high molecular weight. Fuks, et al. (1997) found that when used as an intrapulpal medicament, a 92% success rate was achieved, although it...
was not statistically significantly better than the success rate achieved with diluted formocresol. Several studies since then have continued to demonstrate a success rate that is essentially equivalent to the formocresol technique. As a means of gaining hemostasis, there are few materials available in pediatric dentistry that achieves this as well as ferric sulfate. While the mechanism of action of ferric sulfate is not fully understood, it is felt that the coagulum formed immediately subjacent to the ferric sulfate pellet creates a relatively impermeable barrier, thus preventing re-infection of the remaining pulp tissue.

Many studies have demonstrated that ferric sulfate has an average success rate very similar to that reported for formocresol. Caution should be exercised when using ferric sulfate, however, since its hemostatic abilities can mask radicular hemorrhage that may be indicative of more extensive inflammation. Due primarily to this fact, some authors have reported that the margin for error and subsequent clinical success is potentially reduced with the routine use of ferric sulfate.

**Mineral Trioxide Aggregate**

A newer material has recently shown favorable results in clinical studies evaluating the success of primary tooth pulpotomies. Mineral trioxide aggregate (MTA) has been used for many years as an endodontic perforation repair material for the adult dentition. Consisting primarily of calcium, silicon, and bismuth, MTA has been shown to be readily biocompatible with the periapical tissues. When used as a pulp capping agent, some research has indicated a greater degree of dental bridge formation when compared to the standard formocresol and zinc oxide/eugenol technique (Holan, 2005). MTA’s use in pediatric dental research is limited, but promising due to its regenerative abilities which Ranly (1994) advocated as an ideal goal for a pulp therapy agent. Having no “fixative” properties of its own, MTA’s action on the pulp is purely to isolate the remaining pulp tissue and allow healing in the form of dental bridge formation. Questions regarding the material’s expense, however, are valid and may prohibit its generalized use.

**Intrapulpal Filling**

Zinc oxide and eugenol with or without accelerator or filler is still the recommended fill for the chamber following the placement of the intra-pulpal medicament. Few materials exhibit the same sealing and anti-bacterial properties as zinc oxide and eugenol (or its various combinations). The placement of eugenol-containing compounds directly onto vital unfixed tissue is not, however, recommended. Placed directly onto vital tissue, eugenol exhibits a cytotoxicity that produces a significant inflammatory response. In the majority of cases where this occurs, inflammation is induced with a resultant decrease in the success rate of the procedure.

**Choice of Restoration**

The American Academy of Pediatric Dentistry recommends that primary molars receiving pulp therapy be definitely restored with stainless steel crowns as other types of restoration have demonstrated increased failure rates. In a 16-year restrospective study of pulpotomy procedures, Holan et al. (2002), demonstrated that carefully selected primary molars restored with multi-surface amalgam restorations were not more likely to fail than those restored with stainless steel crowns. They were very careful to point out the limitations of generalizing this conclusion, however. Those teeth that received multi-surface amalgams had been carefully chosen for their restorability based upon ideal cavity preparation criteria. The authors felt that a randomized, prospective study comparing amalgams to crowns would render a significantly lower success rate for the multi-surface amalgam. Still, the authors did believe that a pulpotomized primary molar restored with an occlusal amalgam was acceptable if the tooth was to be lost within two years.

Farooq et al. (2000) and Vij et al. (2004) demonstrated that indirect pulp therapy cases that were restored with stainless steel crowns can be successful in appropriately selected, asymptomatic cases or cases demonstrating reversible symptoms only. In these two studies, success was higher than the comparison groups that received formocresol pulpotomies. However, when pulpotomies were restored with IRM alone, the success rate was significantly lower, especially in cases where emergency pulpotomies had been performed (Guelmann et al. 2002). By implication, the authors of these studies felt that the lack of adequate restoration margin and / or restoration failure with subsequent leakage to the pulp was responsible for those cases that had poor outcomes.

**Summary**

Pulp therapy in the primary dentition remains a technique generating a tremendous amount of study. Formocresol has been and continues to be the most commonly used intra-pulpal medicament despite its known ability to escape the microcirculation of the pulp. Ferric sulfate has gained significant favor as a result of formocresol’s disadvantages, though at the cost of requiring a much more acute awareness of the potential for remaining disease and its ability to mask that process. Mineral trioxide aggregate perhaps offers the best immediate alternative to either of the above though at this time it is still cost-prohibitive in a practice that actively treats many children. And, as MTA has no fixative properties of its own, accurately analyzing the extent of the pulpal disease becomes even more critical to the overall success of the procedure. As with other techniques in dentistry, the debate is sure to continue for several years to come.

**Bibliography**


Current Trends in Primary Tooth Pulp Therapy

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Objectives

- Indications and contraindications for primary tooth pulp therapy
- The pulpotomy technique
- The Formocresol pulpotomy
- The Ferric Sulfate pulpotomy
- Other Medicaments for pulpotomies
- Indirect pulp treatment for the primary tooth

Indications for pulpotomies

- Asymptomatic, or symptoms suggestive of reversible pulpitis (elicited pain only of short duration, brief cold sensitivity, etc.)
- No clinical or radiographic signs of pathology
  - No sinus tract
  - No sulcular discharge
  - No abnormal mobility
  - Greater than 1/2 root remaining

Also, we typically treatment plan a primary molar for a pulpotomy if their is marginal ridge breakdown due to the expected depth of caries and proximity of the pulp.

Contraindications to pulpotomies

- Spontaneous (not elicited)
- Prolonged pain (may require medication)
- Abnormal mobility
- Percussion tenderness
- Sinus tract
- Sulcular discharge
- Radiographic signs of internal/external pathologic resorption
- Near exfoliation

Typical scenario

A child presenting to your office has been complaining of pain in a primary molar. The parent says the child was up at night crying and required pain medications to calm the tooth. Clinically, the tooth doesn’t look too bad and soft tissues look healthy. Radiographically, the tooth appears to be normal. What treatment is required?

Success of “emergency” pulpotomies

- Positive history of pain, yet absent clinical and radiographic signs of pulpal degeneration
- The temptation is to do a pulpotomy, even though the clinical history indicates a more aggressive therapy is needed

Only about 50% successful. Why?
Success of “emergency” pulpotomies

- Most “emergency pulpotomies” remain temporized.
- Failure in two areas:
  - Inadequate diagnosis of pathology beyond the canal orifice (pulpectomy or extraction indicated)
  - Leakage of the temporary and continued degeneration of the pulp.

If you are going to do pulpotomies on symptomatic teeth, at least put a crown on the tooth!

A review of the pulpotomy technique

- Case Selection
- Materials Selection
- Restoration type

Case Selection

- Healthy periodontal attachment as determined by clinical and radiographic diagnosis
  - no swelling
  - no spontaneous pain
  - no scelecal discharge
  - greater than 1/2 root
  - no abnormal mobility
- Anesthesia and rubber dam isolation

Coronal Access

- Entry into the pulp with a HS bur (#8 round, or #330)
- Amputation of pulp stumps with either sharp curette or slow speed round bur
  - as confidence in the handpieces is gained, the slow speed round bur becomes the method of choice for amputation of the pulp at the canal orifice. Prior to that, a spoon excavator should be used to minimize the chance of perforating the chamber floor.

Ideal Access

- mimics the outline of the tooth
- allows complete visualization of all canals
- pulp tissue is removed to the canal orifice
- little or no hemorrhage before medicament placement

Deep occlusal and interproximal caries. Healthy furcations on both. These teeth are candidates for pulpotomy therapy, assuming there have been no symptoms suggestive of irreversible pulpitis.

Hint - persitent bleeding often arises due to tissue present beneath an unroofed portion of the chamber - PARTICULARLY in the buccal area.
Coronal Amputation

- Pulp needs to be amputated to the canal orifice
  - Slow speed round bur
  - Sharp spoon curette
- Partial pulpectomy???

Placement of medicament

- Ideally, hemorrhage control is achieved easily with a lightly moistened cotton pellet PRIOR to placement of the medicament.
- However, most dentists use the medicated pellet to achieve hemostasis and provide fixing at the same time.
- Length of time depends upon the medicating agent being used (4-5 minutes for formocresol, and 2-3 minutes for Ferric Sulfate).

Is there a rational???

The original technique, described by Sweet in the 1930’s advised that no medicament be used on the pulp prior to evaluating whether the pulp could clot on its own. This was achieved by first amputating the pulp, then placing a cotton pellet slightly moistened with water onto the pulp stumps. Following approximately 5 minutes, the pellet was removed. If the stumps had clotted and remained non-hemorrhagic the pulp was judged to be healthy. If the pulp hemorrhaged, the tooth was judged to be hyperemic and further treatment was required.

Though this is the technique still taught didactically, only about half of pediatric dentists follow this technique, instead placing the medicament immediately following the pulpal amputation, and obtaining virtually the same results.

Evaluation of hemorrhage

- Removal of the medicated pellet should reveal a darkened, non-hemorrhaging pulp stump.
- Continued hemorrhage is indicative of:
  - Pulpitis extending beyond the canal orifice
  - Poor amputation procedure
  - Perforation

Placement of medicated base

- IRM or ZOE B&T are the classic bases used in pulpotomies
  - Obstructant qualities due to the eugenol
  - Antibacterial due to the eugenol
  - Somewhat resistant to microleakage
  - Relative high compressive strength (wears relatively well)
- However...
  - Eugenol is caustic to vital tissues and may contribute to pulpal degeneration

appropriate Restorations

- Crowns are still the #1 choice following pulp therapy
- Class I amalgams may be acceptable if tooth is within two years of exfoliating.

A word about crowns...

- Messer and Levering articles
  - Crowns are approximately 90% successful from the time of placement.
  - Most common reason for crown failure is due to misdiagnosis / failure of the pulp treatment.
  - Class II amalgams are significantly less successful than crowns (more on this later).
- Currently no long term studies evaluating class II composites to crowns in regard to success in pulpally treated teeth.

The Players in Pulp Therapy...
Currently used Medicaments

- **Formocresol**
  - full strength
  - 1:5 dilution

- **Ferric Sulfate**
  - Astringent
  - Cut-Trol

Regardless of the medication, the term “vital” pulp therapy is used as the goal is to retain as much vital tissue in the peri-apex as possible, in order to maintain a healthy environment for the permanent tooth.

**Formocresol**

- History
  - Developed in the 1930s
  - Technique altered in early 1960’s to decrease exposure and concentration
  - Studies routinely show a 70-90% range of success.
  - Still considered the “gold standard” by which all other intra-pulpal medicaments are judged.

- Availability
  - Sultan's Formocresol
    - 48.5% formaldehyde
    - 48.5% cresol
    - 3% glycerin
  - Buckley's
    - 19% formaldehyde
    - 35% cresol
    - 17.5% glycerin

In a study King, et al., 2002, pediatric dentists split down the middle. Few actually dilute as recommended by textbooks.

**Formocresol Research**

- Series of articles in late 70’s and early 80’s demonstrated that formocresol escapes the canals of dogs in very low amounts and enters the peripheral circulation.
- There was no conclusive evidence to demonstrate any long term sequelae from this escape.
- Other pulp agents available at that time also escaped the canal into the circulation and did not show as good of clinical success.
- 1:5 dilution has been found to be equally effective as full strength.

Myer’s and Pashley’s articles fueled the research to find other medications which would be as effective.

**Ferric Sulfate**

- Comparable success rate
- Does not cause the same amount of cellular destruction
- Does not escape the pulp canal

**Ferric Sulfate vs. Formocresol**

- Overall success of FS vs. Formo is about the same (75-85% over time).
- Seems to be less margin for error with FS. Why? - its ability to induce hemostasis even in unhealthy pulps may mask the need for further treatment.
- Survival rates begin to drop after about 40 months for both.
Pulpectomies for the Primary Dentition

Similar to the permanent dentition, pulpectomy for primary molars means the complete removal of the pulp.

Indications for Pulpectomies

- Non-vital or irreversibly inflamed primary second molars:
  - prior to the complete eruption of the permanent first molar
  - minimal mobility
  - minimal root resorption
  - minimal furcation involvement
  - minimal sulcular drainage
- Non-vital or irreversibly inflamed primary incisors prior to age 4
- Primary canines prior to age 6

Technique

- Anesthesia
- Rubber Dam Isolation
- Access is the same as for a pulpotomy

Access the canals starting with a #15 file and using no greater than a #35 file as the final file. The point is to debride the canal of diseased pulp with MINIMAL filing of the canal walls. The tortuous nature of the primary tooth canals make it nearly impossible to completely remove the diseased tissue without perforating!

Indirect Pulp Therapy for Primary Molars

- Slightly “short” fills have a better prognosis than “long” fills.
- You MUST use a resorbable paste such as un-reinforced ZOE (NOTIRM or ZOE B&T)
- A crown is the restoration of choice following treatment.

Indirect Pulp Therapy

Multiple studies are looking at the success of indirect pulp caps performed on primary molars as opposed to the routine performance of a pulpotomy.
- Essentially, the IPC for the primary molar is performed exactly the same as for a permanent tooth.

Thin layer of caries remains over the pulp.
IPC vs Formocresol Pulpotomy

• Indications for both procedures are the same
  – Asymptomatic or reversible signs only
  – No mobility
  – No drainage
  – No radiographic signs of pathologic resorption
• Research indicates the highest success rate for both modalities occurs when the tooth is definitely restored at the same visit.

Indirect pulp therapy

• Various studies suggest success rates above 90% (as successful as the FC pulpotomy)
• Advantage - no exposure to the FC
• Disadvantage - requires great skill to determine if the patient is giving you an accurate history of pain or sensitivity.
• Best success rates are achieved if a glass ionomer base followed by a crown is used

Conclusions…

• Variety of methods of providing pulp therapy to the primary dentition.
• Success is highly dependent upon an accurate pulpal diagnosis at the time of treatment.
• For vital pulpotomies, formocresol is still the gold standard, though Ferric Sulfate and MTA are promising alternatives.
• Indirect pulp therapy may be considered when the primary tooth is asymptomatic, there are no clinical signs of degenerative pulpal disease, and the caries can mostly be removed.
• Regardless of the technique, restoration with a crown and insuring the minimization of microleakage will yield the highest success rates!

References

1. Errors made in correctly diagnosing the extent of pulpal disease in children may include:
   a) misrepresentation of the nature of the pain
   b) failure to ask the appropriate questions
   c) poor radiographic technique/diagnosis
   d) all of the above

2. Which of the following clinical signs / symptoms is an indication for performing a pulpotomy?
   a) persistent thermal pain to heat
   b) deep caries on a primary molar that is near exfoliation
   c) moderate-depth dentinal caries
   d) pain elicited only by food impaction or sweets

3. The goal of vital pulp therapy is to maintain a healthy periapical environment for the developing tooth bud. For cases in which irreversible pulpitis has been diagnosed, a pulpotomy may successfully be performed.
   a) both statements are true
   b) both statements are false
   c) the first statement is true; the second statement is false
   d) the first statement is false; the second statement is true

4. Indirect pulp therapy in primary molars has:
   a) documented long-term success
   b) success rates approaching that of traditional pulp therapy
   c) the highest success rate when a stainless steel crown is placed
   d) all of the above

5. Pulpotomy refers to the removal of the entire pulp from a tooth. Pulpectomy refers to the removal of the coronal portion of the pulp.
   a) both statements are true
   b) the first statement is true; the second statement is false
   c) the first statement is false; the second statement is true
   d) both statements are false

6. Which of the following clinical signs/symptoms is a contraindication to performing a pulpotomy?
   a) sulcular drainage
   b) abnormal mobility
   c) percussion tenderness
   d) all of the above

7. Persistent bleeding from the canals indicates that a conventional pulpotomy is no longer indicated. Light bleeding in the buccal aspect of the primary molar access may be an indication of unexcavated tissue.
   a) both statements are true
   b) both statements are false
   c) the first statement is true; the second statement is false
   d) the first statement is false; the second statement is true

8. The restoration of choice for teeth that received pulp therapy is a stainless steel crown.
   T or F

9. The use of a rubber dam for isolation for pulpotomy procedures is mandatory.
   T or F

10. Which of the following materials is acceptable as a "filling" for primary teeth that have had pulpectomies performed?
    a) plain zinc oxide and eugenol paste
    b) IRM
    c) ZOE B&T
    d) all are acceptable filling materials

11. What is the purpose of completely de-roofing the chamber during the access procedure for pulpotomies?
    a) adequate visualization of the canals
    b) enhance the complete excavation of the coronal contents
    c) appropriately determine the pulpal status of all canals
    d) all of the above

12. Excavation of the chamber floor is best accomplished using which two instruments:
    a) sharp spoon excavator or high-speed handpiece
    b) slow-speed or high-speed handpiece
    c) sharp spoon excavator or slow-speed handpiece

13. Difficulties in achieving hemostasis from the canal orifices can be due to:
    a) poor amputation technique
    b) perforation of the chamber floor
    c) poor access into the chamber
    d) all of the above

14. Which of the following is true regarding formocresol use?
    a) a 1/5 dilution of formocresol is as effective as full strength
    b) the average long-term success rate of formocresol pulpotomies is >90%
    c) formocresol "fixes" the tissue all the way to the apex
    d) formocresol escapes the canals in significant quantities

15. Formocresol is rapidly redistributed by the microcirculation of the pulp. Reversible tissue damage has been noticed in histologic analysis of formocresol studies.
    a) both statements are true
    b) both statements are false
    c) the first statement is true; the second statement is false
    d) the first statement is false; the second statement is true

16. Glutaraldehyde, when compared to formocresol as an intrapulpal medicament:
    a) demonstrated a higher success rate
    b) was less stable during storage
    c) more quickly achieved tissue fixation
    d) does not break down as quickly

17. Ferric sulfate, when compared to formocresol as an intrapulpal medicament:
    a) demonstrates a success rate almost equivalent to formocresol
    b) has less potential for escape from the canals
    c) has a wider margin for diagnostic error

18. Mineral trioxide aggregate (MTA) has shown promise as an intrapulpal medicament. This is most likely due to its:
    a) greater ability to fix the pulp than formocresol or ferric sulfate
    b) ease of use
    c) ability to isolate the remaining healthy pulp tissue

19. The recommended intra-pulpal material to fill the chamber after completing the pulpotomy is a zinc-oxide and eugenol material. This is because of its:
    a) ability to isolate the pulp
    b) anti-bacterial properties
    c) ease of use
    d) cost-effectiveness

20. Primary molars receiving direct pulp therapy have the best prognosis if restored with stainless steel crowns. The best prognosis for primary molars receiving indirect pulp therapy is achieved when the teeth are restored with stainless steel crowns.
    a) both statements are true
    b) both statements are false
    c) the first statement is true; the second statement is false
    d) the first statement is false; the second statement is true
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KIDS’ DAY: A 10-YEAR PERSPECTIVE

By: Kevin L. Haney, DDS, MS, FACD

INTRODUCTION

Margaret Mead once said that a small group of people can effect a positive change. I would like to think that the College of Dentistry’s Kids’ Day program has tried to achieve that goal. In its ten-year history, Kids’ Day has provided treatment to over 1700 children, and approximately $44,000 in donations from donors.

STUDENT INVOLVEMENT

I first wrote an article about the program for the ODA Journal several years ago. When our Department of Pediatric Dentistry initiated the service project to fruition, I admit that I underestimated the capabilities of our students. Too often as faculty members, we think of the students as “kids” when in reality they are the mature adults that face many of the same daily decisions about life that we “older” dentists face. However, we aren’t trying to advance through an Ian I have always been amazed at the student turnout demonstrated on Kids’ Day. In 2007, almost the entire student body volunteered! It’s no easy task to organize that many students but the Kids’ Day Organization Committee gets it done, and done well. Volunteers generally recognize that the role they play from clinics, screening patients, or exposing and/or developing radiographs, no single task is less important than any other. They are equally vital to the success of the program.

No organ actual service day. One week following a given year’s event, a debriefing session is hosted in which the successes and failures of the just-completed services New leaders, selected from the rising classes, are invited to attend the debriefing session and offer their opinions. From experience, we’ve learned that philosophy in action.

VOLUNTEERING FACULTY AND STAFF

Where would we be without our faculty coverage? Whether employed by the College, serving as part-time faculty, or just wishing to help out our volunteer faculty are tremendously supportive. We’ve reached a point where recruiting faculty coverage is not an issue. Volunteer dentists now request the date of the event well in advance in order to place it on their calendars. The support from the pediatric dental community has been nothing less than outstanding.

Early in its history, however, the organizers of Kids’ Day recognized the need for faculty support beyond the specialty of pediatric dentistry. Today, general dentists and specialists in endodontics, oral pathology, orthodontics, and oral surgery now participate on a regular basis. Dental residents from several advanced general dental and specialty programs have also given generously of their time to help. And while their services may vary, there is also no doubt that staff support is crucial to the success of Kids’ Day. As the program has grown, so have staffing needs. Only two clinics were used in 1997. now, three clinics and three separate waiting areas require staff supervision. Our Central Sterilization and Clinic dispensaries are demanding but necessary work areas. These are the first areas to open in the morning and the last to shut down. The operational efficiency of these areas is testament to the personnel and their willingness to support the project.

DONORS

With the exception of food, the Kids’ Day project has never had to purchase any supplies. Outstanding support from local and national vendors is connected with Kids’ Day, including those who seek our care, appreciates the generosity and continued support of these donors.

OUR SOCIAL CONTRACT

Each of us that phrase the word “duty”. In the day-to-day task of teaching, faculty often overlook, or fail to verbalize, what dentistry’s obligation is to the community. We are a part of involved in the health and well-being of our community. In a sense, making students (and indeed all those who participate) aware of that special privilege and the obligation it entails is a major part of why Kids’ Day has been successful.

Many years ago, Dr. J. Dean Robertson donated his carefully catalogued library of Journal articles to our department. While reviewing those articles, I discovered something rather unique. Over the course of many years, Dr. Robertson had carefully made notes in the margins of many of the articles. These notes were not of a personal nature; they were more in the vein of “learning”. What I was seeing was life-long learning in action. Compassionate care possible has only grown stronger. Perhaps, that is really what Kids’ Day is all about.
Introduction

Children traumatize their teeth far more commonly than we realize. The daily play of a busy child often includes activities that adults consider rough. Indeed, if the six-year-old and younger child were older, many would consider the use of protective equipment to prevent facial injuries. Parents innocently dismiss many injuries to the teeth and supporting structures as inconsequential. In fact, many of these injuries lead to recognizable patterns of malformation of the permanent teeth. The intent of this article is broadly discuss injuries to the primary dentition and describe the long-term effects of those injuries. For a full description of the diagnosis and case management of specific traumatic injuries, one is advised to review any of several excellent textbooks published on the subject.

Child Abuse

No article addressing the issue of oral trauma to a child can be considered complete if mention is not made of the possibility of child abuse. In 2002, the state of Oklahoma experienced 35 confirmed deaths due to child abuse. While greater than 50% of these deaths occurred in children under one year of age, only 13% occurred in children over seven years of age. In 2006, over 13,000 confirmed cases of neglect/abuse occurred in our state, and once again the greatest majority were in children less than six years of age (OKDHS, 2006). As one can see, the greatest risk for child abuse occurs in children under seven years of age, and the risk of injury to the head and neck region has been reported to be between 50 and 75% of the reported cases (Needleman, 1986; Fonseca et al., 1992). Commonly reported injuries include ecchymosis, soft tissue lacerations and tears, tooth displacement, coronal and root fracture, and bony fracture. Importantly, these types of injuries are also commonly seen in children who experience playground accidents. An index of suspicion should be raised when the clinical findings do not match the reported cause. Simple questions such as "how did you bump your teeth" and "when did you bump your teeth" should routinely be asked. Oklahoma law requires that all suspected cases of child abuse or neglect be reported. Failure to report is considered a misdemeanor.

Incidence of Injury

Most dental injuries occur when children are beginning to walk and explore their surroundings, between 18 and 24 months, and occur to the anterior dentition. Another peak is found between six and nine years of age, with a definite predilection toward boys. Children with impaired mobility are also at greater risk for experiencing traumatic injuries. And while crown and root fractures can occur, displacement injuries are more commonly found in the primary dentition due primarily to the immaturity of the supporting structures.

Displacement Injuries

The majority of injuries in the primary dentition can be characterized as partial displacement injuries. The types of displacement injuries are: subluxation, lateral displacement, extrusion, and intrusion. The least severe of these are subluxation injuries. They typically result in bruising to the adjacent soft tissues, but with minimal to no abnormal mobility. While many subluxation injuries are managed outside of the dental office by parents, clinical and radiographic changes such as pathologic root resorption or canal obliteration can occur. Often, an incidental finding of a past injury is noted during a routine examination.

Lateral luxations (labial, palatal, or lingual) more frequently result in a child being seen for an emergency visit as the tooth is visibly displaced from its original position. Of these, intrusive injuries pose the greatest risk to the developing tooth bud (Andreasen and Andreasen, 1992). Clinically, the clinical crown appears to be short or, in extreme cases, completely missing. The assumption that a primary incisor has been avulsed is not wise, however, without a confirming occlusal radiograph. In many instances, the primary incisor has been completely intruded rather than being avulsed. Clinically, the condition of the soft tissue combined with the expected hemorrhage make an adequate visual examination very difficult.

Intruded primary incisors do have the potential to re-erupt, however the health of the pulp must be closely monitored. Tsukibashi (2000), as well as many others, has demonstrated cases in which spontaneous re-eruption will occur. Wilson (1995) has cautioned, however, that in severe cases of intrusion the risk of damage to the permanent incisor must be carefully weighed against the potential benefit of allowing the intruded primary incisor to re-erupt.

Extrusive injuries to primary incisors are less frequent. Clinically, the affected tooth will appear longer than the non-affected teeth. Radiographically, the periodontal ligament will be enlarged in the apical region. Depending upon the severity of the injury and degree of extrusion, treatment may range from simple occlusal adjustment to extraction. In severe cases, the temptation is to splint the primary tooth. With the exception of anecdotal reports of success, this course of treatment is not recommended unless segmental alveolar fractures accompany the extruded tooth. Short clinical crowns, young age, behavior, and difficulty fabricating an adequate splint have all been cited as reasons not to place a splint. Perhaps the best reason, however, is that the potential for damaging the developing permanent tooth bud outweighs the benefit of maintaining the traumatized incisor.
It is very difficult to reliably predict when damage will occur to developing permanent teeth. Of the luxation injuries that occur to primary incisors, the type carrying the greatest risk for causing damage to the permanent tooth bud is the labially displaced tooth. Such cases usually occur when a child falls while grasping an object between the incisors. As the crown is labially displaced the root of the primary incisors rotates around a center of axis, forcing the root into the developing tooth bud. The damage that results can range from no visible damage to severe dilacerations. In general, the younger the child is at the time of injury the greater the probability that a severe injury will result in significant damage to the permanent tooth bud. Depending upon the severity, consideration should be given to extracting the displaced primary tooth in these cases.

Avulsions occur less often than displacement injuries. As mentioned previously, an occlusal radiograph should be obtained to confirm the avulsion and rule out the possibility of complete intrusion. The benefit of replanting the avulsed primary incisor is countered by the risk of damaging the permanent tooth or altering its path of eruption. In general, early loss of a primary incisor will result in a delay of permanent tooth eruption, while loss occurring near the time of normal exfoliation may hasten the eruption. Space maintenance is not needed in these cases as space loss is inconsequential if primary cuspids have already erupted.

Sequeleae to the Primary Tooth

Discoloration

Perhaps the most frequent finding secondary to primary tooth trauma is tooth discoloration. Internal hemorrhage may leave the tooth pink or gray in color. Unlike permanent teeth, color change is not as predictive of tooth vitality. Early color change may indicate only that internal bleeding has occurred and that no treatment may be required. While color change occurring later on may indicate necrosis (Holan and Fuks, 1996), definitive treatment with a pulpectomy may not be required. Other factors such as clinical and radiographic findings, symptomology, and exfoliation status need to be evaluated prior to instituting treatment.

Another common sequela is calcific metamorphosis. This typically results when the injury occurs after the primary tooth apex has closed. The subtleties of color change may not be clinically visible, despite a finding of an obliterated pulp chamber and canal. Parents often have no recollection of a traumatic injury that would lead to calcific metamorphosis. Pulpal treatment is not recommended on these teeth. Esthetic management, with parent request, is the treatment of choice.

Internal and External Resorption

Unlike calcific metamorphosis, internal resorption is usually found in teeth that have been traumatized prior to the apex closing. Obviously then, traumatic injuries occurring prior to three years of age tend to have a higher probability of restoration. Unless the child presents soon after the traumatic event and is closely monitored, many traumatized teeth with internal resorption will progress to the point of non-restorability by the time the child presents to the office. This is especially true if the resorption is occurring in the root. On the other hand, internal resorption limited to the coronal aspects of the tooth may cause the tooth to become pink. If the astute parent seeks prompt care, the tooth may be successfully restored to function with a conventional pulpotomy and restoration.

External resorption of the primary incisor cannot successfully be treated. Unfortunately, this is a common sequela of repeated injury or severely displaced primary teeth. While the progress of the resorption may arrest without treatment, invariably the tooth will be lost.

Pulpal Necrosis

Pulpal necrosis can occur at any time following the injury. Necrosis occurs asymptotically in many cases. The presence of a sinus tract or the notation of an enlarged radiographic periodontal ligament may be the first suggestions that a tooth has been traumatized. Treatment will depend upon the age of the child, the state of exfoliative physiologic resorption, or the presence of other pathologic findings. Assuming the tooth is restorable, the practitioner should consider performing a pulpectomy and crown if the child is four years of age or younger.

Coronal and Root Fractures of Primary Incisors

Although displacement is by far the most common type of injury, coronal and root fractures of primary incisors are regularly seen and are perhaps under-reported in the literature. Minor fractures limited to the enamel of primary incisors may easily be treated by enameloplasty only, while more extensive enamel and dentin injuries may require more definitive care. Fractures include the pulp present further difficult in decision-making. It is well established that direct pulp caps of pulp exposures of primary teeth are contraindicated in the primary dentition as the risk of internal resorption is high. Depending upon the site of injury, traditional pulpotomy may be required and offers a better prognosis. Regardless, definitive treatment as near to the time of injury as possible provides the best prognosis (Andreassen and Andreassen, 1992).

Root fractures are the most infrequent of all fractures to primary incisors. Treatment will vary depending upon the site of the fracture. In general, vertical fractures will not respond to treatment; consequently, these teeth should be removed. Fractures located in the coronal third also present a poor prognosis as the placement of an adequate restoration is exceedingly difficult. On the other hand, fracture located in the middle to apical third may require no treatment other than monitoring. While the prognosis would still be guarded, these teeth often maintain themselves very nicely in the arch. Should the tooth become symptomatic, the occlusal segment can be removed. Attempts to remove the apical segment must carefully be weighed against the risk of damage to the developing permanent crown. Where retrieval can be accomplished easily, the attempt should be made. In many cases, however, it can be exceedingly difficult to adequately visualize the apical segment. Parents should be advised that the root tip remains and should be monitored. In most instances, physiologic resorption will usually solve the problem.
Sequelae to the Permanent Tooth

The extent of damage inflicted upon the permanent tooth by the injured primary tooth is dictated by the amount of force exerted, the direction of that force, and the degree of hard tissue development of the permanent tooth. Injuries occurring to primary incisors that are near exfoliation are far less likely to cause significant damage to the permanent tooth since the enamel of the permanent crown is already formed. Therefore, the earlier the injury occurs to the primary incisor, the greater the chance that the permanent tooth will be affected. These changes may range from mild enamel dysplasia or discolorations (hypoplastic changes) to severe dilacerations or coronal displacement and ectopic eruption. Rarely, arrested development of the permanent tooth may be seen.

Hypoplasia (Turner’s Tooth)

Focal hypoplasia and discolorations compose the majority of enamel disturbances found on permanent incisors. Lateral and intrusive luxations between two and five years of age are the primary cause of this type of injury. Due to disruption in the enamel formation process at the site of injury, esthetic restorative management is usually all that is required. In some mild cases, microabrasion techniques alone may be sufficient to resolve the color discrepancy.

Dilacerations

Despite its low reported frequency, dilacerations of the permanent incisors can be significantly disruptive to the normal arch development. The site of injury is most likely to be located more in the cemento-enamel junction area, and at a time when the crown has completed its mineralization process although it can occur at any point within the tooth. The majority are caused by labial and intrusive displacement injuries to the primary incisors. Depending upon the severity of the dilaceration, treatment may range from minor orthodontic realignment to extraction in severe cases.

Ectopic Eruption

Traumatized primary incisors frequently cause ectopic eruption of the permanent incisors and for a number of causes. In some cases, necrosis and subsequent abscess may displace the erupting permanent tooth. In other cases, the displacing force may redirect the eruption pattern of the permanent tooth. Obviously, the treatment will be variable depending upon the specific case.

Summary

The guiding principle in managing trauma to the primary dentition is potential sequelae to the permanent tooth. If the risk to the permanent tooth is great, the primary tooth should be removed. If esthetics are a concern to the parent, a number of appliances can be fabricated to temporarily manage this issue. It is important that parents realize that the desire to maintain optimum esthetics by maintaining a significantly injured primary tooth can, in many cases, cause more damage to the permanent tooth. Where avulsions have occurred, the old adage “when in doubt, leave it out” is still perhaps the most reliable advice.

References


Dentistry for the Child and Adolescent, 8th ed. McDonald and Avery. Mosby.


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