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TO PREMEDICATE, OR NOT PREMEDICATE:

BRINGING CLARITY TO
PREMEDICATION GUIDELINES

DISCLOSURE STATEMENT:

- The content for this self-study course was written by Susanna E. Scherer, RDH, BS, Education and Professional Relations Manager, Water Pik, Inc.
- This course was designed, developed, and produced by Water Pik, Inc., a subsidiary of Church & Dwight, Inc.
- Water Pik Inc., manufactures and distributes products addressed in this course.

AUDIENCE

This course is intended for dentists, dental hygienists, dental assistants, office managers and dental office staff members.

EDUCATIONAL METHOD

The educational method used is self-study. A post-test must be submitted to receive credit.

COURSE OBJECTIVE

Compared with previous recommendations, there are currently very few patients who require antibiotic prophylaxis (AP) prior to dental procedures. The purpose of this course is to help dental professionals understand the current guidelines for AP prior to dental procedures for the prevention of both viridans group streptococcus (VGS) infective endocarditis (IE) and prosthetic joint infections (PJI). This self-study course will examine the growing concern for antibiotic resistance and the role of dental professionals toward antibiotic stewardship. This course will also focus on the 2021 American Heart Association Scientific Statement which reaffirms the 2007 recommendations that emphasizes good oral health and regular access to dental care as more important than AP for a dental procedure.

LEARNING OUTCOMES

- Define the etiology of bacteremia and identify the incidence of bacteremia reported for daily activities versus a dental cleaning.
- Review the history of antibiotic prophylaxis.
- Understand the current American Heart Association (AHA), American Dental Association (ADA) and American Academy of Orthopaedic Surgeons (AAOS) guidelines for antibiotic prophylaxis prior to dental procedures.
- Examine the role of dental professionals toward antibiotic stewardship.
- Recognize that maintenance of good oral health and regular access to dental care is more important than AP for a dental procedure.

INTRODUCTION

Uncertainty of AP guidelines results in many patients continuing to premedicate when it is unnecessary. A cohort study of dental visits between 2011-2015 found that 80.9% of AP prescriptions were unnecessary.¹ Additionally, only 20.9% of patients had a cardiac condition at the highest risk of adverse outcomes from infective endocarditis which would warrant AP prior to dental procedures.¹ The study also found that despite changes in clinical guidelines AP prescribing has remained steady among dentists.

BACTEREMIA

Bacteremia is the presence of bacteria in the bloodstream. Bacteremia usually causes no symptoms, but sometimes bacteria accumulate in certain tissues or organs and can cause serious infections. Bacteremia will usually occur during ordinary activities such as chewing food or toothbrushing. It does not cause infections because bacteria are typically present in small numbers and rapidly removed from the bloodstream by the immune system. However, if bacteria are present long enough and in large enough numbers, particularly in people who are high risk, bacteremia can lead to other infections and sometimes trigger a serious body wide response called sepsis. Bacteremia may cause endocarditis, most commonly with staphylococcal, streptococcal, or enterococcal bacteremia and less commonly with gram-negative bacteremia or fungemia.²

20%–68%		From tooth brushing or flossing ³
20%–40%		From use of wooden toothpicks ³
7%–51%		From chewing ³
7%–50%		From water flossing ⁴
Compared to 40%		From a dental cleaning ³

Table 1. Incidence of bacteremia for daily activities^{3,4}

The oral cavity is home to an abundant number and variety of microorganisms. Because it has a rich blood supply, any physical manipulation in the oral cavity has the potential to introduce microorganisms into the bloodstream.³ Daily activities such as chewing food and toothbrushing may result in VGS bacteremia at a higher frequency than a dental procedure (see table 1).

Due to the potential for invasive dental procedures to result in bacteremia, there has been a long-standing theoretical concern about such bacteremia leading to infection at distant sites.³ The most prominent examples of this is concern for VGS IE and PJI. For several decades' patients with a number of cardiac conditions, and/or prosthetic joint replacements, have received AP prior to invasive dental procedures. Over the years AP guidelines have undergone several changes causing confusion for many dental professionals about when premedication is recommended.

HISTORY OF ANTIBIOTIC PROPHYLAXIS

Historically AP existed primarily for two groups of patients:

1. Those with heart conditions that were believed to predispose them to infective endocarditis and,
2. those who have prosthetic joint(s) and were believed to be at risk for developing hematogenous infections.

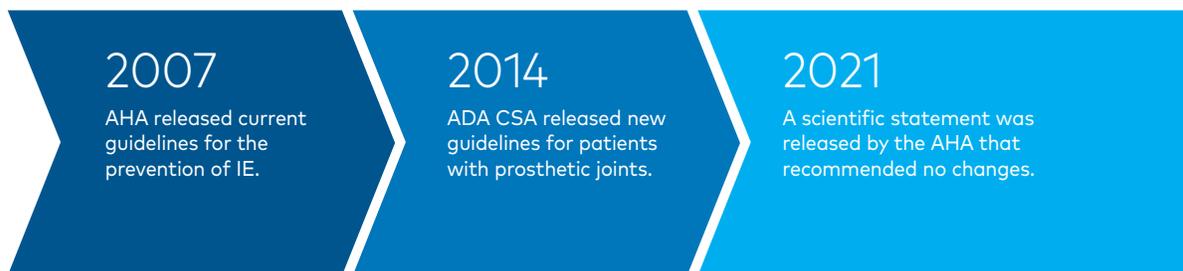
AP prior to dental procedures was first introduced in the early 1930's for patients with heart conditions that were believed to predispose them to infective endocarditis.⁵ Since AP was introduced in the early 1930's there have been several changes to AP regimens. Changes have included the way AP is administered, the dose, the agent, the duration for which AP should be taken and who should take AP.

In 1941 the antibiotic prophylaxis regimen proposed was the use of 15 grains of sulfapyridine every six hours, starting two days before the manipulation and continuing for two or three days afterwards.⁵ In 1955, the Committee on Prevention of Rheumatic Fever and IE of the AHA, prophylactic protocol recommended an injection of a dose of 600,000 International Units (IU) of aqueous penicillin and 600,000 IU of procaine penicillin dissolved in oil with 2% aluminum monostearate administered 30 minutes before the dental procedure.⁵ Alternatively (although considered less desirable), they proposed the oral administration of 250,000-500,000 IU of penicillin 30 minutes before each meal and before bedtime, starting 24 hours before the dental treatment and continuing for five days afterwards, and with an extra dose of 250,000 IU of penicillin immediately prior to the manipulation.⁵ By 1965, the AHA stated

that AP should only be administered immediately before the dental procedure and on the subsequent days. In 1997 the AHA adopted a more conservative attitude; AP protocol was now a single dose of amoxicillin administered orally one hour before the procedure.⁵

In 2007, with input from the ADA, the AHA released updated guidelines for the prevention of IE, reducing AP to a very small subset of patients. Most recently the AHA scientific statement released May 18, 2021 recommended no changes to the 2007 guideline recommendations.

Following the success of joint replacement surgeries in the late 1960's there was a rapid increase in number joint replacement surgeries taking place in the United States. Despite a lack of scientific evidence to connect PJI to dental procedures, a widespread recommendation for AP prior to dental treatment for patients with prosthetic joints took place in the 1970's.⁶ In 1997, the ADA and the AAOS released joint guidelines to provide dental professionals with better guidance for patients with prosthetic joints. The 1997 guidelines stated that AP was not necessary for patients who had pins, plates or screws, nor most patients with total joint replacements, and recommended AP for only a small group of individuals at high risk of infection.⁶ In 2009, the AAOS released new guidelines suggesting AP for all total joint replacement patients prior to invasive procedures. However, the 2009 guidelines were not supported by the ADA because they did not meet the criteria for evidence-based guidelines.⁶ In 2012, the AAOS and the ADA were again in agreement and released a statement that clinicians



"might consider discontinuing the practice of routinely prescribing prophylactic antibiotics for patients with hip and knee prosthetic joint implants undergoing dental procedures".^{6,7}

Evidence from rigorous case-control studies suggests that there is no increased risk of PJI following either low- or high-risk dental procedures.⁷ Furthermore, antimicrobial prophylaxis given before dental procedures does not decrease the risk of subsequent PJI.⁷ Therefore, in 2014 the ADA Council on Scientific Affairs released the most current guidelines for patients with prosthetic joint implants stating that in general AP is not recommended prior to dental procedures to prevent prosthetic joint infections.⁸

ANTIBIOTIC STEWARDSHIP

Antibiotic stewardship is the effort to measure and improve how antibiotics are prescribed by clinicians and used by patients. Improving antibiotic prescribing and their use is critical to effectively treat infections, protect patients from harms caused by unnecessary antibiotic use, and combat antibiotic resistance.⁹ A retrospective cohort study of dental visits from 2011-2015 found more than 80% of antibiotic prescriptions prior to dental procedures were unnecessary. Of the 91+K patients that received AP only 20.9% had a high-risk cardiac condition.¹

Antibiotics are medicines that fight bacterial infections. Antibiotic resistance happens when bacteria change and become resistant to the effects of an antibiotic.¹⁰ Antibiotic resistance is a growing problem worldwide that has been attributed to the overuse and misuse of these medications.¹¹ According to the Centers for Disease Control and Prevention, at least two million people in the U.S. become infected with bacteria that are resistant to antibiotics and at least 23,000 people die each year as a direct result of these infections.¹⁰

Systemically administered medications may result in adverse effects. A 2018 study found that adverse events from systemically administered antibiotics resulted in over 145,000 emergency hospital visits between 2011 and 2015.¹² Approximately 75% of the cases involved allergic reactions to antibiotics.¹² Adverse effects can include, but are not limited to, anaphylaxis, rash, diarrhea, c. diff, nausea, gastric pain and fever (table 2).¹² Penicillin is the most frequent medication related to anaphylaxis and connected to 75% of fatal anaphylaxis cases in the U.S. every year.¹³

ADVERSE EFFECTS
Anaphylaxis
Rash
Diarrhea
C. Diff
Nausea
Gastric Pain
Fever

Table 2. Adverse Effects Associated with Antibiotics¹²

Current premedication guidelines support antibiotic stewardship. The dental professionals' role is to ensure that AP is reserved for patients at high-risk of post-treatment complications and that antibiotics are only prescribed when needed. A thorough review of the patient's medical history must be completed prior to the recommendation and administration of AP. It is important to inform patients of their choices, including the potential risks and benefits of taking AP. It should be noted that current evidence does not show that AP prevents VGS IE or PJI.¹⁴

AHA GUIDELINES FOR THE PREVENTION OF VGS IE

Compared with previous recommendations the current AHA guidelines have significantly reduced the number of patients whom AP is indicated. Rather than identify the risk of acquisition of VGS IE, the new guidelines identify patients with the highest risk of adverse outcome from complications of VGS IE. In May of 2021 the AHA released the following scientific statement that affirms the 2007 recommendations on the prevention of VGS IE:

On the basis of a review of the available evidence, there are no recommended changes to the 2007 VGS IE prevention guidelines. We continue to recommend VGS IE prophylaxis only for categories of patients at highest risk for adverse outcome while emphasizing the critical role of good oral health and regular access to dental care for all.¹⁴

The AHA continues to recommend AP to prevent VGS IE for the following patients who are at the greatest risk of post treatment bacterial-related complications:

Group 1

- Prosthetic cardiac valve.
- Prosthetic material used for valve repair.
- Implantable cardiac devices such as transcatheter aortic valve.

Group 2

- Previous, relapse or recurrent IE.

Group 3

- Congenital Heart Disease
- Unrepaired cyanotic congenital heart disease, including palliative shunts and conduits.
- Any repaired congenital heart defect with residual shunts or valvular regurgitation at the site of or adjacent to the site of a prosthetic patch or a prosthetic device.

Group 4

- Cardiac transplant recipient with valve regurgitation due to a structurally abnormal valve.

PEDIATRIC CONSIDERATIONS

AP should only be considered when the pediatric patient has the following congenital heart disease (CHD).

- Cyanotic congenital heart disease (birth defects with oxygen levels lower than normal) that has not been fully repaired, including children who have had surgical shunts and conduits.
- CHD that has been completely repaired with prosthetic material or a device for the first six months after the repair procedure
- Repaired CHD with residual defects such as persisting leaks or abnormal flow at or adjacent to a prosthetic patch or prosthetic device.

AP is not recommended for any other form of CHD, including mitral valve prolapse and/or heart murmurs.⁸

LESS ANTIBIOTIC USE IN DENTISTRY: NO INCREASE IN VGS IE

A group of experts, in both the prevention and treatment of IE, reviewed the frequency of morbidity and mortality from VGS IE after the publication of the 2007 IE guidelines.¹⁴ The group included members of the AHA, ADA, the Infectious Diseases Society of America, and the American Academy of Pediatrics. The review concluded that "there was no convincing evidence that VGS IE frequency, morbidity or mortality had increased since 2007".¹⁴

Some of the findings to support the 2007 guidelines include:

- Despite a 78.7% reduction in AP prescription, no significant change in the general upward trend of IE cases or death.¹⁵
- No increase of IE hospitalizations among children 5-18 years with CHD.¹⁶
- No increase in hospitalization or mortality rates among adults.¹⁷
- Scaling down AP not associated with increased incidence of oral streptococcal IE among populations with preexisting valve disease.¹⁸

In Sweden, the Swedish Medical Products Agency lifted their recommendation of AP prior to dental procedures for the prevention of VGS IE in October of 2012.¹⁹ This change was in response to the lack of evidence that AP is effective in prevention of VGS IE and because of the growing concern for antibiotic resistance.¹⁹ Amoxicillin prescriptions among Swedish dentists declined 40 percent following the recommendation change.¹⁵

A nationwide cohort study, which included 76,762 high-risk adult individuals (>17 years), was conducted from January 2008 to January 2018 to determine whether there was an increased incident of VGS IE since the recommendation had been lifted.¹⁹ The study found no increased incidence of oral streptococcal IE among high-risk individuals during the five years after the cessation of AP.¹⁹ Based on these findings the research suggests that the current Swedish recommendation not to administer antibiotic prophylaxis for the prevention of IE in dentistry has not led to an increased incidence of VGS-IE among high-risk individuals.¹⁹

AP FOR THE PREVENTION OF PROSTHETIC JOINT INFECTION

In general, AP is not recommended prior to dental procedures for patients with prosthetic joints. A systematic review conducted by the 2014 ADA Council on Scientific Affairs concluded that best evidence fails to show a link between PJI and dental procedures.¹³ According to the AAOS moderate strength evidence finds that dental procedures are unrelated to implant infection and AP prior to dental procedures does not reduce the risk of subsequent

implant infection.²⁰ Additionally, for most patients the risks of adverse reactions and antibiotic resistance generally outweighs the benefit of AP.

A cohort study performed between May 2018 and June 2021 was conducted to determine whether there is an association between invasive dental procedures (IDP) and late prosthetic joint infection (LPJI). The study used a population in England where AP is not recommended prior to IDP for patients with prosthetic joints and therefore the association would be fully exposed.²¹ Early PJI occurs within three months of the surgical procedure and is considered to be a result of contamination at the time of surgery. Hence, the study focused on LPJI which occurs three months or longer after joint replacement surgeries. There was a total of 9,427 LPJI hospital admissions and dental records that were reviewed. It was concluded that there was no evidence of an association between IDP and LPJI, confirming there is no rationale for administering AP before IDP in patients with prosthetic joints.²¹

In cases where AP is deemed necessary it is recommended that the orthopedic surgeon write the prescription.²² Special considerations that may indicate AP for patients with prosthetic joints:

- If the patient has a history of a previous medical condition associated with the joint replacement surgery.
- If the patient had a complication(s) associated with the joint replacement surgery.

In lieu of AP prior to IDP, the AHA and AAOS recommend that patients maintain optimal oral hygiene through preventative dental visits and good oral hygiene homecare practices, which leads to a lower risk of PJI.⁷

CLINDAMYCIN NO LONGER RECOMMENDED

The 2021 AHA scientific statement no longer recommends the use of clindamycin for patients who are allergic to penicillin or ampicillin. This is because clindamycin is known to cause more severe adverse reactions like *C. difficile*. In fact, one dose of clindamycin has an equivalent risk of *C. difficile* compared with a prolonged course.¹ Additionally, the AHA states that cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema or urticaria with penicillin or ampicillin.¹⁴ The AHA recommends cephalexin, azithromycin, clarithromycin, or doxycycline for patients who can take oral medication and cefazolin or ceftriaxone for patients who cannot take oral medication (**see table 2**).

DELIVERY ROUTE	Oral	Unable to take oral medication	Can take oral medication and allergic to penicillin or ampicillin	Cannot take oral medication and allergic to penicillin or ampicillin
MEDICATION	Amoxicillin	Ampicillin OR cefazolin or ceftriaxone	Cephalexin OR azithromycin or clarithromycin OR doxycycline	Cefazolin or ceftriaxone
ADULTS	2 g	2 g IM or IV	500 mg	1 g IM or IV
		1 g IM or IV	100 MG	
CHILDREN	50 mg/kg	50 mg/kg IM or IV	50 mg/kg IM or IV	50 mg/kg IM or IV
		50 mg/kg IM or IV	15 mg/kg <45 kg, 4.4 mg/kg >45 kg, 100mg	

Table 3. Current antibiotic regimens prior to a dental procedure are available.¹⁴

*Single Dose should be taken or administered 30 to 60 minutes before dental procedure.

**Table modified slightly and adapted from the 2021 AHA Scientific Statement

SPECIAL CONSIDERATIONS

- If the patient inadvertently forgets to take their AP, the dosage may be taken up to two hours after the procedure.¹³ In patients who are receiving a short course (seven to ten days) of oral antibiotic therapy before a dental procedure, selecting a different class of antibiotic is preferable (**see table 3**).¹⁴
- In patients who are receiving a short course (seven to ten days) of oral antibiotic therapy before a dental procedure, selecting a different class of antibiotic is preferable (**see table 2**).¹⁴
- If possible, it is preferable to delay an elective dental procedure for at least 10 days after completion of a short course of antibiotic therapy.¹⁴
- In patients who are receiving parenteral antimicrobial therapy for IE or other infections and require a dental procedure, the same parenteral antibiotic may be continued through the dental procedure.¹⁴
- In patients undergoing multiple sequential dental appointments, if possible, it is preferable to delay the next procedure for four weeks between treatment sessions.¹⁴
- Patients undergoing chemotherapy who have a central venous catheter should consult with their treating oncologist prior to dental procedures to determine if AP is indicated.⁸

SCENARIOS AP IS UNWARRANTED

When patients have undergone a variety of surgical interventions, it may raise the question "should this patient be taking AP?". Unless the patient is predisposed to infection, here are some additional scenarios where AP is unwarranted.^{8,14}

- Implantable electronic devices such as a pacemaker or similar devices
- Septal defect closure devices when complete closure is achieved
- Peripheral vascular grafts and patches, including those used for hemodialysis
- Surgically placed pins, plates or screws
- Coronary artery stents or other vascular stents
- Central nervous system ventriculoatrial shunts
- Vena cava filters
- Pledgets - a small wad of absorbent cotton or other soft material used to stop up a wound or other opening in the body.
- Solid organ transplant
- Breast augmentation with implants
- Penile implant

THE IMPORTANCE OF GOOD ORAL HEALTH

The 2021 AHA scientific statement emphasizes the critical role of good oral health. Daily activities such as brushing and flossing result in a higher frequency of bacteremia than a dental procedure. For example, there is a 20-68% chance of bacteremia from brushing or flossing versus a 40% chance from a dental cleaning (see table 1).³ Therefore it is imperative to emphasize to patients the importance of achieving optimal oral health to help prevent bacteremia reducing the risk of VGS IE and PJI.^{7,14} This includes both professional and home care. If insurance or affordability are a barrier to routine care the dental team can guide the patient to resources that will provide access—i.e., a local dental hygiene school or federally qualified health center (FQHC).



Dental professionals know that brushing alone is not enough to achieve optimal oral health. Research found that regardless of the type of toothbrush used, people leave up to 40% of plaque behind.²³ It is essential to educate patients that in addition to brushing routine hygiene appointments and interdental cleaning are a necessity to achieve optimal oral health.

Oral hygiene instruction (OHI) begins with the hygienist asking the patient their personal success, failure, and preference regarding interdental aids. Traditionally, dental floss has received the most attention among interdental aids and is highly recommended because of its ability to remove plaque where toothbrushes cannot reach.²⁴ However, many patients do not floss and there are many reasons why. Tight contacts, hard to reach areas, complexity of technique and discomfort are just a few of the reasons patients do not use dental floss.

Offering a variety of options will help patients find the most successful homecare tools to fit their oral health needs. A systematic review of ten different oral hygiene aids found that interdental brushes (IDB) and water flossers ranked highest for reducing inflammation while toothpicks and dental floss ranked last.²⁴ A review by Ng and Lim concurred finding IDB and water flossing more effective for reducing gingivitis. They also noted IDB, and water flossing are preferred over floss for cleaning around implants.²⁵

Water flossing has proven to be a great alternative to traditional dental floss. There are six studies comparing water flossing to traditional dental floss. Water flossing was proven to be 50% more effective at reducing gingivitis and 29% better at removing plaque.^{26,27}



Gorur et al. found that the unique combination of pulsation and pressure created shear hydraulic forces capable of effectively removing plaque. Via use of the scanning electron microscopy, they were able to show that three seconds of water flossing at medium pressure removed up to 99.9% of plaque from treated areas (see Figure 1).²⁸ Research also shows that water flossing, even used at the highest pressure, is safe and more effective than brushing and flossing.²⁹



Figure 1: Before treatment with the Waterpik® Water Flosser and after a 3-second treatment with the Waterpik® Water Flosser.

CONCLUSION

Premedication guidelines have significantly reduced the number of patients who require AP prior to invasive dental procedures.

This is based on a review of scientific evidence, which shows adverse reactions to antibiotics generally outweighs the benefits of prophylaxis. AP should be reserved for patients who are at the greatest risk of post treatment bacterial-related complications. It is the responsibility of dental professionals

to educate patients on the risk versus the benefits of AP prior to invasive dental procedures--i.e., adverse reactions and antibiotic resistance. A consultation with the cardiologist, orthopedic surgeon or other prescribing physician may be necessary if it is unclear if the patient should be premedicated, or to obtain medical clearance to discontinue AP. Careful review of the patients' medical history should be conducted to ensure they are taking the correct premedication based on current guidelines (refer to table 3). Last, home-care education should emphasize the importance of good oral health to prevent VGS IE and lower the risk of PJI.



RESOURCES

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PREMEDICATION GUIDELINES FOR DENTAL PROFESSIONALS

Post-Test Question – you must complete online to receive credit

1. **A cohort study of dental visits between 2011-2015 found that _____ % of AP prescriptions were unnecessary.**
 - a. 20.9%
 - b. 40.9%
 - c. 60.0%
 - d. 80.9%
2. **Any physical manipulation in the oral cavity has the potential to introduce microorganisms into the blood stream.**
 - a. True
 - b. False
3. **In _____ the AHA guidelines underwent significant changes recommending AP for the prevention of infective endocarditis prior to dental treatment for a very limited number of situations.**
 - a. 1997
 - b. 2007
 - c. 2015
 - d. 2021
4. **Antibiotics are medicines that fight viral infections.**
 - a. True
 - b. False
5. **Adverse effects from systemically administered antibiotics include all of the following except:**
 - a. Rash
 - b. Diarrhea
 - c. Fever
 - d. Halitosis
 - e. Gastric pain
6. **Which is not indicated for AP prior to dental procedures?**
 - a. Prosthetic cardiac valve
 - b. Previous history of IE
 - c. Heart Murmur
 - d. Cardiac transplant
7. **The AAOS current guidelines recommend that all prosthetic joint replacement patients take AP prior to invasive dental procedures?**
 - a. True
 - b. False
8. **Which of the following medications is not recommended for patients who are allergic to Penicillin?**
 - a. Cephalexin
 - b. Azithromycin
 - c. Clindamycin
 - d. Clarithromycin
9. **If the patient inadvertently forgets to take their AP, the dosage may be taken up to _____ hours after the procedure?**
 - a. 1
 - b. 2
 - c. 3
 - d. 4
10. **VGS IE occurs at a much higher rate for dental procedures than it does during routine daily activities.**
 - a. True
 - b. False

OBTAINING CONTINUING EDUCATION CREDITS

CREDITS - 2 HOURS

AGD SUBJECT CODE: 134

If you have questions about the CE credits, please consult your state or provincial dentistry board.

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SCORING

To receive credits, you must correctly answer 7 of 10 questions.

RESULTS

Can be downloaded immediately.

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This free self-study is designed for all dental professionals – no prior skills are needed.

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