

PREVENTING ADVANCED CARIOUS LESIONS WITH CARIES ATRAUMATIC RESTORATIVE TECHNIQUE

Tammi O. Byrd

Editor's Note

Borne of her compassion for people coping with the pain of untreated dental caries, this author, a past president of American Dental Hygienists' Association, describes why she believes that interim therapeutic restorations provided by dental hygienists comprise an essential component of comprehensive prevention for vulnerable populations.

ABSTRACT

An alternative approach to controlling dental caries and preventing the associated pain, called atraumatic restorative technique (ART), is described for populations in need, where dental hygienists restore decayed teeth with glass ionomer restorations without prior removal of all decayed tooth structure.

Background and purpose

There are populations whose decay needs are not adequately being met within the current oral health care delivery system. These include those in poverty conditions, vulnerable children, and the elderly who are often in long-term care facilities without adequate resources or opportunities for traditional dentistry. ART provides a viable option for controlling caries and relieving the pain of untreated decay. The purpose of this article is to suggest that the evidence surrounding ART be viewed objectively and that dental hygienists, with additional education in this approach, can contribute to relieving the pain of untreated dental decay.

Conclusion

Evidence suggests that teeth can be effectively restored with ART. Dental hygienists represent an appropriate workforce to provide ART with their current background and education combined plus a brief training program; it is suggested that dental hygiene educational programs include ART within the curriculum. Along with dental sealants and fluoride varnish application, ART can be an important component of a comprehensive preventive program to address the unmet needs of vulnerable populations.

INTRODUCTION

Dental caries and periodontal diseases have historically been considered the most important global oral health burdens. Dental caries is still a major oral health problem in most industrialized countries, affecting 60%-90% of schoolchildren and the vast majority of adults. In many countries, access to oral health services is limited, and teeth are often left untreated or are extracted because of pain or

RDH, Health Promotion Specialists, CEO/
Clinical Director, Columbia, SC, USA

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Corresponding author: Tammi O. Byrd. Tel.: +1 803
348 2973.
E-Mail: tbyrd@hps-sc.com

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Table 1. Prevalence of untreated dental caries and existing dental restorations in teeth, by sex, race and ethnicity, and poverty level: United States, 2005-2008.

Characteristic	Untreated dental caries				Dental restoration			
	Age (y)							
	Total	5-19	20-64	65 and over	Total	5-19	20-64	65 and over
Total	21.5	16.6	23.7	19.9	75.5	45.9	84.3	88.5
Race and ethnicity								
Non-Hispanic white ^a	17.8	13.3	19.3	17.8	80.1	46.2	88.8	91.6
Non-Hispanic black	34.2 ^b	22.6 ^b	39.7 ^b	35.8 ^b	62.6 ^b	40.4 ^b	73.1 ^b	63.7 ^b
Mexican American	31.1 ^b	22.4 ^b	35.2 ^b	36.4 ^b	61.8 ^b	50.1	67.4 ^b	69.3 ^b
Poverty level								
Below 100%	35.8 ^b	25.4 ^b	41.9 ^b	41.3 ^b	62.7 ^b	48.6	71.5 ^b	63.3 ^b
100% to less than 200%	30.5 ^b	19.3 ^b	37.7 ^b	22.5 ^b	68.8 ^b	46.3	75.1 ^b	85.6 ^b
200% or higher ^a	15.5	12.1	16.6	15.3	80.2	44.5	89.0	92.6
Sex								
Male	24.6 ^b	17.6	27.2 ^b	25.1 ^b	72.1 ^b	44.8	80.5 ^b	86.3 ^b
Female ^a	18.6	15.5	20.2	15.6	78.7	47.0	88.0	90.4

^a Reference group.
^b P < .05.
 Source: CDC/NCHS, National Health and Nutrition Examination Survey, 2005–2008. NCHS Data Brief Number 96, May 2012.

discomfort.¹ The current oral health care delivery system is not reaching the populations with the most needs.

According to the Healthy People initiative reports, the percentage of studied children in the United States experiencing untreated decay remained virtually unchanged from 1990-2010 at 30%.² For underserved, rural, and minority populations, the percentage is significantly higher, reaching almost 50%.³ For over 100 years, dentistry has focused on surgically treating dental disease for those who can access care. Even with access, preventive measures must be prioritized; survey research indicates that only a third of practitioners deliver recommended decay preventive interventions.⁴

Target Populations

Lack of dental insurance and poverty are key factors in determining access to dental care. In 2012, 46.5 million people were living in poverty in the United States with 1 in 7 in poverty and 1 in 16 in deep poverty (50% below the poverty line). This was the highest number of people since the census started measuring the poverty level 54 years prior. Racial and ethnic minorities, women, children, and families headed by single women are particularly vulnerable to poverty and deep poverty and adults with a disability are over twice as likely as nondisabled adults to live in poverty.⁵

Untreated decay is significantly higher among adults aged 20-64 years living in poverty.⁶ Adding to the problem, there are very few “safety nets” available for uninsured adults. Many adults and children seek relief from dental pain in emergency rooms for preventable dental conditions. This comes at a great cost to the economy and further indicates that the current delivery model is failing to reach many populations (see [Tables 1-3](#)).

Children

Although largely preventable, dental caries remains the most common chronic disease of children aged 6-11 years and adolescents aged 12-19 years. Tooth decay is 4 times more common than asthma among adolescents aged 14-17 years.⁷ Poor oral health has been related to decreased school performance, poor social relationships, and less success later in life.⁸

Older adults

Longer life spans and aging baby boomers have created an unprecedented growth in the proportion of older adults in the United States. The number of Americans aged 65 years and older will double that population in the next 25 years, bringing it to about 72 million and comprising 25% of the population. By 2030, the number of nursing home residents is expected to double, creating approximately 3 million residents, many more with teeth and dental neglect than in the past.⁹

Table 2. Snapshot of dental-related emergency room costs—2012.

State	Costs	Emergency room visits and/or costs
Florida	\$88 million	More than 115,000 visits with one-third being Medicaid recipients
Georgia	\$23 million	Approximately 60,000 visits for nontraumatic dental or oral health issues
New York	\$31 million	Treating young children jumped from \$18.5 to more than \$31 from 2004 to 2008

Source: PEW Centers for States, *A Costly Dental Destination: Hospital Care Means States Pay Dearly*, January 2012.

Table 3. Trends in numbers of medicaid enrollees.

State	Year	Change
Florida	2010	Increased 40% from 2 years prior
Oregon	2010	Increased 31% from 2 years prior
South Carolina	2009	Increased 59% from 4 years prior
New York	2008	Increased 32% from 4 years prior
Hawaii	2007	Increased 74% from 3 years prior
New Hampshire	2005	Increased 45% from 4 years prior

Source: PEW Centers for States, *A Costly Dental Destination: Hospital Care Means States Pay Dearly*, January 2012.

Older adults encounter barriers that make access to oral health services more difficult than younger adults. These include lack of insurance, physical and transportation limitations, and a lack of perceived need of oral health care. When an elderly person suffers from poor oral health, it not only increases his/her chance of other health issues but also may lead caregivers and family members to shy away from intimate contact such as hugs and kisses, increasing feelings of alienation.

During the last years of a person’s life, he/she should be afforded the opportunity to be free from dental pain, to eat, to lessen the incidence of pneumonia,¹⁰ and to have the

Box 1. Dental need scenarios

- School children whose family situations limit access to dental care exhibiting untreated decay that continues to spread within the child’s mouth. Painful teeth lead to lost school days each month. Other family members also have untreated decay (see [Figure 1](#)).
- People come to “free dental care days,” with carious lesions only be able to have 1-2 teeth extracted with the untreated decay likely to worsen. Without enough dentists to provide care, only a fraction of people who stand in long lines for many hours receive any dental care (see [Figure 2](#)).
- A gentleman with numerous carious lesions was given a treatment plan at a dental office costing more than \$17,000. With a wife and 2 children, he could not meet his basic living expenses and pursue this care. His untreated decay will likely worsen, and he needs to consider the oral health of his children (see [Figure 3](#)).
- A nursing home resident has dementia and some tooth decay. No dentist comes to the nursing home. Transporting her in her condition is costly, and being in unfamiliar surroundings is traumatic.

personal touch of loved ones not shying away because of mouth odor and disease. Dental hygienists are ready, willing, and able to serve these populations.

CURRENT MODEL OF DENTAL TREATMENT

Today’s model of dental care is financially feasible for only 5%-10% of the population, but there are many in need of safe and evidence-based care that supports the 21st century concept of minimally invasive dentistry. The time has arrived for a comprehensive program that prevents and stops dental decay for populations not currently being reached. When the longevity and costs of restorations are compared to prevention, investment in prevention is more cost-effective than investing in restoration.¹¹⁻¹⁴ The current surgical approach to treating decay reflects underuse of effective prevention and overuse of treatment.¹⁵ [Box 1](#) lists dental need scenarios that occur too often in the United States.

A POSSIBLE SOLUTION

Consider an innovative approach to addressing children’s carious lesions called the ForsythKids program in Boston. In this clinical setting, dental hygienists perform atraumatic restorative technique (ART) by placing glass ionomer temporary fillings. (Also referred to as caries control technique [CCT], intermediate restorative technique, and therapeutic sealants.) This is an approach to placing a filling without initial removal of decayed tooth structure. Short-term results demonstrate a 50% reduction in untreated caries.¹⁶ On visiting the Forsyth program, the author (T.B.) became educated in this preventive procedure. Returning

Figure 1. Common sight in school-based dental prevention programs.



Source: Photo courtesy of Health Promotion Specialists, South Carolina.

Figure 2. People waiting in line for free dental care at Mission of Mercy CT. Most waited overnight.



Source: Photo by Nancy Guenther Chapman for CT News Junkie.

Figure 3. Mouth of an adult with no dental insurance coverage and no avenue for care.



enthusied to South Carolina and after several meetings with leaders at state agencies, it became apparent that the political climate was not ready to pursue this type of endeavor.

As inequities continued to grow, it became evident that change had to occur. Dental hygienists already have the core educational background and, with some additional education, could impact the oral health outcomes of vulnerable populations using ART. In addition, the United States is currently educating more dental hygienists than dentists. From 1990 to 2010, the United States trained 10% more dentists and 60% more dental hygienists than the previous 20 years.¹⁷

The Origin of ART

ART was originally developed in the mid-1980s for use in field settings but is now promoted by the World Health Organization primarily for children and is used in clinical settings throughout the world. ART is considered a viable option for those who cannot access more expensive treatment. Although ART was developed to solve a problem in less economically developed countries, its philosophy and techniques are being used in the United States.

ART is in harmony with modern concepts of dental tissue preservation, yet its use in the United States is limited because it can be considered a less than optimum treatment. This attitude may be linked to lack of education in predoctoral and postdoctoral training curricula within US dental schools about the purpose, technique, and success of ART. The same documented reasons for not using dental sealants are now being used to discredit techniques such as ART. These include concerns about failure, lack of confidence in the technique, preference of other materials, and concerns about leakage.¹⁸

Sealants and ART are being held to a higher standard than traditional restorations however classic surgical care followed by fillings does not reduce or prevent the underlying causative factors from instigating further tooth destruction.¹⁵ Research demonstrates that dental sealants and ART, are effective in reducing cariogenic conditions because of sealing the tooth against the bacterial insult and to the fluorides in the glass ionomer used in ART especially if followed with an additional fluoride regimen.^{19,20}

The techniques used today for ART rely on highly viscous restorative glass ionomer cements which also are used for fissure sealants. Glass ionomer cements are tooth colored, pulp friendly, water-based dental cements that bond chemically to tooth structure and exchange ions with their surroundings (see [Figure 4A-4D](#)).²¹⁻²⁴

ART-related Evidence

An early study demonstrated that all decay does not need to be removed to arrest the carious process if the tooth is bonded and sealed. Although this study preceded the ART technique, it lends credence to its viability. The controlled clinical trial compared 3 types of restorations: (1) conventionally placed amalgam, (2) bonded and sealed composite restorations placed directly over frank cavitated lesions extending into dentin, and (3) sealed conservative amalgam restorations. Results indicated that the sealed restorations exhibited superior clinical performance and longevity compared with the traditional amalgam. The bonded and sealed composite restorations placed over the frank cavitated lesions arrested the clinical progress of the lesions for

Figure 4. (A) Carious teeth before ART. (B) Carious teeth after lesion treatment. (C) Carious lesions being conditioned before GIC placement. (D) Completed ART. GIC, glass ionomer cement.



Source: Photos courtesy of Nels Ewoldsen, DDS, MSD.

10 years.²⁵ Additional studies have indicated that complete caries removal can lead to pulp exposure and its sequelae adding additional support for the cost-effectiveness of ART vs traditional restorations.¹²

The survival percentage for single surface restorations has been shown to be better for ART than for traditional amalgams after 6.3 years.²⁶ A 2011 meta-analysis of ART as a follow-up from a 2005 meta-analysis confirmed that the ART approach is an effective evidence-based option for managing dental caries and that single surface ART has a better survival rate than multiple surface ART. The 6-year outcomes of the ForsythKids program demonstrated that comprehensive prevention (ART, dental sealants, and fluoride varnish application) reduced caries prevalence from 65% (twice the national average) to 25% (less than the national average) and exceeded Healthy People 2020 goals before 2010.¹⁶

IMPLEMENTING A COMPREHENSIVE PREVENTION PROGRAM THAT INCLUDES ART Advocacy and Policy Change

Creating a paradigm shift to a comprehensive prevention program including ART requires several elements to be in place: (1) Change in state practice acts that (a) allow dental hygienists to work in settings outside the traditional office, to include schools, nursing homes, assisted living facilities, hospitals, community clinics, Federally Qualified Health Centers, and medical offices; (b) allow direct access to dental hygiene services for target populations without unnecessary supervision barriers; Both of these are already operational in many states; (2) The ability for dental hygienists to be directly

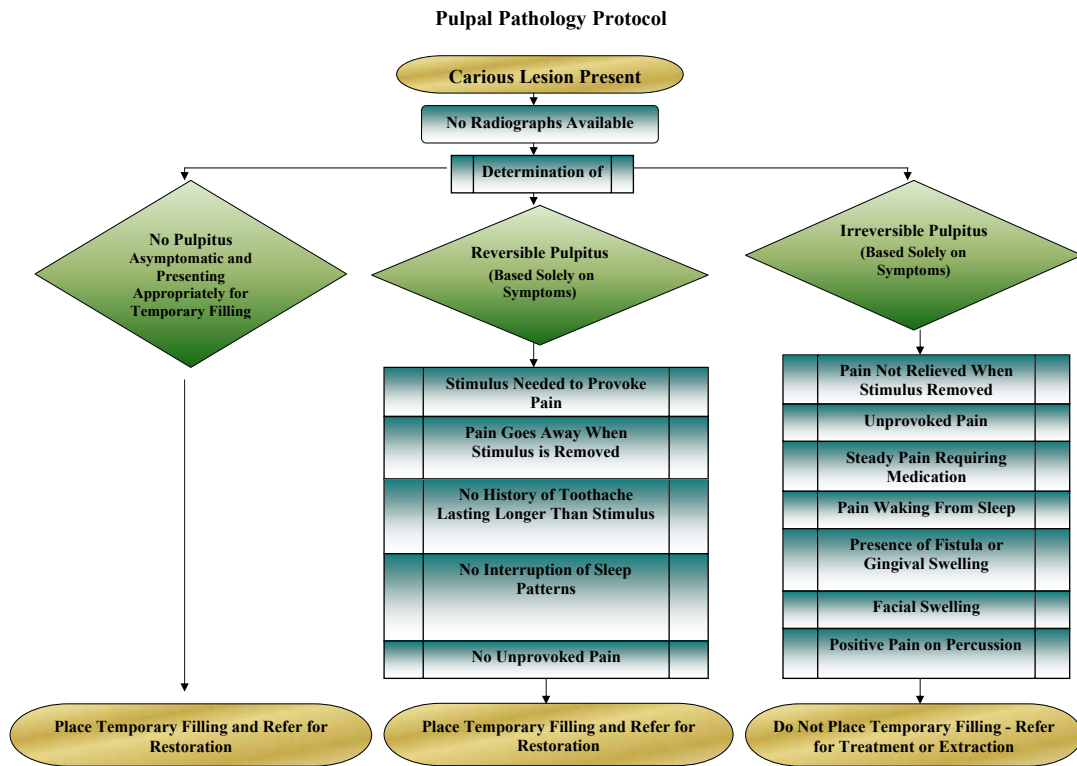
reimbursed for services provided (also operational in some states); and (3) Brief continuing education courses with the goal of teaching ART concepts and skills within the basic dental hygiene educational curriculum.

Policy change requires working collaboratively with other associations, professions, organizations, legislators, and community partners such as nursing home associations, Association of American Retired Persons, hospital associations, children's advocates, community health centers, and pediatric academies (see Juhl and Stedman article in this issue). Other groups have their own concerns but will often listen and even join in the challenge if viable solutions are presented. As a dental professional who understands the issues and the challenges better than others, be concise when presenting facts and keep the focus on the needs of and benefit for the underserved populations, the costs associated with change, and the potential savings. Meet with as many entities identified as potential allies as possible. Even without actively committing to support the change, another group of individuals has been educated regarding the problems with the current delivery model and the need for change. Once a strong coalition of supporting groups has been established, meeting with legislators can help bills get drafted. Continued communication with the coalition will be critical as the bill/regulation moves through the legislative process. Letter writing, phone calling, and testimony at committee hearings are essential.

Education of ART Providers

The first goal in educating providers is to establish a cadre of qualified practitioners capable of teaching others. At least 2 trainings are needed to kick start the program. The first educational offering should focus on active providers thus

Figure 5. Temporary filling algorithm. State of Maine Board of Dental Examiners.²⁷



allowing the program to start and data collection to begin as early as possible. The second training course could be a “train the trainer” event focusing on dental hygiene educators who can incorporate it into curricula. There are already protocols in many states to guide practitioners in the decision-making process of when to use ART and when to refer. (See Figure 5 for the algorithm developed by the State of Maine Board of Dental Examiners.)

Measuring the Outcomes

Outcome assessment is an important aspect of evaluating an ART program. It is important to establish a reporting requirement for providers performing ART. To assist in designing outcome measures, the state rural health association, department of health, dental, dental hygiene and medical school institutions, and/or schools of public health can be valuable resources. In addition, a satisfaction survey to be completed by parents, caregivers, patients, and facility staff is needed.

As seen in the ForsythKids program, children are benefitting from ART, as can underserved adults and elderly. Visibly missing or decayed teeth are the outward markers of a “caste system,” for a certain segment of the population who cannot access oral health care. Decayed and missing teeth are one of the first facial features noticed in personal encounters. Thus,

missing teeth can lead, in part, to a “death spiral” of unemployment, the absence of affordable and accessible health care (including oral health care), and the perpetuation of unemployment often leading to homelessness. Conversely, an optimal dentition is important for nutrition, systemic health, educational success, and social interactions.

CONCLUSION

ART is a validated patient-friendly CCT which conserves tooth structure, preserves pulp health, and controls caries lesions economically and expeditiously.²⁸ Implementing a comprehensive prevention program that includes ART is a safe and cost-effective aspect of improving oral health across our nation. Dental hygienists, with additional education in the principles and practices of ART and appropriate legislative measures in place, provide a workforce poised to provide this beneficial public health measure.

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