

## Problem

Dental caries (tooth decay) is a chronic, progressive, multi-factorial, infectious disease that can begin in early infancy. By adulthood, dental caries will affect over 92 percent of the US population.<sup>1</sup> A smaller proportion of the population will develop moderate to severe dental caries. Dental caries prevalence and severity vary by age, dentition, and type of tooth surface.<sup>2</sup> In addition, dental caries is highly related to socio-environmental determinants, with the greatest burden on disadvantaged and socially-marginalized populations.<sup>3,4</sup> Historically, efforts to prevent and control dental caries have primarily focused on daily brushing, modifying dietary practices, and improving the resistance of tooth enamel to acid attack. However, only fluorides and dental sealants have been shown to be highly effective in preventing or reducing dental caries. Benefiting from fluoridated water and toothpastes, baby boomers will be the first generation to routinely maintain their natural teeth throughout their lives.<sup>5</sup>

## Method

Fluoride modalities are systemic and topical, and include water (natural and adjusted levels), dietary fluoride supplements, toothpaste, mouthrinse, and professional application of concentrated fluoride in gels, foams, or varnishes. The amount of caries protection, lifetime cost, and the appropriateness for use in populations will vary by the fluoride method or combination of fluoride methods selected.<sup>6,7,8,9,10,11,12,13</sup> Fluorides are most effective when used in combination with other modalities to prevent, control, and reverse the progression of dental caries early in the disease process.<sup>14,15,16,17</sup> Fluorides are relatively more effective in preventing dental caries on the smooth surfaces rather than the pits and fissures of teeth.<sup>18</sup> For the prevention of carious lesions that are limited to the pits and fissures of permanent molar teeth, dental sealants alone or combined with multiple fluoride applications are more effective than fluoride alone.<sup>19,20</sup> Daily, multiple, low-dose topical exposures to fluorides facilitate the balance between remineralization and demineralization of tooth enamel, thus reducing the incidence of dental caries.<sup>21,22</sup>

Fluoride is the only over-the-counter (OTC) toothpaste additive proven to prevent dental caries.<sup>23,24</sup> Toothpastes can also contain mild abrasives, humectants, flavoring agents, thickening agents or binders, detergents, emetics or other ingredients to address sensitivity, gingivitis, calculus, stains or bad breath.

Endorsed by the American Dental Association (ADA) in 1960<sup>25</sup>, fluoride toothpastes account for over 90% of the toothpaste sold in the United States since the 1980s.<sup>26,27</sup> Fluoride toothpastes, containing either 2% sodium fluoride, 4% stannous fluoride or 1.23% sodium monofluorophosphate, with a concentration of 1000 parts per million (ppm), are similar in caries prevention.<sup>28</sup> The stability of stannous fluoride in toothpaste has been questioned and not all fluoride toothpaste formulas are effective; however, the ADA Seal of Acceptance is awarded to fluoride toothpaste consumer products demonstrating identical or similar laboratory data.<sup>29</sup>

Lower concentrations of fluoride have not been found to be as effective as higher concentration toothpastes.<sup>30,31,32,33,34</sup> Toothpastes containing concentrations greater than 1000-1500 ppm fluoride confer greater protection against caries but also increase the risk of fluorosis during childhood enamel maturation.<sup>35,36</sup> Toothpastes containing 5000 ppm are available by prescription only. Rinsing, after spitting out or expectorating fluoride toothpaste after brushing, reduces the effectiveness of the toothpaste.<sup>37</sup> Brushing twice a day or more, rinsing less thoroughly, or not rinsing at all, confer greater caries

reductions than brushing once a day or less often.<sup>38,39</sup> Supervised tooth brushing with fluoride toothpaste in school-based programs has also been shown to be superior compared to unsupervised use.<sup>40</sup> A high level of compliance with the amount of fluoride toothpaste dispensed and daily use is required for it to be effective in the general population.<sup>41</sup>

The US Centers for Disease Control (CDC) ranks the quality of evidence for the efficacy of fluoride toothpaste for permanent teeth as Grade I.<sup>42</sup> [See endnote for definition of Grade I.] The benefits of fluoride toothpastes on permanent dentition are firmly established and supported by more than half a century of research and high quality clinical trials.<sup>43,44</sup> Fluoride toothpaste provides additional caries reduction in populations with and without fluoride in their drinking water.<sup>45,46,47</sup> Two more recent systematic reviews support the use of fluoride toothpaste for caries prevention in primary teeth, as also noted in the 2011 Cochrane Review, with more limited evidence.<sup>48,49</sup> Caries reductions have been mainly attributed to the gradual increase in the daily home use of fluoride toothpastes, by far the most widespread form of fluoride usage.<sup>50,51,52,53,54,55</sup>

Over time, in consideration of protecting against dental caries and reducing the risk of dental fluorosis, different recommendations have been developed regarding the amount of fluoride toothpaste for different age groups, particularly for young children. In 2001, CDC recommended that children reduce fluoride ingestion by using no more than a pea-size amount of fluoride toothpaste beginning at age two and that parents should be encouraged to ask a dentist if they need to begin earlier as a measure to balance caries risk and risk of fluorosis.<sup>6,56,57,58</sup> Ingestion of fluoride from toothpaste in young children is common; they need to be taught to expectorate fluoride toothpaste after brushing.<sup>59,60</sup> Concerned about a possible increase in early childhood caries, the 2007 Health and Human Services Maternal and Child Health Bureau Expert Panel recommended the use of a “smear” of regular US fluoride toothpaste for children younger than age two.<sup>61</sup> In 2014, the ADA recommended using a reduced amount of fluoride toothpaste beginning even earlier, with a smear or rice-grain size amount of toothpaste with the eruption of the first tooth until age three, a pea-size amount until age six, and to continue twice daily use of fluoride toothpaste throughout life.<sup>7,23</sup>

While community water fluoridation has substantial evidence for effectiveness in reducing dental caries, the use of fluoride toothpastes offers additional protection when used on a regular basis. The concentration of fluoride in toothpaste at 1000-1500 ppm has the strongest evidence for preventing tooth decay; however, unsupervised use in young children, particularly children under age 3, may increase the risk for enamel fluorosis. The use of fluoride toothpaste has stronger evidence for caries prevention with permanent teeth than for primary teeth, although it is effective for both.

### **Concluding Statement:**

ASTDD supports twice daily use of toothpaste containing 1000-1500 ppm fluoride, in fluoridated and non-fluoridated communities, for the prevention of tooth decay beginning with the eruption of the first tooth and throughout life.

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