The use of dental sealants as part of an effective regime for preventing pit-and-fissure caries among children is a feature of many practices; however, there remain questions as to the indications for sealant use, placement over non-cavitated lesions, and optimal materials and techniques. A recent report from the American Dental Association Council on Scientific Affairs addressed these issues. The report was based on the deliberations of an expert panel who undertook a rigorous examination of available evidence, including evaluating its quality. It provides a resource to assist clinicians with their clinical decision-making, but is clear in stating that professional judgment and patient preference are important parts of the equation. The recommendations are a tool to guide clinically sound decisions about sealant use.

**Issues with Pit-and-Fissure Sealant Use**

The expert panel set out to address the following set of clinical and technical questions surrounding the use of pit-and-fissure sealants by reviewing the available literature on the use of sealants, grading the strength of the evidence, and providing recommendations, summarized in the Table (next page). The Table is excerpted from the full report published in *JADA*, which contains further details of the recommendations and grading system.

<table>
<thead>
<tr>
<th>Pit-and-fissure sealants are effective as part of a comprehensive approach to caries prevention.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What circumstances indicate that sealants should be placed to prevent caries?</strong></td>
</tr>
<tr>
<td>The panel concluded that resin-based sealants placed on the permanent molars of children and adolescents are effective for reducing caries; the incidence declined by 86% at one year, 79% at two years, and 59% at four years (evidence from systematic reviews of randomized controlled trials). When sealants are reapplied as needed, the incidence of occlusal caries on the first permanent molars of children is reduced by 76% at four years. Children and adolescents receiving sealants on first and second molars are less likely to require subsequent restorative procedures, or the timing of those procedures, when necessary, is...</td>
</tr>
</tbody>
</table>

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**In This Issue**

- Pit-and-Fissure Sealants: The Evidence for Clinical Use
- Periodontal Page
- Hygiene Page
- Clinical Practice
- Health Care Trends

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**Volume 18, Number 4, 2008**

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Resin-based sealants prove more effective in caries reduction at 24 to 44 months after placement than glass ionomer cement in the permanent teeth of children and adolescents. Furthermore, in a population with low caries incidence, placing glass ionomer cement on caries-free first primary molars is not effective in preventing caries. Glass ionomer cements, available in fluoride delivering forms, have unproven clinical benefit.

The recommendation to use resin-based sealant rather than glass ionomer cement is based on some of the strongest evidence evaluated. The panel pointed out that manufacturers’ instructions for sealant placement should be followed and a dry field should be maintained during placement. Glass ionomer cement is recommended as an interim agent where moisture control is of concern.

**What are the best techniques to optimize a sealant’s retention and effectiveness in caries prevention?**

The panel made several recommendations concerning placement techniques (not tabulated). The four-handed technique should be used if possible, whether placing resin-based sealants or glass ionomer cement. To maximize effectiveness, clinicians should monitor sealants and reapply as needed. 

As to surface preparation, the panel did not recommend routine mechanical preparation (e.g., air abrasion or modification with a bur) prior to acid etching. Also not recommended is the use of self-etching bonding agents that do not involve a separate etching step, because they may provide less retention than the standard acid-etching technique. There are one-

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### Extract from Evidence-Based Clinical Recommendations Regarding Pit-and-Fissure Sealants

<table>
<thead>
<tr>
<th>Topic</th>
<th>Recommendation</th>
<th>Grade of Evidence</th>
<th>Strength of Recommendation</th>
</tr>
</thead>
</table>
| Caries Prevention | When it is determined that the tooth or the patient is at risk of developing caries, sealants should be placed on pits and fissures of:  
- Children’s and adolescents’ permanent teeth  
- Adults’ permanent teeth  
- Children’s primary teeth | Ia, Ia, III | B, B, D |
| Non-cavitated Carious Lesions | Pit-and-fissure sealants should be placed on early (noncavitated) carious lesions to reduce the percentage of lesions that progress in:  
- Children, adolescents, and young adults  
- Adults | Ia, Ia | B, D |
| Resin-Based versus Glass Ionomer Cement | Resin-based sealants are the first choice of material for dental sealants | Ia | A |
| | Glass ionomer cement may be used as an interim preventive agent when there are indications for placement of a resin-based sealant but concerns about moisture control may compromise such placement | IV | D |

---

Can placing sealants over non-cavitated lesions prevent progression?

The panel could find no evidence that bacteria increase under sealants. The recommendation to place sealants over non-cavitated carious lesions applies to children, adolescents, and adults in order to reduce the fraction of lesions progressing. The footnote in the table defines such lesions, and the source JADA article contains several photographs as examples.

In terms of retention or caries prevention, are there advantages to placing resin-based sealants rather than glass ionomer cement?

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delayed (based on Medicaid and private insurer databases). A formal cost-effectiveness study showed that a risk-based strategy for the placement of dental sealants was cost-saving, and that universal sealant placement would cost less than a dollar per cavity-free year per tooth.

The recommendation to place sealants for caries prevention is also based on an assessment of a patient’s risk to develop caries. Dentists are therefore encouraged to incorporate caries risk assessment into their decision-making concerning the placement of pit-and-fissure sealants as a primary preventive measure. Because risk factors change with time, the risk of experiencing dental caries changes, calling for periodic reevaluation of caries risk status.
bottle bonding agents available that contain both an adhesive and a primer, and these may be used between the previously acid-etched enamel surface and the sealant material when, in the opinion of the dental professional, the bonding agent would enhance sealant retention in the clinical situation.

Consider Caries Epidemiology

Any decision regarding the use of sealants also entails the epidemiology of caries, allowing for an effective assessment of patient risk. Further, in diagnosing caries, the clinician also evaluates the extent of caries activity. Caries prevalence increases with age, and is higher among low income children and certain ethnic groups. About one quarter of carious lesions go untreated in children and young adults, and about 90% of caries are found in the pits and fissures of permanent molars. However, despite a rise in their use in recent decades, pit-and-fissure sealants are underused, particularly among those at high risk of developing caries. The U.S. Department of Health and Human Services, in its “Healthy People 2010” initiative, has stated its aim to increase the proportion of children receiving dental sealants on their molar teeth to 50% from the 30.5% reflected by national data collected to 2002.

Conclusion

On the basis of a critical, systematic, and comprehensive review of available evidence, the American Dental Association Council on Scientific Affairs recommends the use of pit-and-fissure sealants as part of an effective approach for both primary and secondary prevention of caries and caries progression. However, the role of the dental practitioner is vital to the decision-making process; caries risk assessment is an important component requiring periodic reevaluation to coincide with patients’ increasing age or other changes in risk factors.

References


Educational Objectives

After reading this issue of the Colgate Oral Care Report and correctly answering the questions in The Forsyth Institute Continuing Education Program, you will:

1. become familiar with the American Dental Association’s recent recommendations for the indications for sealant use, their placement over non-cavitated lesions, and the optimal materials and techniques used in their placement.

2. understand the clinical implications of a recent application of the National Health and Nutrition Examination Survey data to the relationship between diabetes and periodontal disease.

3. know the results of a recent study assessing evidence-based data on safety outcomes of providing periodontal treatment and essential dental treatment to pregnant women.

4. learn the results of two studies to determine if low levels of mercury from amalgam have greater deleterious health and developmental outcomes on children compared to those receiving non-amalgam dental restorations.
The Association Between Periodontal Disease and the Risk of Type 2 Diabetes

Although the association between type 2 diabetes and periodontal disease is well documented, periodontal disease has traditionally been considered a consequence of diabetes.\(^1\) Given the evidence suggesting periodontal disease as a risk factor for atherosclerotic cardiovascular disease, and the view that diabetes is a cardiovascular disease,\(^2,3\) it has been hypothesized that periodontal disease may contribute to the development of type 2 diabetes, possibly as a result of the chronic inflammation characterizing periodontal disease.\(^1\)

Using National Health and Nutrition Examination Survey (NHANESI) data, Demmer and colleagues assessed the association between baseline clinical periodontal disease and the risk of subsequent diabetes in a cohort (n = 9296) that was diabetes-free at baseline.\(^1\) The periodontal index\(^4\) represents an average of scores for all teeth for a given participant, and ranges over a continuum from 0 to 8 for each tooth, with a score of 8 representing advanced tooth destruction. Using the periodontal index, baseline periodontal disease status was defined, and dentate participants were divided into six categories. Subjects with a periodontal index (PI) of zero were classified as periodontally healthy (PI0; n = 3368), and the remaining participants were classified into quintiles of continuous PI values from the most to the least periodontally healthy (PI1 to PI5; n = 762, 761, 759, 759, 760, respectively). Edentulous subjects comprised a seventh grouping (n = 2127).\(^1\)

Any association between baseline periodontal disease and the cumulative incidence of diabetes was assessed using logistic regression analysis. Data on potential confounding variables were collected, including age, sex, race, poverty index, education level, body mass index (BMI), subscapular and triceps skin fold, physical activity, total cholesterol, hypertension, and cigarette smoking history. Covariate adjustment was used to address the impact of confounding variables on diabetes risk.

Over a 17 (± 4)-year follow-up, 817 incident cases of diabetes were reported, representing a cumulative incidence of nine percent.\(^1\) Strong predictors of incident diabetes included age, sex, education level, BMI, subscapular skin fold, and hypertension. The figure above shows several models that adjusted for the influence of various factors compared to periodontally healthy participants in group PI0, where the risk of diabetes was used as the reference point (odds ratio = 1; dashed line). Model 1 represents the crude rate for incident diabetes (no adjustments; dark blue bars), while Models 2 to 4 represent various adjustments considering risk factors for diabetes, as indicated. Further adjustment to account for

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**Odds Ratios for Incident Diabetes by Category of Baseline Periodontal Index Relative to Periodontally Healthy Individuals**

- **Model 1**: Crude rate for incident diabetes compared to PI0
- **Model 2**: Adjusted for age, sex, education, smoking
- **Model 3**: Model 2 and adjusted for BMI, subscapular skin fold, and physical activity
- **Model 4**: Model 3 and adjusted for hypertension and cholesterol

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**Baseline periodontal disease is a clinically relevant predictor of type 2 diabetes, independent of other established diabetes risk factors.** Patients with periodontal disease may benefit from a referral by their dental practitioner to a physician for assessment of diabetes.
socioeconomic status did not significantly affect the results (model not shown).

Results showed that the odds ratios for incident diabetes varied across periodontal index categories in a nonlinear manner, with increases in the odds of developing diabetes observed for subjects in categories PI3, PI4, and PI5 compared to those in the PI0 category. Of importance, when confounding factors were removed from the analysis in the various models, the risk of diabetes remained higher in the groups with poor periodontal health. The highest odds ratios for diabetes were recorded for men in the PI4 group and for women in the PI3 group. No odds ratio gradient was observed among blacks in the various periodontal disease categories.

Interestingly, edentulous subjects also had an increase in risk for diabetes compared to those in the PI0 category, but had a lower risk than those with intermediate tooth loss (e.g., the PI3 group). This observation is consistent with data from the Oral Infections and Vascular Disease Epidemiology Study, which demonstrated a higher incidence of cardiovascular disease by reducing lifetime oral infection exposure, and perhaps this is similar for diabetes.

Conclusions

Baseline periodontal disease has a positive, nonlinear association with incident type 2 diabetes. This study demonstrates a 50 to 100 percent increase in diabetes odds associated with periodontal disease, a finding that is both clinically relevant and comparable to other established type 2 diabetes risk factors.

References


Continued from Clinical Practice p. 8

… both trials suggest that children exposed to dental amalgam will not have effects on neurobehavioral or neurological development.

research investigating the effects of low-level mercury exposure in children with a genetic polymorphism for sensitivity to mercury, and studying potential health effects of composite resin, the most widely used alternative to amalgam. However, for the present, both trials suggest that children exposed to dental amalgam will not have effects on neurobehavioral or neurological development. This finding suggests that removal of existing dental amalgam in children is not necessary, and that dental amalgam remains a viable restorative treatment option in children. Further, to allay fears about the effects of mercury exposure through amalgam, these results may benefit from dissemination via patient education and professional publications.

References


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Is Dental Treatment of Pregnant Women Safe?

Because periodontal disease may confer a greater risk for preterm deliveries or low birth weight babies to pregnant women, the American Academy of Periodontology recommends that currently or potentially future pregnant women undergo a periodontal examination and be provided with appropriate preventive or therapeutic care.¹ But in practice, only 25% to 50% of women in the US, and even less among those in low socioeconomic strata, receive dental treatment during their pregnancies.²

Why are Women Less Likely to Receive Dental Care During Their Pregnancies?

Behaviors of both patients and dental professionals may explain this phenomenon. On the one hand, women attend a lower number of dentist consultations during their pregnancies. On the other hand, perhaps due to a lack of objective data on the safety of providing dental treatments to pregnant women, dental professionals may limit treatment over concerns about potentially harming the fetus. Supporting this hypothesis, Pistorius and colleagues revealed that only about half of the 702 dentists surveyed in their study considered that they were sufficiently informed and educated about the treatment of pregnant patients.³

Studying Evidence-Based Data on Safety Outcomes

The aim of a study by Michalowicz, et al., the first of its kind, was to supply evidence-based data on safety outcomes of providing periodontal treatment and essential dental treatment (EDT) to pregnant women.⁴ The study population of the Obstetrics and Periodontal Therapy (OPT) trial consisted of 823 pregnant women with generalized slight-to-moderate periodontitis, defined as the presence of four or more teeth with a probing depth of at least 4 mm, a clinical attachment loss of at least 2 mm, and bleeding on probing at 35% or more of tooth sites. The subjects were randomly assigned to receive scaling and root planing either at 13 to 21 weeks of pregnancy (periodontal treatment group; n = 395) or up to 3 months after delivery (control group; n = 428). All subjects were also evaluated for EDT needs, defined as the presence of decayed, fractured, or abscessed teeth. Dental treatments, performed on 351 women (177 and 174 randomized to the periodontal treatment and control groups, respectively, of which 72.1% of the total were evaluated as needing EDT), consisted of temporary or permanent restorations, endodontic therapy, or tooth extraction.

Serious adverse events and pregnancy outcomes included events which resulted in termination of pregnancy, such as spontaneous abortions before 20 weeks and stillbirths between 20 weeks and 36 weeks 5 days, or those that did not result in pregnancy termination, such as hospitalizations (for more than 24 hours because of labor pain or of any duration for any other reason), preterm births, fetal or congenital anomalies, and neonatal deaths.

Continued on p. 8

Adapted from Michalowicz, et al., 2008⁴

The ratios represent the number of subjects with events over the total number of subjects.
Mercury has been used commercially and medically for centuries. It can be found in thermometers, blood pressure cuffs, batteries, and fluorescent light bulbs. Physical exposure of the general public to mercury can occur through fish consumption, vaccines, and dental amalgam.¹

Dental amalgam fillings, which are approximately 50% mercury,² release mercury vapor into the oral cavity which is inhaled and absorbed into the bloodstream, representing low-level mercury exposure. Exposure to high levels of mercury can affect the nervous, digestive, and respiratory systems, as well as the kidneys.¹ Since neurological damage can be an outcome of high-level exposure, there have been studies investigating links between mercury vapor exposure and various neurological conditions. A 2005 review found insufficient evidence to support a relationship between low-level mercury exposure from dental amalgam and adult health problems.³ However, there has been little data on the effects of dental amalgam restorations and psychosocial symptoms in children.

### Assessing the Effects of Mercury Exposure in Children

Two randomized controlled trials, the Casa Pia trial² and the New England Children’s Amalgam Trial (NECAT),⁴ tested the hypothesis that children exposed to low levels of mercury from amalgam may have more deleterious health and developmental outcomes than children receiving composite resin (i.e., non-amalgam) dental restorations. Both trials collected urine samples to determine mercury levels in the children. Various outcome measures were used to assess possible neurobehavioral changes during the study.

#### Dental amalgam does not appear to be deleterious to the psychosocial development of elementary school-aged children.

### The Casa Pia Trial

The Casa Pia² study used outcome measures that assessed visual and verbal learning, memory, attention, concentration, motor and visual motor skills, and nerve conduction velocities. At the end of the study, children in the amalgam group had significantly higher urinary mercury levels than children in the composite resin group; however, this difference did not translate into a disparity in neurological function indices, with no statistical differences found in outcome measures between the two treatment groups.²

### The NECAT Study

NECAT measured competence, behavioral problems, social adaptation, and emotional disturbances in the two groups. In this trial, surface-years of amalgam were also prospectively calculated to determine mercury exposure. Contrary to their original hypothesis, significant group differences that favored the amalgam group significantly improved in CBCL categories of: competence, total behavior problems, and three additional subscales¹.

Continued on p. 8

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### Major Elements of the Casa Pia Trial² and New England Children’s Amalgam Trial⁴

<table>
<thead>
<tr>
<th>Type of Trial</th>
<th>Casa Pia²</th>
<th>NECAT⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country of Origin</td>
<td>Portugal</td>
<td>U.S.</td>
</tr>
<tr>
<td>Total Number of Participants</td>
<td>507</td>
<td>395</td>
</tr>
<tr>
<td>– Amalgam Group</td>
<td>253</td>
<td>197</td>
</tr>
<tr>
<td>– Composite Resin Group</td>
<td>254</td>
<td>198</td>
</tr>
<tr>
<td>Age Range</td>
<td>8-10 years</td>
<td>6-10 years</td>
</tr>
<tr>
<td>Frequency / Length of Follow-up</td>
<td>Annually for 7 years</td>
<td>Semi-annually for 5 years</td>
</tr>
<tr>
<td>Mercury Level Determination</td>
<td>Urinalysis</td>
<td>Urinalysis &amp; dental surface-years of amalgam exposure</td>
</tr>
</tbody>
</table>
| Behavioral Outcomes Measured | • RAVL & VL: Memory  
• Attention/Concentration⁵  
• Motor and visual motor⁵  
• Nerve conduction velocity | • CBCL: Competence; and internalizing, externalizing, and total behavior problems  
• BASC-SR: Clinical, school, personal, and emotional adjustment |
| Results | • No difference between groups was found for any measured outcomes | • Amalgam group significantly improved in CBCL categories of: competence, total behavior problems, and three additional subscales¹ |


⁵ These outcomes were measured by various tests listed in DeRouen, 2006²

¹ Subscales of CBCL with significant differences: activities, anxious/depressed and delinquent behaviors
Continued from Hygiene Page 6

Are There Adverse Events and Pregnancy Outcomes Associated with EDT and Periodontal Treatment?

The risk of all serious adverse events and adverse pregnancy outcomes has been compared among four groups of patients, defined according to the combination of EDT and periodontal treatment received (see Figure on page 6). The distribution of adverse events and pregnancy outcomes was not significantly different among the four groups, even after adjusting for the propensity to receive EDT according to the baseline characteristics of the patients included in each group. In addition, the rates of adverse events did not significantly differ whether women received complete EDT, needed but did not receive complete EDT, or did not need EDT. These findings are supported by those of two other randomized controlled trials suggesting that periodontal treatment of pregnant women did not increase the risk of spontaneous abortion.5,6

The Obstetrics and Periodontal Therapy trial found that essential dental treatment administered between 13 and 21 weeks of pregnancy, and the use of topical and local anesthetics for scaling and root planing, are safe in pregnant women; treatment outside the 13- to 21-week time frame was not assessed in this study. Because women may require even more dental and periodontal care when they are pregnant due to the effects of hormonal changes and a predisposition to nausea and vomiting, it is important for dental care professionals to be aware and assured that providing pregnant patients with appropriate preventive or therapeutic care does not increase the risk of serious adverse events or of adverse pregnancy outcomes. Emphasizing the safety of dental treatment for pregnant women through professional and lay publications may encourage continued good oral healthcare throughout pregnancy.

Conclusion

Essential dental treatment administered between 13 and 21 weeks of pregnancy, and the use of topical and local anesthetics for scaling and root planing, are safe in pregnant women; treatment outside the 13- to 21-week time frame was not assessed in this study. Because women may require even more dental and periodontal care when they are pregnant due to the effects of hormonal changes and a predisposition to nausea and vomiting, it is important for dental care professionals to be aware and assured that providing pregnant patients with appropriate preventive or therapeutic care does not increase the risk of serious adverse events or of adverse pregnancy outcomes. Emphasizing the safety of dental treatment for pregnant women through professional and lay publications may encourage continued good oral healthcare throughout pregnancy.

References


The results of these trials highlight the need for further study...
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Emphasizing Oral Health Promotion with an Expanded Allied Dental Workforce

Joan I. Gluch, RDH, Ph.D.

In previous Trends columns throughout the past year, discussion has focused on the significant burden of oral disease throughout the world, and the many oral health and general health problems that result from both the presence of dental diseases, as well as a lack of access to dental care. In addition, the Trends columns have identified creative solutions to addressing and increasing access to care, including the integration of oral health care within general health care by nurses and physicians. Two common and consistent themes have emerged that bear closer examination in this last Trends column for 2008: emphasis on oral health promotion and disease prevention; and expansion and full utilization of the allied dental workforce.

The World Health Organization has recently clarified and reoriented the Global Oral Health Programme to focus on disease prevention and promotion of oral health.1 Health promotion orientation emphasizes a “root cause” approach that addresses the full spectrum of care, from primary prevention before disease inception to tertiary care, including restoration and rehabilitation. Oral health promotion has become an essential component of care, and forms a critical component in the management of chronic endemic diseases, such as dental caries and periodontal diseases. The centrality of health promotion activities emphasizes that oral health is an essential part of total health, and vital to the quality of life throughout the age spectrum and across disciplinary boundaries.

The central nature of health promotion leads to a wider inclusion and definition for providers of oral health care, and acknowledges the critical role of the wide range and functions of allied dental providers. In the United States, multiple emerging models have been proposed and are demonstrating the crucial role of mid-level practitioners to extend both oral health promotion and dental care to underserved populations.2,3

Certainly, from an international perspective, the continued growth and evolution of the dental therapists has been long demonstrated to increase access to dental care, especially for children, and recent efforts in both Britain and elsewhere have extended the benefits of care to more individuals. However, greater efforts are needed throughout the world to maximize the use of current allied dental providers, and incorporate emerging models for dental care professionals in order to address dental workforce issues in a planned intentional manner.4

Ultimately, the oral health of our citizens is at stake, and our ethical and professional responsibilities mandate the highest level of effort to improve the oral health outcomes for our global community. Disparities in oral health care based on racial, ethnic, or socioeconomic characteristics can no longer be tolerated in a world where community-based programs, based on innovative partnership models, exist and flourish in many communities.4

Extending all the benefits of oral health promotion and dental care to improve oral health status becomes our most important professional challenge for the 21st century. Employing the dual emphasis of health promotion and full use of all allied dental professionals provides the pathway to meet and achieve our goals.5

References


1. Which of the following statements is TRUE?
   a) Glass ionomer cements are the best choice in sealant material.
   b) Sealants should be placed on the pits and fissures of all children, adolescents, and adults.
   c) Caries risk assessment is a crucial component of the decision-making process where sealants are concerned.
   d) Pit-and-fissure sealants have no role in caries prevention for children’s primary teeth.
   c) is no longer suitable for those of elementary school age.
   d) a and c

2. Concerning the placement of pit-and-fissure sealants over non-cavitated lesions, which of the following statements is FALSE?
   a) Placement over non-cavitated lesions can slow caries progression.
   b) Bacterial growth increases under sealants.
   c) Placement over non-cavitated lesions can benefit children, adolescents, young adults, and adults.
   d) All of the above

3. Concerning techniques for placing pit-and-fissure sealants, which of the following statements are TRUE?
   a) Four hands are better than two.
   b) Acid etching is best effected through the use of self-etching bonding agents.
   c) Air abrasion or modification with a bur should always precede acid etching.
   d) None of the above

4. Which statement best reflects the target for sealant placement set by the “Healthy People 2010” initiative?
   a) 30%, up from 8%
   b) 50%, up from 15%
   c) 30%, up from 15%
   d) 50%, up from 30%

5. According to the best available evidence, what reduction in caries results from the placement of resin-based sealants on the permanent molars of children and adolescents?
   a) 86% in the first year
   b) 79% at two years
   c) 59% at four years
   d) All of the above

6. Physical exposure to mercury can occur through which of the following ways?
   a) Vaccines
   b) Dental amalgam
   c) Fish consumption
   d) All of the above

7. Dental amalgam
   a) is comprised of approximately 50% mercury.
   b) causes high-level mercury exposure.
   c) is less safe than non-amalgam restorations.
   d) All of the above

8. Clinical trials that investigated mercury exposure from dental amalgam and psychosocial development in children found that amalgam use
   a) is linked to neurological deficits.
   b) does not appear to have deleterious effects.

9. A factor(s) that has (have) been suggested to influence an individual’s sensitivity to elemental mercury is (are):
   a) genetic polymorphisms.
   b) country of birth.
   c) oral hygiene.
   d) All of the above

10. What proportion of women in the US receives dental treatment during their pregnancies?
    a) 0% to 25%
    b) 25% to 50%
    c) 50% to 75%
    d) 75% to 100%

11. What is (are) the most likely reason(s) that women do not receive adequate dental treatment during their pregnancies?
    a) Pregnant women limit the number of visits to the dentist.
    b) There has been a general lack of evidence-based information about dental treatment for pregnant women.
    c) Dentists may fear that dental treatment could harm the fetus.
    d) All of the above

12. From the findings of the Obstetrics and Periodontal Therapy trial, which of the following statements is (are) true?
    a) Essential dental treatment administered between 13 and 21 weeks of pregnancy is safe.
    b) The use of topical and local anesthetics for scaling and root planing is safe in pregnant women.
    c) Periodontal treatment of pregnant women does not increase the risk of spontaneous abortions.
    d) All of the above

13. Which of the following statements is (are) true?
    a) Periodontal disease has traditionally been considered a consequence of diabetes.
    b) Evidence suggests that periodontal disease is a risk factor for atherosclerotic cardiovascular disease.
    c) Periodontal disease is a predictor of type 2 diabetes development.
    d) All of the above

14. Periodontal disease was reported to be associated with an increase in type 2 diabetes risk odds, which ranged from
    a) 5 to 10%.
    b) 25 to 50%.
    c) 50 to 100%.
    d) 500 to 1000%.

15. Which of the following is true?
    a) Edentulism was associated with the greatest risk for type 2 diabetes.
    b) Dental patients have significantly lower diabetes risk compared to those with intermediate tooth loss.
    c) Patients with intermediate tooth loss are at the lowest risk of diabetes.
    d) None of the above