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*Achieving Isolation to
Avoid its Adverse Effects*

By Christopher Canizares, DMD

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Saliva Contamination

Achieving Isolation to Avoid its Adverse Effects

ABSTRACT

Despite its importance for dental health and normal digestive function, saliva can have an adverse effect on restorative materials and dental procedures. To prevent a negative outcome, care must be taken to avoid contamination by saliva. Practitioners have a number of methods for controlling saliva, and new systems and materials are currently in development. Methods for preventing saliva contamination vary widely amongst practitioners, and across specialties, for logistical reasons. Research comparing the merits of different methods can yield ambiguous results. Therefore, more research is needed.

EDUCATIONAL OBJECTIVES

The goal of this course is to provide information on best methods for preventing saliva contamination in dental, orthodontic and endodontic procedures. After completing this article, the reader will:

1. Understand some of the natural benefits of saliva
2. Understand how salivary contamination can adversely affect restorations and root canals
3. Have learned about various methods of moisture contamination control
4. Understand the pros/cons of various methods of moisture control
5. Recognize clinical implications in the field of pediatric dentistry and orthodontics.

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Introduction

The production of saliva is not only integral for swallowing and digestion, but is also important in maintaining a healthy dentition. Patients suffering from decreased salivary production, whether due to disease, medication, or radiation therapy, are shown to be more likely to suffer from dental caries. A review by Rabelo et al. lists six characteristics of saliva that make it an important biologic deterrent to the progression of dental caries. Among the six are saliva's ability to clear substances from the oral cavity, buffer dietary acids, and provide a reservoir of mineral content, such as calcium and fluoride, that are important for remineralization.¹ Despite its known benefits to the oral cavity, saliva can have a negative effect on dental restorations and various procedures. In addition to saliva, crevicular fluid, and also often blood, can contaminate the dental field and contribute to these adverse effects. Various efforts are routinely undertaken to prevent contamination.

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Effects of Salivary Contamination on Restorations

The advent of adhesive dentistry has revolutionized dental restorations, and the field of dentistry, in general. Optimally, these types of restorations can provide some advantages over their traditional amalgam counterparts. These include increased micromechanical retention, prevention of leakage (resulting in less recurrent caries), and more conservative tooth preparations. However, to be effective, a dry field is of utmost importance. Although saliva is composed of 99.4% water, macromolecules such as proteins and sugar (among others), as well as organic and inorganic particles are also present.² These substances can negatively impact bonds by interacting with an acid-prepared tooth surface. The surface absorbs these materials, leaving it in compromised condition for optimal bonding.² Other potential effects of salivary contamination include discoloration, sensitivity, and decrease in mechanical properties such as hardness.³

A 2017 literature review by Nair et al. surveyed 54 studies, evaluating various bonding systems (2-step etch-and-rinse, 3-step etch-and-rinse, and both 1-step and 2-step self-etch systems) to compare the impact of salivary contamination. This review found that saliva contamination (during one or several stages of the restorative process) statistically showed an adverse effect on adhesives (64.6%). However, of those systems included in the review, 2-step etch-and-rinse adhesives were slightly more forgiving of salivary contamination.² Although these numbers might seem daunting, the review did provide some other, more encouraging, findings. Many of the articles cited in this review discussed decontamination techniques such as rinse/dry and re-etching of the contaminated surfaces to improve restorative success. Reviewers found that 65% of the studies claimed restored or enhanced bond strength after utilizing one of these techniques.² If nothing else, this thorough overview reinforces the need for proper moisture control.

Although this section focuses on adhesive dentistry,

it is important to note that salivary contamination can negatively affect amalgam restorations as well. It has been long known that saliva can impact the physical properties of amalgams. For example, a 1981 study by Yamada and Fusayama found that saliva contamination affected the setting dimensional change of amalgams containing zinc, and had an adverse effect on compressive strength and creep value.⁴ Although amalgam restorations may not be as negatively impacted by saliva contamination as composites, maintaining a dry dental field is still important.

Effects of Saliva Contamination on Root Canaled Teeth

Prevention of saliva contamination is of utmost importance during root canal therapy. It is important for several reasons, the most critical of which are: 1) maintaining an aseptic field, and 2) prevention of microbial contamination inside of the tooth. If a practitioner is unable to completely dry the root canal space prior to obturation, contamination of the root canal dentin can adversely affect the setting of apical root canal sealers and may lead to a higher incidence of leakage.⁵ A 2007 study by Roggendorf et al. found that the effect of moisture contamination may also depend on the type of sealer used. In this study, 120 single-rooted teeth were instrumented and randomly assigned to 10 experimental groups and 1 control. The teeth were dried before obturation, and then split into experimental groups using various sealers. Half the teeth remained dried while the others were remoistened. A methylene blue dye penetration test was used to determine the extent of microleakage. This study found higher values of microleakage for AH Plus and Ketac-Endo, while the use of Apexit, RoekoSeal, and Tubli-Seal resulted in less microleakage when moisture was reintroduced.⁵ Thus, microleakage of root canal fillings differed significantly according to sealer type and combination of sealer and moisture.⁵

Even after completion of the root canal, saliva contamination can result in failure. As with bonding of restorations, saliva can inhibit bonds within the prepared canal. A 2017 study by Yaman et al. tested the effects



of saliva contamination on bond strength of fiber posts cemented with self-adhesive resin cements. Researchers also compared different canal cleansing agents. This study tested 60 lower premolar roots and found that saliva contamination negatively affected bond strength of cemented fiber posts.⁶ The use of cleansing agents, such as chlorhexidine, ethanol, and phosphoric acid, however, can improve the bonds of saliva-contaminated dentin surfaces.⁶

It should be noted that faulty temporary and permanent restorations can have a negative effect on root canal treated teeth even after the root canal is completed. Without a proper seal to keep bacteria and saliva out, recurrent caries or recontamination of a root canal are a danger.

Methods of Contamination Control

Various methods can be employed to address saliva contamination and prevent associated adverse effects. Practitioners often prefer different methods for different procedures. Methods include the use of cotton rolls, intraoral mirrors and dry angles, four-handed dentistry, rubber dams, and isolation systems.

Cotton Rolls/Cotton Roll Substitutes

Cotton rolls are a commonly used, practical, and cost-effective tool for saliva control. They are frequently used during restorative, fixed, and endodontic procedures, both alone and in combination with other methods of contamination prevention. Cotton rolls have certain qualities that make them preferable for use by many clinicians. First, and to some most important, they are inexpensive. Cotton rolls are also versatile; they can be placed in either the buccal vestibule or beneath the tongue, serving to displace the cheeks and tongue away from the operatory field (Figure 1). This helps with contamination control, and also to keep these anatomical structures away from instruments and burs that could cause injury.

Cotton roll use, however, is not without its disadvantages. For starters, the rolls need to be replaced as they absorb moisture from the oral cavity, and care

must be taken not to contaminate the dental field when doing so. Moreover, the rolls can move during the procedure, particularly when placed underneath the tongue. It is often necessary to use a mirror or other instrument to maintain their position, or else to have an assistant keep them in place via four-handed dentistry.

Regarding the efficacy of cotton rolls for contamination control during the placement of dental restorations, the findings are equivocal. Proponents of the rubber dam will argue that cotton rolls are a less effective method, resulting in a higher frequency of restoration failures. However, other studies show different results. A systematic review by Cajazeira, De Sabóia, and Maia compared the use of rubber dams to cotton rolls (in combination with a saliva ejector) for moisture contamination control efficacy, mainly in its effect on the longevity of tooth-colored dental restorations. The review included five randomized clinical trials with a minimum follow-up period of 12 months, and found that in four of the studies analyzed, the use of a rubber dam did not especially promote longevity of these restorations, as compared to the use of cotton rolls and saliva ejector use.⁷ The authors do go on to state, however, that these findings do not urge clinicians to forgo rubber dam use in favor of cotton rolls; rubber dams have other benefits, such as better protection



Figure 1. Patient with cotton rolls in buccal vestibule and under the tongue

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for soft tissue structures and aspiration prevention, that may make them more suitable for particular procedures.⁷ Studies with longer follow-up periods show similar findings. For instance, a study by Raskin et al. investigated 100 Class I and Class II composite restorations completed by a single operator with the use of rubber dam, or cotton rolls and saliva ejector. Restorations were reviewed after 1 week, and then within 1 month of placement. They were subsequently examined at 6 months, and then 1, 2, 3, 4, 5, 6, and 10 years.⁸ Failures were not significantly associated with the method of isolation used at the time the restoration was placed.⁸ As is common in the world of dentistry, more studies are needed to thoroughly assess the efficacy of these methods for saliva contamination control.

Examples of replacement options for cotton rolls are Dri-Angles and DryTips. These absorbent pads are placed on the buccal mucosa and cover the Stensen's duct of the parotid gland (Figure 2). These replacements are relatively inexpensive and can be useful during a variety of procedures, including the placement of restorations and bonding of orthodontic brackets (Figure 3).

Cheek Retractors

Cheek retractors can augment the saliva control accomplished with cotton rolls, Dri-Angles, mirrors, and/or saliva ejectors. An advantage of cheek retractors is that the patient can bite down to help keep it in place. Care must still be taken to avoid saliva pooling in the sublingual area and in the buccal vestibules. Cheek retractors are very commonly used in bonding orthodontic brackets.

Rubber Dam

The rubber dam has been widely used in the field of dentistry since its invention by Sanford Christie Barnum in 1864. It has been indicated for use in a wide range of procedures ranging from restorations and root canals to placement of orthodontic brackets, and even the application of sealants. The list of its purported



Figure 2. Dri-Angle, cotton roll substitute of buccal mucosa.

benefits include improved protection against moisture contamination, enhanced visibility, better access, prevention of aspiration of instruments or materials, and better tongue and lip control.⁹

Despite its almost ubiquitous use during dental school and residency training, use of rubber dams in everyday dental practice is not nearly as common, especially among general dentists (Figure 4). For instance, a study by the Dental Practice-Based Research Network investigated the use of rubber dams by general



Figure 3. Patient with cheek retractor with the suction system incorporated in it.



dentists during restorative procedures. This network covers five regions: Alabama/Mississippi, Florida/Georgia, Minnesota, Permanente Dental Associates, and Scandinavia. In this study, 229 dentists collected data on 9890 consecutive restorations on previously unrestored teeth from 5810 patients.¹⁰ The majority of dentists (63%) did not use a rubber dam for any restoration in the study. Only 12% of the total restorations were completed with a rubber dam.¹⁰ This study also found that rubber dams were used more for maxillary anterior restorations. In addition, it was found that dentists performing restorations of Classes I, II, or IV were significantly more likely to use a rubber dam.¹⁰

A different study conducted by the National Dental Practice-Based Research Network investigated use of rubber dams by general dentists during nonsurgical root canal treatment. Of 1716 eligible practicing general dentists, 1490 completed the questionnaire. Of these respondents, only 697 (47%) reported always using a rubber dam when completing a root canal.¹¹ This study was in accord with previous studies in finding a lower frequency of rubber dam use during root canal treatment of anterior teeth when compared to premolars and molars.¹¹ It also found that anterior root canal treatment was more likely to involve cotton rolls for saliva contamination control (46%) than were premolar (36%) and molar (32%) root canals.¹¹ Although these studies only investigated a small population of general dentists, they clearly show a trend away from the all-encompassing rubber dam use practiced during dental training.

The official position of the American Association of Endodontists on rubber dams is that the rubber dam is the standard of care for any nonsurgical endodontic treatment (Figure 5).¹² According to its position statement, "...only dental dam isolation minimizes the risk of contamination of the root canal system by indigenous oral bacteria."¹² Accordingly, it is not surprising to find that rubber dam use is higher among endodontists than general dentists. For instance, in a survey conducted by Madarati, the researcher found that

84.8% of endodontists, surveyed in Saudi Arabia, used rubber dams during nonsurgical root canal treatments, while only 21.6% of general dentists from the same population used them.¹³ This study also reported that a combination of cotton rolls, gauze, and saliva ejectors was the most common alternative method for saliva contamination control.¹³ Due to findings such as these, efforts are being made to promote the use of rubber dams, particularly during root canal treatment.



Figure 4. Rubber dam set-up for restorative treatment



Figure 5. Tooth prepared for root canal with rubber dam placed

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Isolation Systems

Isolation systems are relatively new appliances that have many attractive attributes. Examples of such systems are Isolite and DryShield. Although there is some variation depending on brand, they share similar qualities. Both provide suction that assists with saliva clearance. Soft and disposable mouthpieces are commonly found in isolation systems, also often a bite block to assist the patient in maintaining an open mouth without discomfort. The mouthpiece may also have an extension that reaches the buccal mucosa on the opposing side. This extension can help keep the tongue in place as well as provide protection to the throat and, along with the built-in suction, contribute to aspiration prevention. Some brands, such as Isolite, have a light to illuminate the field (Figure 6). Isolation systems are commonly used during restorative, fixed, and endodontic procedures, and have been embraced by the pediatric dental community—more on that later.

Summary of Techniques

With various contamination control options currently available, and newer ones growing in popularity and being developed, it is no surprise that practitioners have varying opinions on what technique is better suited to a particular procedure. Often technique selection depends on the practitioner's preference, education/training, and perception of the method's efficacy. For these reasons, more research on these techniques should be conducted. It should be noted that these techniques are not mutually exclusive, but rather are often used in combination with one another.

Orthodontic Considerations

Adhesive restorative materials have not only impacted restorative dentistry, but also the field of orthodontics. With practitioners using bonding systems and composites to bond brackets to teeth, the same precautions and steps to avoid saliva



Figure 6. Patient with Isolite system while getting a crown cemented.

contamination must be used as in restorations. Some circumstances, such as bonding of second molars or ectopically erupted canines, may present additional difficulties in maintaining a dry field. Most often, saliva control during placement of orthodontic hardware is accomplished using cheek retractors, mirrors, cotton rolls, and dry angles (Figure 7). Having an extra



Figure 7. Orthodontic patient with cheek retractor during the brackets bonding appointment



pair of hands available (four-handed dentistry) is particularly useful when bonding posterior teeth such as second permanent molars. Although not commonly seen, some practitioners use rubber dam isolation when bonding brackets (Figure 8). While the benefits of rubber dam isolation have been previously discussed in detail regarding restorations, at least one study found it does not provide an advantage over cotton rolls when bonding brackets. Heringer et al. conducted a (1993) study in which 44 brackets were bonded in vivo to maxillary and mandibular premolars that were to be extracted for orthodontic purposes.¹⁴ The isolation technique employed was either a rubber dam or cotton rolls. The teeth were left in the patients' mouths for 30 days before extraction, after which they were mounted in plastic rings with gypsum, and immersed in water for 7 days before debonding occurred. Debond was completed using a Universal Instron machine to apply an occlusal shear force directly at the enamel-bracket interface. No statistically significant differences were found between the cotton roll and rubber dam isolation groups.¹⁴

Some products aim to address contamination issues using chemical properties. For instance, Transbond MIP is a bonding primer resin that is alleged to have

hydrophilic qualities and achieve adequate bonding strength despite saliva contamination of an etched enamel surface. A 2001 study by Hobson, Ledvinka, and Meechan examined the impact of blood and water contamination on the bond strength of this product, ex vivo. In this study, 90 premolars were acid etched and then bonded using Transbond MIP. Teeth were then split into three equal groups where the enamel surfaces were either dry, moistened, or contaminated with blood. Although the dry group resulted in a significantly higher bond strength over the two other groups, bond strengths of all three groups were higher than the clinically sufficient bond strength of 6 to 8 MPa, recommended in other studies.¹⁵ No significant differences were found between the water and blood contaminated groups.¹⁵ This study also tested both the tooth and bracket surfaces for remaining adhesive material to create an adhesive remnant index. No significant differences were found between the groups, and most failures occurred at the enamel-composite interface.¹⁵ Despite these interesting findings, the authors are careful to note that the composition of saliva is different from water and that its components may affect bond strength differently.

Although bracket bonding has been the main focus of this section, it should be noted that a dry field is also important when cementing other orthodontic hardware such as bands, fixed space maintainers, and fixed functional appliances.

Pediatric Considerations

The pediatric population often presents a unique challenge for practitioners due to compliance issues. Patient comfort should be of utmost importance as it can promote compliance by even the most anxious patients. This raises the question: What is the most effective method of providing saliva contamination control, while simultaneously providing the pediatric patient with a less stressful environment, in order to encourage compliance? Despite the potentially

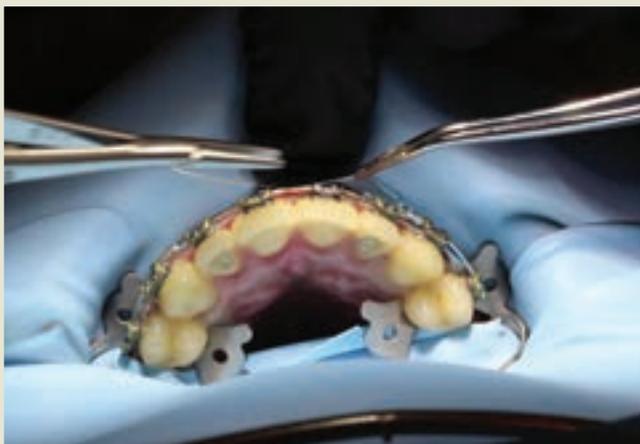


Figure 8. Orthodontic patient with rubber dam placed

time consuming, and somewhat cumbersome, set-up of a rubber dam, some studies show that pediatric patients respond favorably towards them. Ammann et al. conducted a randomized control clinical study investigating patients' physical response to rubber dam use versus cotton roll and saliva ejector isolation.¹⁶ In this study, 72 subjects ranging in age from 6-16 years old were randomly split into two groups. Both groups had pit and fissure sealants placed. In procedures on the experimental group, practitioners used rubber dams, while those working on the control group utilized cotton rolls and saliva ejectors for contamination control. Patients' level of stress was inferred from data on skin resistance, pulse rate, blood pressure, and breathing rate. Subjective pain level during the procedure was recorded using a questionnaire and visual analog scale.¹⁶ This study found that patients in the rubber dam group reported significantly lower pain perception and presented with a significantly lower respiratory rate, significantly higher level of skin resistance, and tendency for a lower pulse during treatment.¹⁶ This finding indicates a higher level of relaxation with use of a rubber dam. Authors speculate that this may be due to the fact that the rubber dam serves as a barrier to the operating field, possibly giving a patient a sense of the treatment being completed outside of his/her body.¹⁶ Although patient acceptability and comfort levels vary widely from person to person and are often dependent on treatment type and duration, this study indicates that rubber dam use should not be disqualified out of hand on assumption that children will not tolerate rubber dams.

One procedure commonly performed on pediatric patients is the placement of preventative sealants. The goal is to prevent caries by reducing the number of bacteria and their needed food sources in vulnerable pits and fissures. Pits and fissures are caries-friendly and account for 80-90% of caries in permanent posterior teeth and 44% of those found in the primary dentition.¹⁷ A review of scientific literature on preventive

restorative dentistry from 1995-2003 by Tinanoff et al. showed strong evidence supporting the use of sealants on pit and fissure surfaces that were at risk of caries, or those with surfaces already exhibiting incipient lesions, to prevent progression.¹⁷ On the other hand, they found insufficient evidence to support the use of pit and fissure sealants on the primary dentition.¹⁷ Regardless, pit and fissure sealants are a staple of many pediatric and general dentistry practices.

Saliva contamination control is equally important when placing sealants. This must be done with an eye to efficacy, while simultaneously providing comfort and promoting compliance by the pediatric patient. All of the aforementioned methods of moisture contamination control are used regularly during placement of sealants. Several studies have been completed on the efficacy of these methods and their impact on sealant retention rates. A study by Lygidakis et al. compared the use of cotton roll isolation to rubber dam placement, for teeth that were either prepared with a simple bristle brush or mechanical preparation of the pits and fissures.¹⁸ In this study, 95 children between the ages of 7 and 8, with fully erupted, cavity-free first permanent molars were chosen to participate. Each patient had one sealant placed using each of four methods: cotton rolls/bristle brush preparation, cotton roll/mechanical preparation, rubber dam/bristle brush preparation, and rubber dam/mechanical preparation. The study found a good four-year retention rate for all methods of isolation and occlusal preparation ranging from 81-93%. However, mechanical preparation of the occlusal surface may result in better retention of sealants when cotton rolls are used.¹⁸ When comparing the isolation techniques to the same teeth, no significant differences were found in retention rate. However, mandibular permanent molars demonstrated better retention rates than their maxillary counterparts regardless of the isolation and preparation techniques employed.¹⁸

A systematic review by Griffin et al. investigated the effects of four-handed dentistry on the retention of



autopolymerized resin- based sealants. Authors reviewed 11 studies and concluded that four-handed dentistry, while controlling for other factors that could affect retention (for example, all studies included used cotton roll and/or high- or low-volume suction for isolation) was associated with higher retention of these types of sealants.¹⁹

Isolation systems are another widely used form of saliva control during pediatric procedures. These systems have grown in popularity in the pediatric community due to ease of use and their all-in-one functionality that includes isolation, saliva ejection, bite block opening, and sometimes illumination. They have quickly become a favorite among pediatric dentists and are commonly used during many procedures, particularly during the placement of sealants. Some studies have even found a reduction of procedure time when using isolation systems for saliva control when placing sealants. For example, a study by Henig and McGrath investigated sealant placement times on first and second molars while using either the Isolite system or cotton rolls for isolation. In this study, 104 pediatric patients between the ages of 5 and 15 were enrolled. Of these patients, 65 received sealants on their first molars while the remaining 39 received sealants on their second molars. Subjects were randomly allocated into the Isolite group or the cotton roll isolation group. This study found a significant reduction in procedure time when the Isolite system was used (22% reduction for first molars, 25% reduction for second molars).

Conclusion

Saliva contamination control is an important issue in the field of dentistry. With implications in nearly every discipline, including restorative dentistry, endodontics, pediatric dentistry, and orthodontics, much attention has been given to the topic. As per the American Association of Endodontists, the standard of care for tooth isolation during nonsurgical endodontic

treatment is the rubber dam.¹² During dental school and residency training, the rubber dam is used for nearly every restorative procedure; however, isolation systems are increasingly being taught alongside rubber dam use in dental schools around the country. However, this has not been the case in real world general dentistry. Often practitioners will opt for quicker methods such as cotton rolls, Dri-Angles, four- handed dentistry, or a combination of techniques. The development of new methods of contamination control, such as isolation systems, as well as the development of new restorative materials that are more forgiving of saliva contamination are also helping practitioners address contamination control issues. Although our current methods are, for the most part, clinically successful, many studies show ambiguous results regarding the efficacy of these contamination control methods on the survival rate of various types of restorations. This topic needs to be explored with future research. Despite all of the uncertainty on the topic, it is well known that moisture contamination control is important for the success of many types of dental procedures and appropriate efforts should be made to achieve it.

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CE Quiz

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- Benefits of saliva include _____.**
 - clearing substances from the oral cavity
 - buffering dietary acids
 - providing a reservoir for mineral content
 - all of the above
- Saliva is composed of approximately _____ percent water.**
 - 79
 - 89
 - 99
 - none of the above
- In addition to water, saliva contains _____.**
 - macromolecules such as proteins and sugars
 - organic particles
 - inorganic particles
 - all of the above
- Potential effects of salivary contamination include _____.**
 - disruption of bonds of restorative material to tooth structure
 - discoloration
 - sensitivity
 - all of the above
- A 2017 review by Nair et al. found that saliva contamination (during one or several stages of the restorative process) showed an adverse effect on _____ percent of adhesives.**
 - 54.6
 - 64.6
 - 74.6
 - 84.6
- The same review by Nair et al. found that _____ percent of studies claimed restored or enhanced bond strength after utilizing decontamination techniques such as rinse/dry or re-etching.**
 - 65
 - 75
 - 85
 - 95
- Saliva contamination adversely affects amalgam restorations.**
 - True
 - False
- A 1981 study by Yamada and Fusayama found that saliva contamination can adversely affect _____.**
 - compressive strength
 - creep value
 - both A and B
- Adverse effects of saliva contamination during a root canal include _____.**
 - disruption of an aseptic field
 - setting of root canal sealers leading to higher leakage
 - decreased bond strength of cemented fiber posts
 - all of the above
- A 2007 study by Roggendorf et al. found that the effect of saliva contamination on an apical root canal seal did NOT vary depending on the type of sealer used.**
 - True
 - False
- _____ are commonly used as methods to control saliva during dental procedures.**
 - Cheek retractors
 - Cotton rolls
 - Rubber dams
 - Isolation systems
 - all of the above
- In a systematic review by Cajaziera et al., comparing the use of rubber dams to cotton rolls/saliva ejector for moisture contamination control on the longevity of tooth-colored restorations, four studies found that _____.**
 - use of rubber dam did not influence the longevity of these restorations when compared to cotton rolls/saliva ejector
 - rubber dams resulted in longer lasting restoration
 - cotton rolls resulted in longer lasting restorations
 - none of the above
- A 1999 study by Raskin et al found that restoration failures were significantly associated with the method of isolation used.**
 - True
 - False
- Purported benefits of rubber dam use, outside of moisture control, include _____.**
 - enhanced visibility
 - better access
 - preventing aspiration of instruments
 - all of the above
- A study by Dental Practice-Based Research Network, investigating the use of rubber dams by general dentists during restorative procedures, found that _____ percent of dentists did NOT use rubber dams.**
 - 53
 - 63
 - 73
 - 83

CE QUIZ

16. The same study by Dental Practice-Based Research Network, investigating the use of rubber dams by general dentists during restorative procedures, found that _____ percent of restorations were completed using a rubber dam.
- 12
 - 15
 - 20
 - 25
17. A study by Dental Practice-Based Research Network investigating the use of rubber dams by general dentists during restorative procedures found that restorations of _____ were most likely to have had a rubber dam used.
- mandibular anteriors
 - mandibular posteriors
 - maxillary anteriors
 - maxillary posteriors
18. A study conducted by the National Dental Practice-Based Research Network, investigating the use of rubber dams by general dentists during nonsurgical root canal treatment, found that _____ percent of general dentists always used a rubber dam when completing a root canal.
- 47
 - 57
 - 67
 - 77
19. The same study by the National Dental Practice-Based Research Network investigating the use of rubber dams by general dentists during non-surgical root canal treatment found that _____ had a lower frequency of rubber dam use during root canals.
- anteriors
 - premolars
 - molars
 - procedures on all teeth
20. According to the same study by the National Dental Practice-Based Research Network investigating the use of rubber dams by general dentists during nonsurgical root canal treatment, _____ percent of anterior root canals were likely to use cotton rolls/saliva ejector for contamination control.
- 36
 - 46
 - 56
 - 66
21. The official position of the American Association of endodontists is that rubber dams are the standard of care for nonsurgical root endodontic treatment.
- True
 - False
22. A 2016 study by Madarati found that _____ percent of endodontists surveyed in Saudi Arabia used a rubber dam during nonsurgical root canal treatment.
- 64.8
 - 74.8
 - 84.8
 - 94.8
23. The same study by Madarati found that _____ percent of general dentists surveyed in Saudi Arabia used a rubber dam during nonsurgical root canal treatment.
- 21.6
 - 31.6
 - 41.6
 - none of the above
24. Depending on the brand, benefits of isolation systems include _____.
- saliva ejection
 - illumination
 - bite block
 - all of the above
25. The aforementioned saliva control techniques and materials (cotton rolls, cotton roll substitutes, saliva ejectors, cheek retractors, rubber dams, isolation systems, etc.) can be used together.
- True
 - False
26. Creation of more moisture-tolerant resins is another method to battle saliva contamination.
- True
 - False
27. Saliva control is important for the bonding of _____.
- orthodontic brackets
 - bands
 - fixed appliances
 - all of the above
28. Pit and fissure caries account for _____ percent of caries in permanent posterior teeth.
- 50-60
 - 60-70
 - 70-80
 - 80-90
29. Pit and fissure caries account for approximately _____ percent of caries found in the primary dentition.
- 34
 - 44
 - 54
 - 64
30. A review by Tinanoff et al. found sufficient data supporting the use of pit and fissure sealants on the primary dentition.
- True
 - False

CE ANSWER FORM (E-mail address required for processing)

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EDUCATIONAL OBJECTIVES

- Understand some of the natural benefits of saliva
- Understand how salivary contamination can adversely affect restorations and root canals
- Have learned about various methods of moisture contamination control
- Understand the pros/cons of various methods of moisture control
- Recognize clinical implications in the field of pediatric dentistry and orthodontics.

COURSE EVALUATION

Please evaluate this course using a scale of 3 to 1, where 3 is excellent and 1 is poor.

- Clarity of objectives ③ ② ①
- Usefulness of content ③ ② ①
- Benefit to your clinical practice..... ③ ② ①
- Usefulness of the references..... ③ ② ①
- Quality of written presentation..... ③ ② ①
- Quality of illustrations ③ ② ①
- Clarity of quiz questions ③ ② ①
- Relevance of quiz questions..... ③ ② ①
- Rate your overall satisfaction with this course ③ ② ①
- Did this lesson achieve its educational objectives? Yes No
- Are there any other topics you would like to see presented in the future? _____

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Fill in the circle of the appropriate answer that corresponds to the question on previous pages.

- | | |
|---------------------|---------------------|
| 1. (A) (B) (C) (D) | 16. (A) (B) (C) (D) |
| 2. (A) (B) (C) (D) | 17. (A) (B) (C) (D) |
| 3. (A) (B) (C) (D) | 18. (A) (B) (C) (D) |
| 4. (A) (B) (C) (D) | 19. (A) (B) (C) (D) |
| 5. (A) (B) (C) (D) | 20. (A) (B) (C) (D) |
| 6. (A) (B) (C) (D) | 21. (A) (B) (C) (D) |
| 7. (A) (B) (C) (D) | 22. (A) (B) (C) (D) |
| 8. (A) (B) (C) (D) | 23. (A) (B) (C) (D) |
| 9. (A) (B) (C) (D) | 24. (A) (B) (C) (D) |
| 10. (A) (B) (C) (D) | 25. (A) (B) (C) (D) |
| 11. (A) (B) (C) (D) | 26. (A) (B) (C) (D) |
| 12. (A) (B) (C) (D) | 27. (A) (B) (C) (D) |
| 13. (A) (B) (C) (D) | 28. (A) (B) (C) (D) |
| 14. (A) (B) (C) (D) | 29. (A) (B) (C) (D) |
| 15. (A) (B) (C) (D) | 30. (A) (B) (C) (D) |

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